Myanmar
ESHIA STUDY FOR THE EXPLORATION
BLOCK PSC-K

Environmental, Social and Health Impact Assessment

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Acronyms and Definitions

Acronym	Definition
ADSL	Asymmetric Digital Subscriber Line
AIDS	Acquired Immunodeficiency 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	Chemical Oxygen Demand
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

Acronym	Definition
ECD	Early Childhood Development
EPC	Engineering, Procurement, and Construction
ERI	Earth Rights International
EBAs	Endemic bird Areas
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
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

Acronym	Definition
IUCN	International Union for Conservation of Nature
LA	Local Authorities
L.O.D.	Limit of Detection
LNDO	Lahu National Development Organization
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
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
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

Acronym	Definition
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
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
UNICEF	United Nations Children's Fund
US EPA	United States Environmental Protection Agency

Acronym	Definition
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

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 PSC-K. The ESHIA is structured in compliance with the most recent Draft version of the EIA Procedure, issued by the Myanmar Ministry of Environmental Conservation and Forestry.

The project foresees the acquisition of a gravimetric and magnetic survey over the entire block extension in order to define the locations of the 2D seismic survey to be performed within the Block.

The series of surveys have the final aim to identify possible exploitable hydrocarbon traps within the Study Area.

This report is based on an analysis of currently available data which will be integrated with further information, through environmental and social surveys, contacts with public and local stakeholders, to be performed in the next stages of the Project.

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 31st July 2014 eni signed the Production sharing Contract (PSC) for the onshore Block PSC-K.

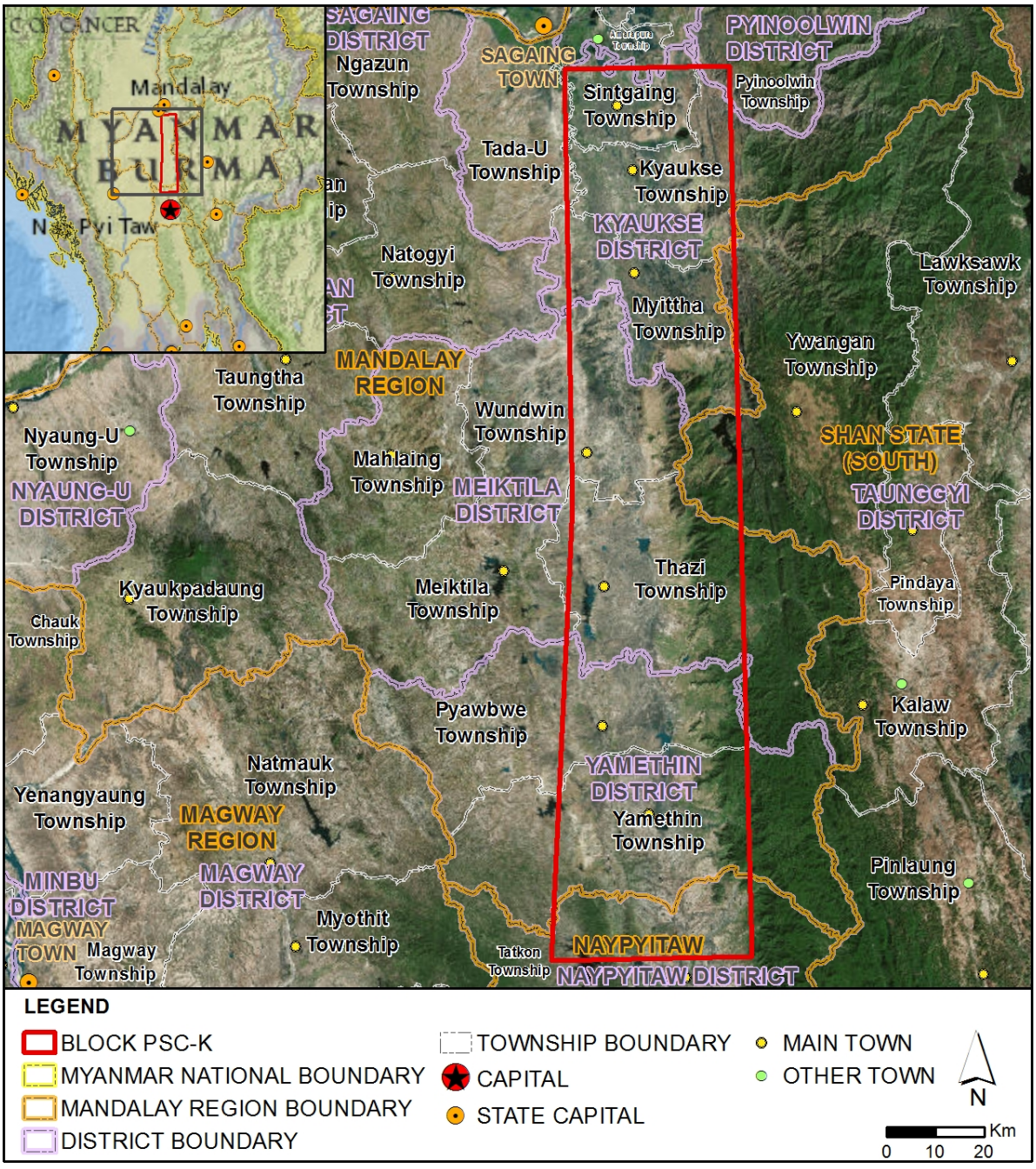
The PSC-K Block covers an area of about 6,560 km^2 in the Mandalay Region, with small eastern portions belonging to the Southern Shan State, and to the Naypyitaw State in the south, as shown in Figure 1.1. The full surface coordinates for Block PSC-K are shown in Table 1.1.

Table 1.1 Coordinates for Block PSC-K

Point	Longitude (E)	Latitude (N)
1	96°00’00’’	21°48’00’’
2	96°19’29’’	21°48’00’’
3	96°20’00’’	20°10’00’’
4	95°56’32’’	20°10’00’’

Source: Myanmar Ministry of Energy, 2013

Figure 1.1 Location of PSC-K Block



Gravimetric and Magnetometric surveys will be performed simultaneously by using airborne instruments mounted on the same aircraft. Surveys are flown for both detailed and regional applications; with line spacing from 50 to 2,000 m. The orientation of the flight paths is dependent on the geology of the area. The flight height is generally between 80m and 100m above ground using draped method.

Gravimetric survey measures the gravimetric anomalies caused by the different density in the subsurface rock bodies. In particular, it allows the interpretation of sub-surface features exhibiting a lateral density contrast to their surrounds.

Magnetometric survey aims at detecting magnetic anomalies in the deep rock bodies resulting from variations in chemistry and magnetism in the rock bodies themselves. Cesium vapor magnetometers are the most widely used instruments for aeromagnetic surveys, whenever the highest resolution and/or cycling rates for measurement of the earth's magnetic field is required.

Cessna Caravan type, carrying three instruments (gravimeter, magnetometer and LiDAR sensor) at one time, represents the currently preferred solution. The final design of the Grav-Mag survey will be driven by the gravimetric part, being the magnetic survey less dependent on the survey design. Figure 4.4 provides an example of the Cessna aircraft in operational phase during a Grav-Mag survey. There is the possibility to replace the airplane with a helicopter in case unexpected constraints or particular requirements are needed. The final decision will be taken as soon as the Grav-Mag contractor will be selected.

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation.

2D Seismic Survey layout will be designed as soon as Gravimetric and Magnetometric interpretations will be available. 2D seismic survey aims at providing a detailed interpretation of the geological and structural features in order to identify the potential presence of hydrocarbons traps in the subsurface.

Once the layout will be set up, and prior to the arrival of geophysical equipment on site, the seismic sources and receivers lines will be surveyed in order to avoid any important sensitivity along the seismic lines.

Weather and environmental conditions, such as agricultural land cover and access road network, suggest the use of explosive source supported 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 2D acquisitions.

Seismic survey performed with micro-charges does not require main site clearance. The source locations will be selected in such a way to minimize any site clearance. A policy of minimal clearance will be implemented by *eni myanmar* in accordance with *eni* Standards.

The vibroseis source option can be possibly considered in the dry season.

2D seismic acquisition will be performed with micro-charges placed along seismic lines with an interval along each line of 50m.

The use of vibroseis for 2D seismic survey will be evaluated on site during the dry season.

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 is likely to be placed for the duration of the whole survey. The Main explosive Storage will be located at the nearby Military Compound. In case 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 and to increase the economy by exporting the extracted resources to foreign countries.

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 most recent version of the EIA Procedure, issued by the Ministry of Environmental Conservation and Forestry 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 to these pending or recent laws related to ESHIA requirements: the Environmental Conservation Law (2012), the Foreign Investment Law (2012) and the Foreign Investment Rules (2013) and the Draft of Environmental Impact Assessment Rules (2013).

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 PSC-K, representing the Project Location. The Baseline is based on a secondary data review, more detailed and in-depth analysis will be provided in a future step of the Project, through specific environmental, social and health surveys, contacts and interviews with public and local stakeholders.

Considering that the seismic survey extent covers the majority of the PSC-K 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 1.2.

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

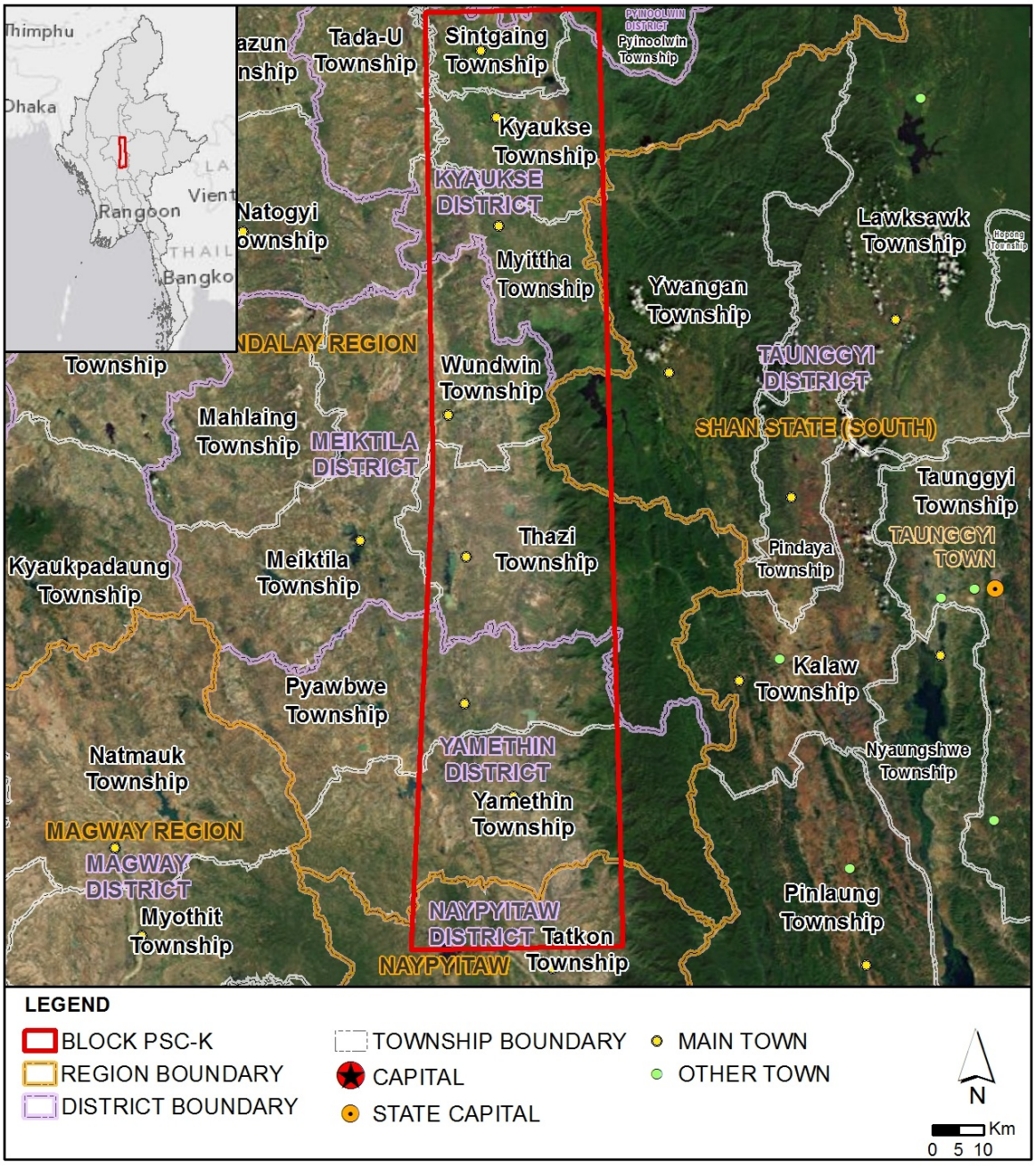
images analysis and land cover information of the whole Block, the following main land cover areas have been identified (described in section 5.3.5 of the ESHIA):

- Bare soil;
- Bush and Shrub;
- Low Laying Mixed Vegetation;
- Urban Area;
- Mixed Agriculture;
- Irrigated/Flooded Agriculture;
- Dry Forest;
- Green Forest;
- 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 1.2 Area of Influence for Environmental, Social, and Health Baseline



1.4.1 Physical Component

Block PSC-K is mainly located in Mandalay Region, as shown in Figure 1.2, and it obtains most of its rainfall from the southwest monsoon. The undulating land is subjected to severe erosion under rain and strong winds. 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 PSC-K is located between the following two climatic zones: Tropical savannah climate (around the Dry Zone), and Subtropical Monsoon and subtropical mountain climates.
- The region is characterized by a monthly maximum temperature between 29 and 33.5 and a monthly minimum temperature between 18.5 and 23.5°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 Minbu Meteorological Station varies from 0.9m/s to 1.7 m/s.
- No Air quality records were available for the Area of Influence; therefore 2009-2010 survey data from a study on the adjacent northern area with very close characteristics was considered (*Environmental Impact Assessment – Myanmar Section of Myanmar – China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM).*
- Baseline air quality concentrations were found to be well below the annual mean WHO guideline (updated 2005) and the annual mean National Ambient Air Quality Standards (USEPA, 1990); while levels of PM_{10} Exceeded the limits in various locations, mainly due to mineral oxides from natural sources.
- 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 CH4 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.

Water

- Block PSC-K is interested by the Mytinge River. Its primary and secondary tributaries run all over the area. The area is prone to high flood hazard.
- No data of surface and ground water quality in the Study Area are available. Information about water quality in the Study Area will be gathered before the beginning of the project activities, during a specific field survey.
- Block PSC-K is located in the Ayeyarwady aquifer and part of the artesian aquifer. Groundwater quality of Ayeyarwady aquifer permits use for both domestic and irrigation water use. An hydrogeological survey related to the groundwater of the study area will be performed before the beginning of the project activities.

Land Cover

- The analysis allowed the detection of a series of main land cover classes as follows: bare soil, bush/shrub, low laying mixed vegetation, urban area, mixed agriculture, irrigated/flooded agriculture, dry forest, green forest, water bodies.

Soil & Subsoil

- Block PSC-K 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 PSC-K is characterized by the following geological units: Recenta Alluvium Units; Metamorphics Rxs; Mainly Granites; Irrawaddy Group and equivalents; Lower Pegu Group and marine, brackish and terrestrial equivalents; Margui Series, Mawchi Series; Molasse-type sediments.
- The Area shows an altitude varying from 45m in the in the western area, up to 1500m in the hilly areas. The slope in the area is mostly flat or very gentle (<1%) with slopes up to 5% in the hilly areas.
- Soil classes in Block PSC-K 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 PSC-K is completely located in 8-9 MMI (according to MMI Modified Mercalli Intensity) area.
- No volcano is located within the Block PSC-K. however Mount Popa is North of the PSC-K Northern border.
- The land of the region is widely cultivated, not much natural vegetation is left apart from the Easter forested areas. The landscape is mostly covered with mosaic croplands/vegetation.

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. 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.

- Nyaung Yan - Minhla Kan and Kyee-ni Inn Key Biodiversity Areas are within the Study Area. Block PSC-K crosses part of the Panlaung-Pyadalin Cave protected area and part of the Myittha Lakes Wey Key Biodiversity Area. These KBAs cover overall, about 1.2 % of the land within the block; in particular, the Kyee-ni Inn KBA is crossed by a 2D seismic line for about 1.700 m.
- The following protected areas are within or cross the Block PSC-K: Panlaung-Pyadalin Cave, Myittha Lakes (Yit Kan, Yewei Kan, Yathar Kan, Myin, Nyaung Yan - Minhla Kan, Kyee-ni Inn, Indo-Burma
- The whole Block PSC-K is included in the Endemic Bird Area of Irrawaddy Plains.
- According to IUCN Red List, PSC-K Block hosts: 6 Critically Endangered species, 10 Endangered species, 17 Vulnerable 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 PSC-K is located Mandalay Region. This Region is situated in the centre of the country, bordering Sagaing and Magwe Divisions to the west, Shan State to the east and Bago Division and Kayin State to the South.

Mandalay 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 socioeconomic conditions in the Study Area presented in the ESHIA are based on a review of the available information, mainly at national and regional levels. 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 no sites on the World Heritage List, however there are eight properties submitted on the Tentative List. The only site located on block PSC-K boundary is the "Badah-lin and associated caves"; the other cultural heritage sites located in a buffer of 30 km around block PSC-K are the "Ancient cities of Innwa, Amarapura, Mingun, Mandalay" and the "Wooden Monasteries of Shwe-Kyaung";
- Myanmar has been referred to as the Land of Pagodas, as there are a considerable number of Buddhist pagodas;
- Within the block PSC-K there are 1,284 temples.

1.4.5 Visual Component

The territory of the Block PSC-K 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 continuous agricultural plots, served by an intricate track network made of very narrow trails connecting isolated farms, small to big settlements, and the crop themselves. The ar-

eas are served by a complex artificial drainage network that is regulated by a series of dams on major rivers.

- Natural forest areas, natural remote areas covered by a uniform canopy cover with no or very few access roads. Settlements are absent or very rare. The superficial waters are organized in typical dendritic drainage networks made of small rivers and streams. The topography is irregular.
- Floodplains areas, dominated by intensive agriculture areas alternated to vigorous natural vegetation patterns, mainly small trees forest patches close to channels and rivers. Rivers are originally braided and their beds are characterized by the presence of wide sand dunes and small islands. Where possible they are cultivated.
- Erosional landforms in hilly areas, dominated by the presence of shrubs and bush with forest patches located close to minor tributaries and streams. These landforms occupy hilly areas. These zones are not served by a well-developed road network; 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 the available information, mainly at national and regional levels. The main findings are summarized below:

- 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;
- 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 65.94 years for total population, 63.57 years for male and 68.46 years for female;
- In Mandalay Region the most common sources of drinking water are tube well/borehole (35.6%) and protected well (21.2%), but as many as 7.9% use unprotected wells and 9.3% 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;
- Mandalay Region has the lowest infant mortality rate and under five mortality rate of Myanmar (respectively 39.24 deaths per 1,000 live births and 47.36 deaths per 1,000 live births). Also maternal mortality ratio is low, 1.76 deaths per 1,000 live births.

1.5 ASSESSMENT OF POTENTIAL IMPACTS AND MITIGATION MEASURES

Identification and assessment of the Project's environmental social and health impacts has been conducted in a phased approach applied throughout the different activities (seismic survey, wells drilling), and phases (construction, operation and decommissioning) 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 Standard - Doc n° 1.3.1.47*):

- 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 extension of the Grav-Mag survey is the entire study area, while the location of the seismic survey is reported in the following section 4. Potential impacts have been assessed for each of the detected main land cover types: bare soil, bush and shrub, low laying mixed vegetation, urban area, mixed agriculture, irrigated/flooded agriculture, dry forest, green forest 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 two activities of the Project (Grav-Mag and seismic survey).

Potential impacts on the above mentioned components are reported in the following sections and have been summarized in Table 1 and Table 6 reported in Annex 3.

1.5.1.1 Air

Grav-Mag Survey

- Potential impacts on air quality can arise only due to atmospheric emissions from the aircraft. They are expected to be **Low** for the whole territory. No mitigation measures will be applied.

Seismic Survey

- 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

Grav-Mag Survey

During the Grav-Mag survey, the aircraft is expected to overfly the Project area at a low height (80-200m), thus the noise emissions may generate a potential impact at sensitive receptors. This disturbance will be temporary and limited to the transit of the aircraft. During the survey no significant vibration emissions will be generated. The potential impact on noise quality is expected to be **Low** for the whole territory.

Seismic Survey

- 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. The impact ranking should be confirmed after a field survey with the aim of ground –truthing the available data. A Noise Monitoring plan will be developed in order to evaluate real noise emissions and effectiveness of mitigation measures.

1.5.1.3 Water

Grav-Mag Survey

During the Grav-Mag survey, no impacts are expected.

Seismic Survey

Sources of impacts 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.

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

Grav-Mag Survey

During the Grav-Mag survey, no impacts are expected.

Seismic Survey

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. A series of specific mitigations measures for drilling muds will be considered (see ESHIA 6.2.3.4).
- 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. Deep ploughing will be applied during decommissioning phase of well sites. 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**. The ranking should be confirmed after the performing of the field surveys.

1.5.1.5 Flora and Vegetation

Grav-Mag Survey

During the Grav-Mag survey, negligible impacts are expected.

Seismic Survey

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 plant 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**. The ranking will be confirmed after the performing of the field surveys.

1.5.1.6 Fauna and Habitats

Grav-Mag Survey

During the Grav-Mag survey, negligible impacts are expected.

Seismic Survey

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. A 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. The ranking will be confirmed after the performing of the field surveys.

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

Grav-Mag survey

The realization of a Grav-Mag survey does not require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports. Therefore, **no impacts** on economy and employment are expected during the Grav-Mag survey.

Seismic Survey

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.

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

Grav-Mag survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports. Therefore, **no impacts** on infrastructures and public services are expected during the Grav-Mag survey.

Seismic Survey

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 nearby village and this may place a strain on existing public health infrastructure.

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.

The potential impact on infrastructures and public services, due to the seismic survey, results as **Low** for the whole territory, although the ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

1.5.2.3 Land and Livelihood

Grav-Mag survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports. Therefore, **no impacts** on land and livelihood are expected during the Grav-Mag survey.

Seismic Survey

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, although the ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

1.5.3 Cultural Impacts

Grav-Mag survey

The realization of a Grav-Mag survey does not require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports. During the survey, furthermore, not significant vibrations will be produced. Therefore, **negligible impacts** on cultural heritage are expected during the Grav-Mag survey.

Seismic Survey

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, although the ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

1.5.4 Visual Impacts

Grav-Mag survey

The realization of a Grav-Mag survey does not require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports. Therefore, **no impacts** on landscape are expected during the Grav-Mag survey.

Seismic Survey

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, although the ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

1.5.5 Health Impacts

Grav-Mag survey

The only project activity and stressor with the potential to negatively impact health and welfare during the Grav-Mag survey is the use of an aircraft. The following types of potential impacts on community health and welfare have been identified:

- temporary atmospheric emissions (NO_2 and $C0_x$) from the aircraft during the data acquisition phase;
- temporary noise emissions from the aircraft during the data acquisition phase.

In order to minimize the annoyance to population, the activity will be performed during the daylight hours.

According to the criteria defined by eni Standard requirements, the potential impact on community health, due to the Grav-Mag survey, results as **Low** for the whole territory.

Seismic Survey

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 main mitigation measures which should be employed during the seismic survey phase to reduce any impacts on community health and welfare are the following:

- 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 PSC-K 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. However, a more detailed investigation will be conducted in next steps of the Project, through onsite surveys and interviews with public and local stakeholders.

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

The objective of this phase of engagement is to present stakeholders with the ESHIA report. This phase will be conducted during the next phases of the project and will provide information on the project impacts and mitigation measures designed to avoid, minimize or, in case of positive impacts, to enhance them.

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 signed in presence of the Country's Energy Ministry the Production sharing Contract (PSC) for the onshore Block PSC-K. This report presents the Environmental, Social and Health Impact Assessment (ESHIA) of the onshore hydrocarbon exploration activities, planned by eni within Block PSC-K and is structured in compliance with the most recent Draft version of the EIA Procedure, issued by the Ministry of Environmental Conservation and Forestry. Block PSC-K is an area of around 6558 km^2 located in the Mandalay Region, with small portions belonging to the Southern Shan State, and to the Naypyitaw State.

The project foresees the acquisition of a gravimetric and magnetic survey in order to define the 2D seismic survey to be performed within the Block.

The series of surveys have the final aim to identify possible exploitable hydrocarbon traps within the Study Area.

This report is a preliminary ESHIA report based on secondary data; the final ESHIA report shall be integrated with further information, through environmental and social surveys and contacts with public and local stakeholders, which will be performed in the next stages of the Project.

2.1 PRESENTATION OF THE PROJECT PROPONENT

The Project proponent consists in a Joint Venture between eni and the Myanmar Production and Exploration Company Ltd (MPRL E&P). eni, has a 90 per cent stake in the deal through it unit eni Myanmar BV, while MPRL E&P, which has operated in Myanmar since 1996, holds the rest. MPRL has operated the Mann onshore oil and gas block in in Central Myanmar as a contractor to state-run Myanmar Oil and Gas Enterprise since 1996. It is registered in the British Virgin Islands.

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.

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 (Appendix F of Contract 50000001477): 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.
- Scope of Work attached to the call-off orders: Establishes the Scope of Work and associated requirements for the Environmental Services required.
- 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 E&P Division – HSE Standard Doc N° 1.3.4.04 "Environmental & Social Impacts in E&P Operations" (2010), including its updated Annex 2 on Biodiversity and Ecosystem Service (BES). 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 E&P Division, Circular 498 9.12.2008, "Community Investment Management System Best Practice (with particular reference to Annex 1 "Stakeholder Management Process" and Annex 2 "Social baseline Analysis")". It establishes best practice principles for the stakeholder management process and for the social baseline analysis.
- eni E&P Division – HSE Standard Doc. N° 1.3.4.01 "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 E&P division- Doc N° 1.3.4.05 "Waste Management planning". 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 standard on Air Quality Monitoring (doc No. 1.3.4.07). It provides a guide or the design, installation and management of Air Quality Monitoring Systems.
- eni standard on Water Management (doc No. 159). 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 sesmic 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 Conserva-tion 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
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

Conventions	Year	Ratified/Acceded /Accepted
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)		
C14 Weekly Rest (Industry)		
C17 Workmen's Compensation (Accidents)		
C19 Equality of Treatment (Accident Compensation)		
C26 Minimum Wage Fixing Machinery		
C29 Forced Labour Convention		
C42 Workmen's Compensation (Occupational Diseases) Revised 1934		
C52 Holidays with Pay		
C87 Freedom of Association and Protection of the Right to Organize		

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 ESHIA Requirements in Myanmar

Myanmar currently does not have official legislative or regulatory requirements for environmental, social and health impact assessments (ESHIA). However, a number of environmental laws are either pending or in the final stages of government approval, and the situation with respect to ESHIA requirements in Myanmar is expected to undergo significant imminent changes. As such, this section will highlight both the current requirements and pending legislation with respect to ESHIAs.

3.2.2.3 Current ESHIA Requirements

Currently, ESHIA requirement and review are conducted on a project-by-project basis under relevant Ministries and Authorities. In the case of Oil & Gas projects, the relevant authority is the Myanmar Oil and Gas Enterprise (MOGE).

Although official ESHIA laws have not yet been promulgated, MOGE has in recent years begun to issue letters to concession owners requiring that ESHIA Reports be prepared for planned developments.

3.2.2.4 ESHIA Legislation

The Myanmar Government has had plans to install new laws on ESHIA requirements since at least 2009. Pending or recent laws related to ESHIA requirements are 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. Currently, the Environmental Conservation Law is in the process of revision, therefore the details below may change before final promulgation of the law.

  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 duties and powers relating to the environmental conservation of the Ministry are as follows:
  …
  (m) causing to lay down and carry out a system of environmental impact assessment and social impact assessment as to whether or not a project or activity to be undertaken by any Government department, organization or person may cause 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. A person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.

  15. The owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, 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 perpetual existence of cultural heritage sites and natural heritage sites, 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 ESIA 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).

- **Draft –Environmental Impact Assessment Rules.** A set of Environmental Impact Assessment Rules are currently being drafted by the Ministry of Environmental Conservation and Forestry (the last draft is actually dated 24/12/2013). Although the draft law is titled Environmental Impact Assessment Procedure, it requires that the Project proponent shall include in its evaluation also social and health aspects of the environment, 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 draft law shall be effectively considered an ESHIA procedure framework.

  As mentioned above, these rules are currently in a preliminary draft form, but state that:

  "…all Projects undertaken in the Republic of the Union of Myanmar by any ministry, government department, organization, corporation, board, development committee, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual having the potential to cause significant Adverse Impacts, are required to undertake IEE (Initial Environmental Examination) or EIA (Environmental Impact Assessment) and to obtain an ECC (Environmental Compliance Certificate) in accordance with this Procedure"

  In Block PSC-K eni myanmar will develop an hydrocarbon exploration Project, in particular the following activities are foreseen:
  - Gravimetric and magnetic (Grav-Mag) aerial surveys;
  - ~280 km 2D seismic survey.

  2D and 3D seismic surveys fall into Category n. 121 "*Onshore Oil and Gas Development (seismic exploration; exploration and production drilling; development and production activities; transportation activities including pipelines; other facilities including pump stations, metering stations, pigging stations, compressor stations and storage facilities; ancillary and support operations; and decommissioning*)", therefore, according to *Annex 1* (*Categorization of Economic Activities for Assessment Purposes*) of the draft of the Environmental Impact Assessment Procedure, they are subjected to the EIA procedure.

  Magnetic aerial survey, on the contrary, does not fall in any of the EIA Categories mentioned by Annex 1, therefore it wouldn't be subjected to the EIA procedure. However, based on cautionary criteria, it is assumed to consider the whole

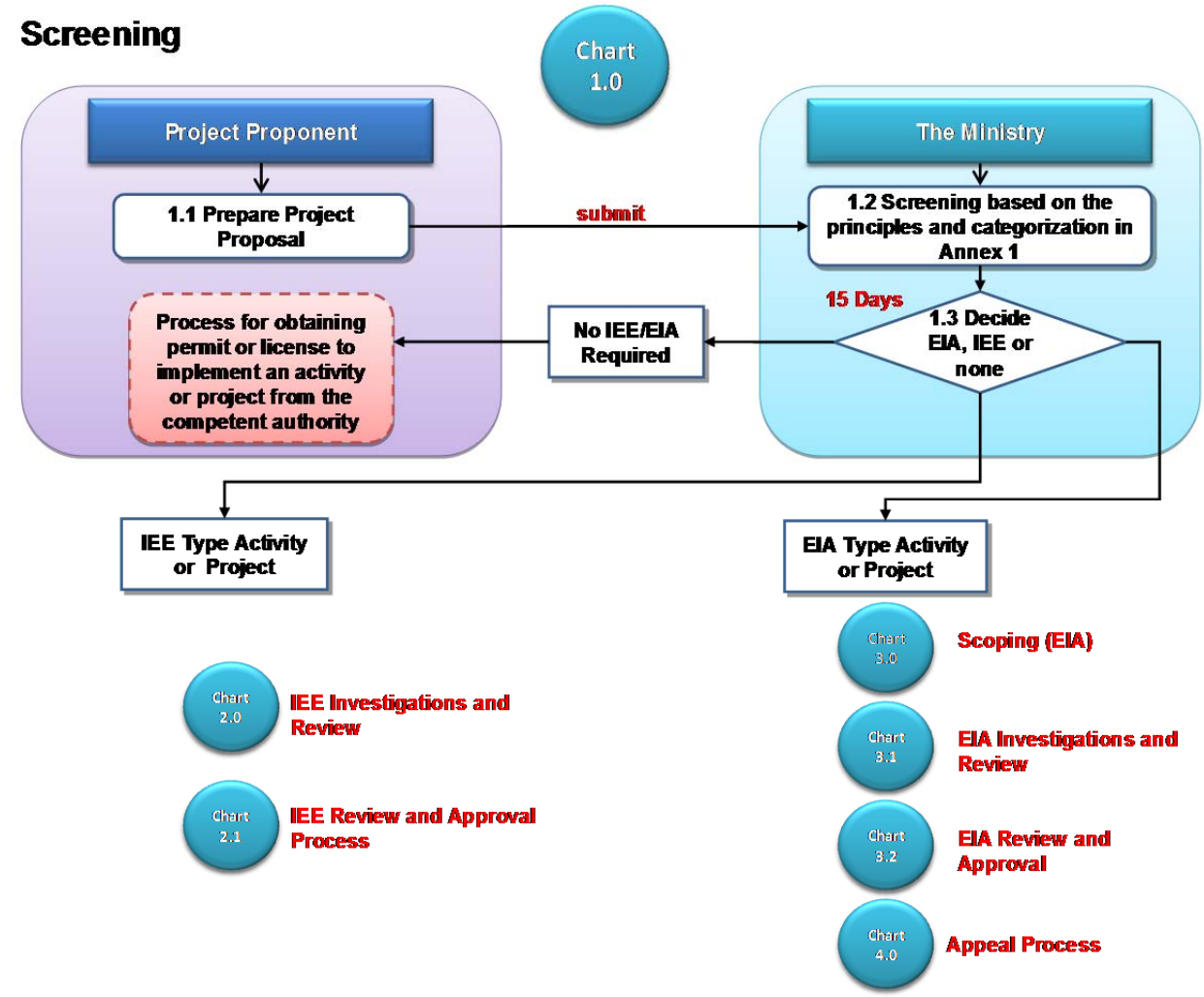
hydrocarbon exploration Project (including Grav-Mag survey and Seismic survey) an EIA Type Project and to completely subjected it to an EIA procedure.

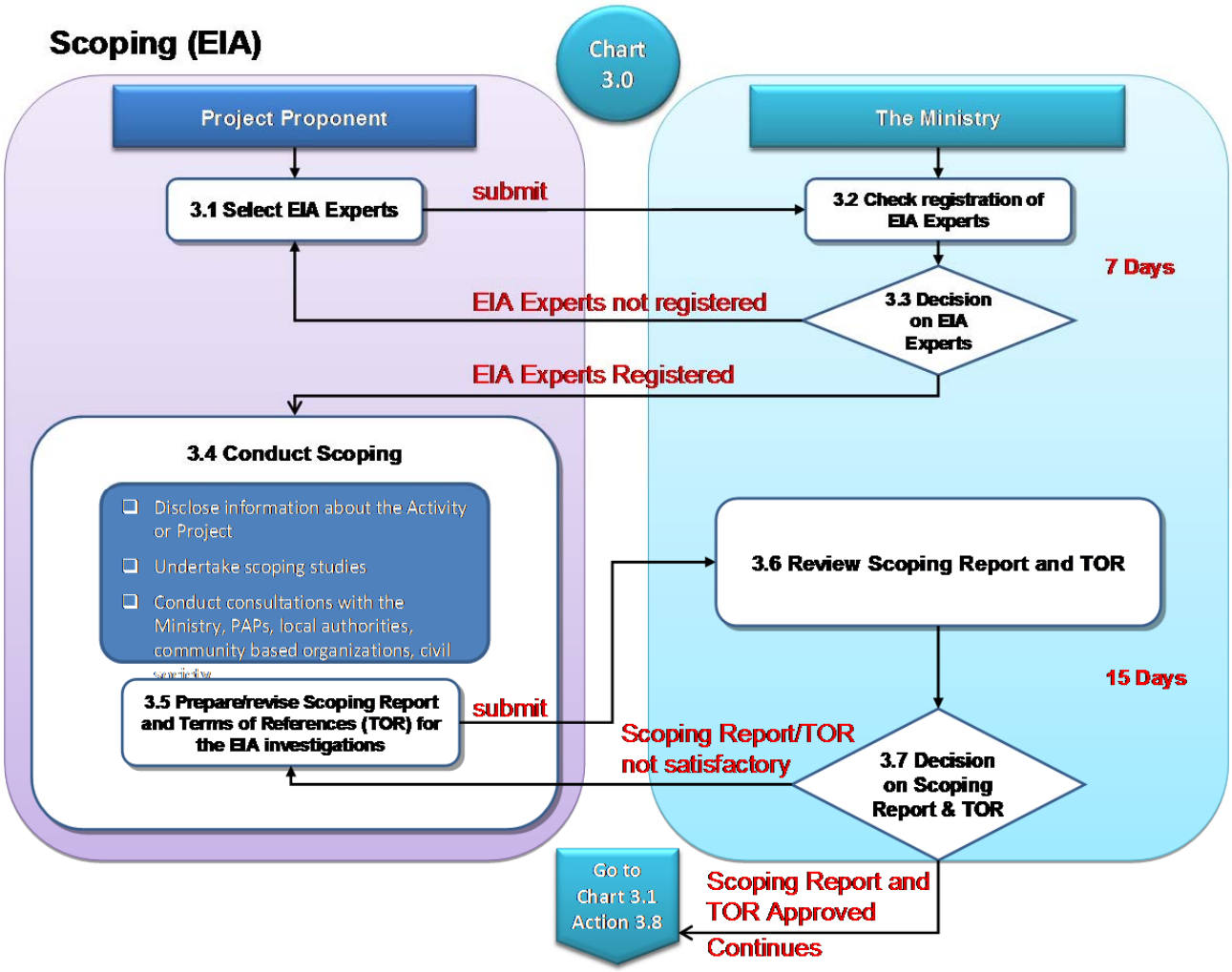
As stated in Chapter V of the draft of the Environmental Impact Assessment Procedure, an Environmental Assessment procedure foresees:

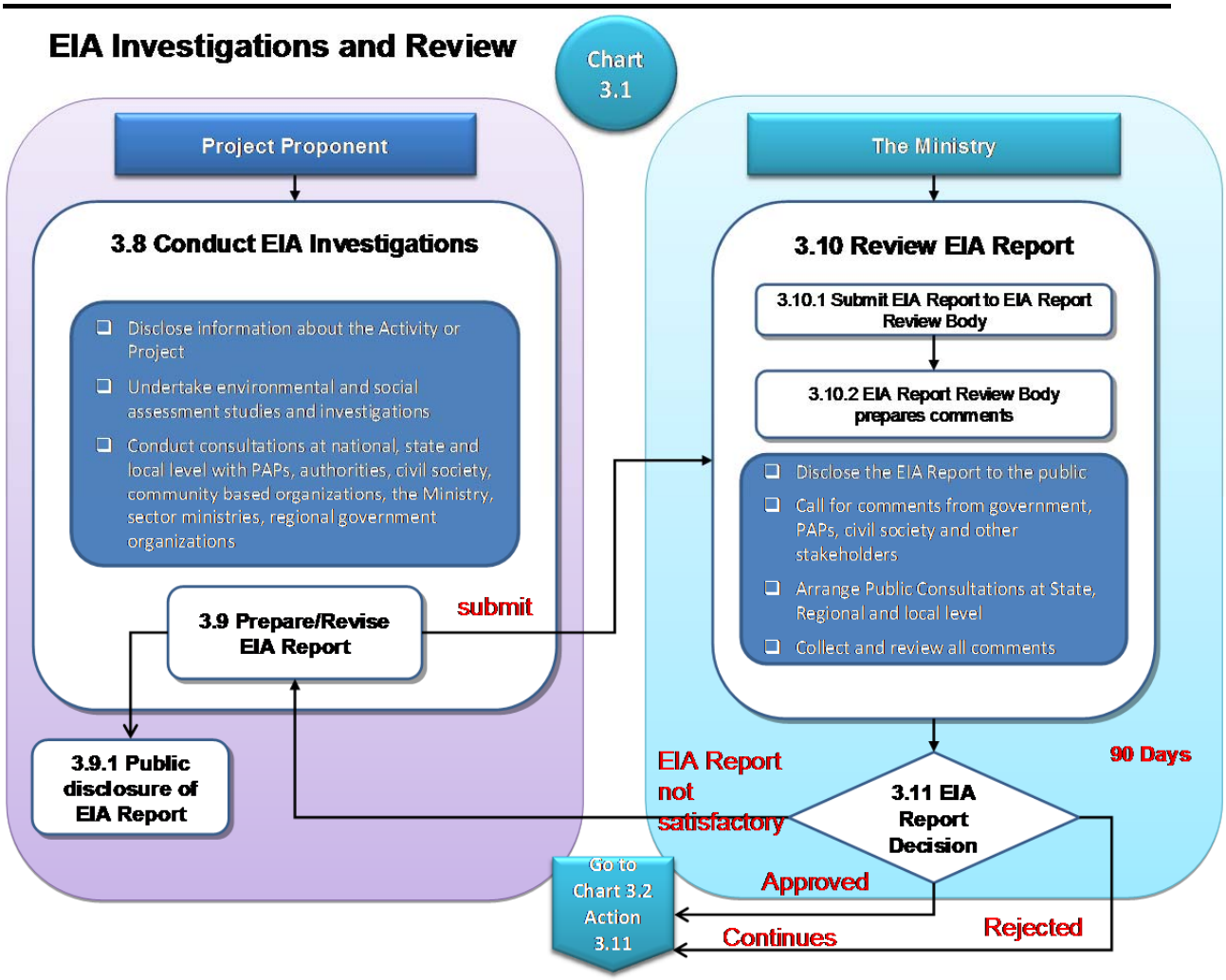
- Screening Phase – An initial assessment is made pursuant to this Procedure to determine whether an IEE or an EIA is required to be carried out. The Project Proponent shall submit to the Department for Screening a Project Proposal completed in accordance with Ministry guidelines;
- Scoping Phase – The 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.

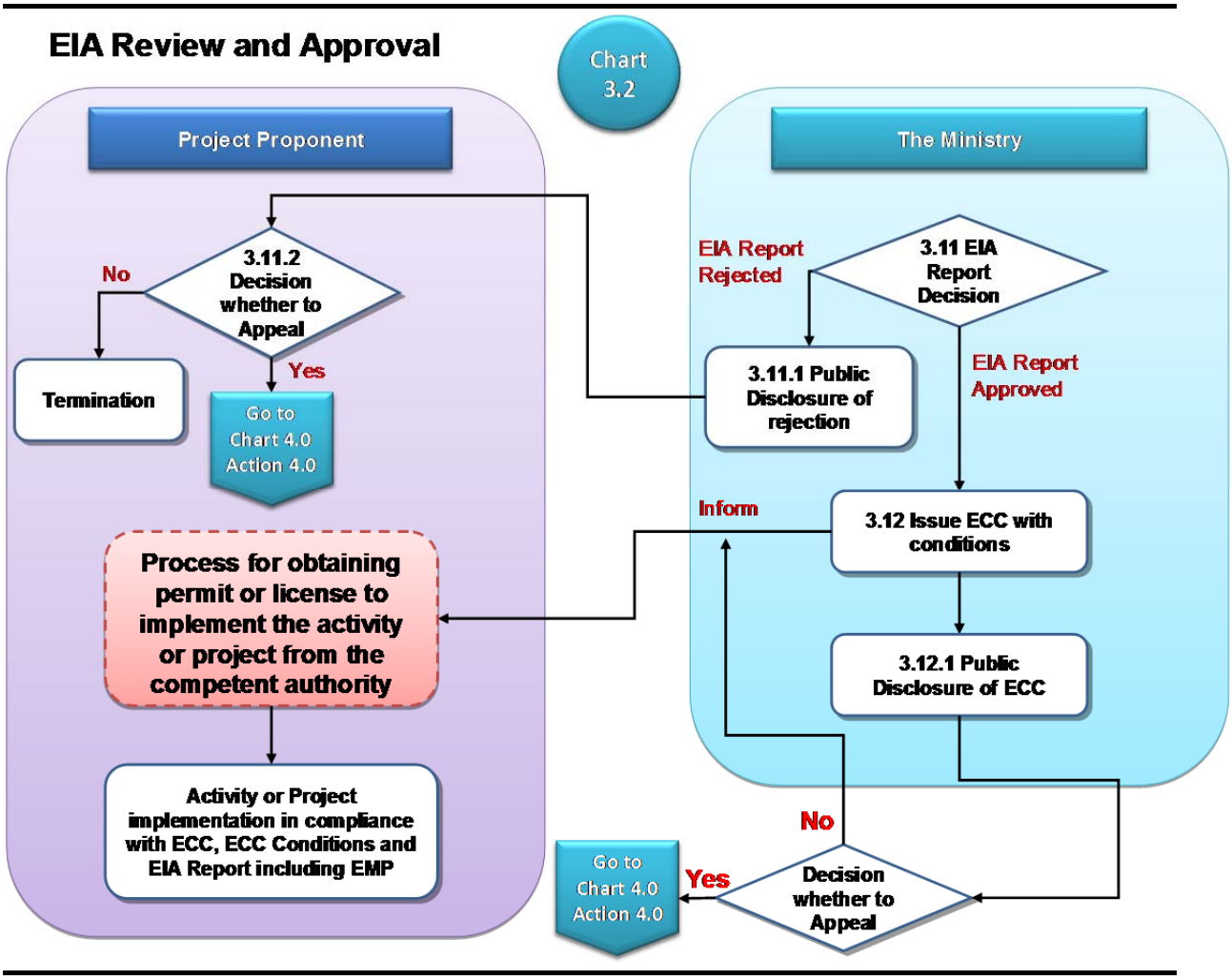
A sample of the preliminary procedure for the full EIA approval according to the draft piece of legislation is illustrating in the following Figure 3.1.

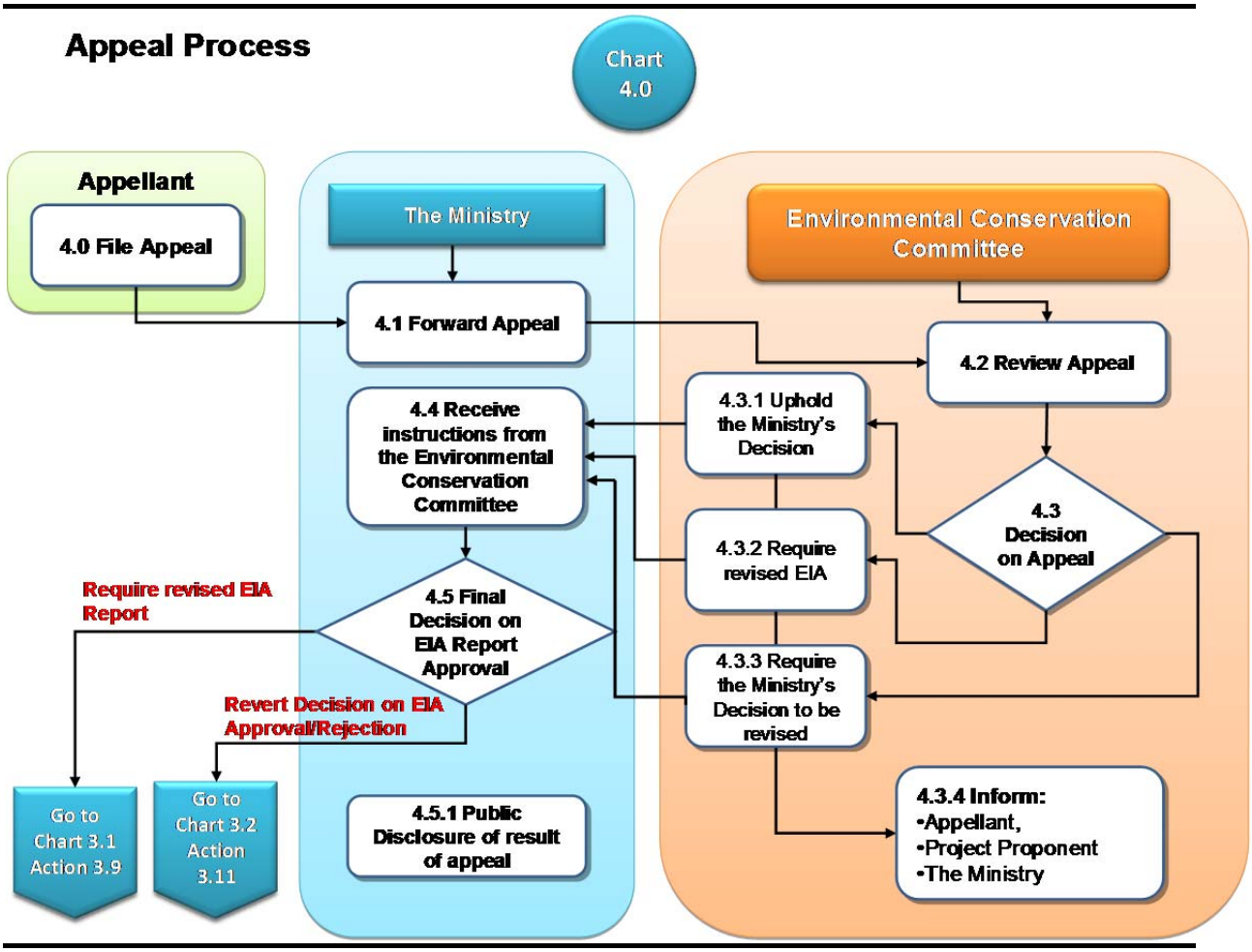
Figure 3.1 A sample of the preliminary procedure for the full EIA Process from Screening to Approval (Draft and preliminary version)











Source: Ministry of Environmental Conservation and Forestry, 2013

As mentioned above the EIA procedure (draft law of 24/12/2013) has not yet been effectively implemented. ESHIA evaluation for all existing license blocks are now still under MOGE instruction and EIA/ESHIA studies are submitted to MOGE for reference only (not required officially).

In case of new blocks (with tendering last year) EIA/ESHIA studies will be submitted to Myanmar Investment Committee for approval, until implementation of the EIA Procedure is made effective.

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, but institutions of power are dominated by the military and its leading clique.

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

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. The next general election is due to be held in late 2015.

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 PSC-K is mainly located in Mandalay Region; part of the Block falls in Shane State (South) to the West and part falls in Naypyitaw Union Territory to the South. Mandalay Region consists of seven districts, as shown in the following *Table 3.2*. Mandalay City is the second city in Myanmar, located at the upstream of Ayeyarwady river.

Table 3.2 Districts of Mandalay Region

District Name	Township Name	Area (km^2)	Population	Capital City
Kyaukse	Kyaukse	1874	236,147	
	Sintgaing	448	128,725	
	Myittha	892	188,441	
	Tada-U	938	151,791	
Mandalay	Amarapura	205	185,997	
	Aungmyethazan	28	190,144	Mandalay City
	Chanayethazan	12	138,869	
	Chanmyathazi	30	196,065	
	Mahaaungmye	15	223,338	
	Patheingyi	593	183,146	
	Pyigyitagon	29	148,367	
Meiktila	Meiktila	1229	310,429	
	Mahlaing	1123	154,860	
	Thazi	2042	206,438	
	Wundwin	1395	225,718	
Myingyan	Myingyan	988	273,006	

District Name	Township Name	Area (km^2)	Population	Capital City
	Kyaukpadaung	1960	306,783	
	Natogyi	1256	182,376	
	Ngazun	962	133,162	
	Taungtha	1352	243,987	
Nyaung-U	Nyaung-U	1464	374,594	
Pyinoolwin	Pyinoolwin	1992	171,698	
	Madaya	1099	241,724	
	Mogoke	1179	191,775	
	Singu	1509	141,810	
	Thabeikkyin	2581	119,856	
Yamethin	Yamethin	2152	242,750	
	Pyawbwe	1649	267,162	
Total		30,999	5,759,158	

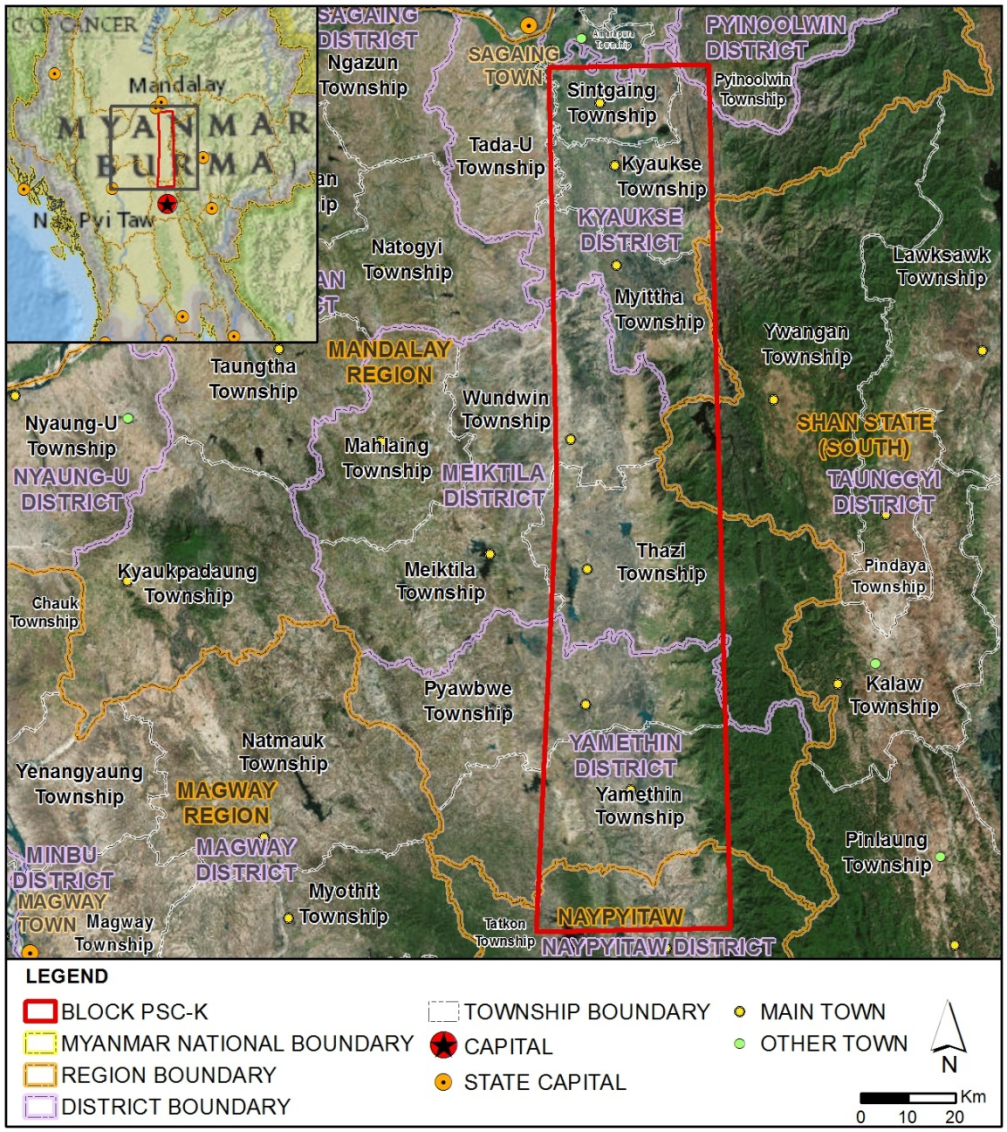
Block PSC-K contains the following region, districts, and townships (*Table 3.3*).

Table 3.3 Region, Districts and Townships within Block PSC-K

Region	District	Township
Mandalay Region	Kyaukse	Kyaukse
		Myittha
		Sintgaing
		Tada-U
	Mandalay	Amarapura
	Meiktila	Thazi
		Wundwin
	Pyinoolwin	Pyinoolwin
	Yamethin	Pyawbwe
		Yamethin
Naypyitaw	Naypyitaw	Tatkon
Shan State (South)	Taunggyi	Ywangan

Figure 3.2 shows the administrative division of the Mandalay Region.

Figure 3.2 Administrative Map of Mandalay 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 Myanmar laws and regulations applicable to the Project and their key requirements are summarized in Table 3.5.

The laws which currently exist in Myanmar do not yet address complex environmental and social management issues. For example, detailed legislation does not exist to deal with issues such as waste management and land use, and Myanmar has no specific laws to govern air and water pollution. A number of 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"*

The National Law does not establish any limits in term of water, air and soil quality as well as any water discharge and/or air, noise, vibration and odour emission limits.

In the absence of relevant national laws, the Project will comply with 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.

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 • Foreign Investment Law, 2012, and the 2013 Foreign Investment Rules • Draft – Environmental Impact Assessment Rules/regulations	• 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 Environmental Conservation and Forestry • Ministry of National Planning and Economic Development • Myanmar Investment Commission
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
Agriculture and Irrigation	• The Fertilizer Law, 2002 • The Plant Pest Quarantine Law, 1993, and amended in 2011 • The Pesticide Law, 1990 • 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

Biodiversity	• The Protection of Wild Life, Wild Plants and Conservation of Natural Areas Law, 1994
	• The Forest Law, 1992
		• The Natural Areas Law, 1994, identifies:
		  • 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.
			• Ministry of Forestry

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
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, reserved fishery and creeks contiguous thereto or in water-courses.	• Ministry of Livestock, Breeding and Fisheries
Land Use/Land Plan*	• Land Acquisition Act, 1894	• 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	• Department of Settlement and Land Records of the Ministry of Agriculture and Irrigation

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
		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 referred 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	• Section 2 of the law defines the protected and preserved cultural monuments as follows: o 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 o 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,	• The State Peace and Development Council • Ministry of Culture • Department of Archaeology

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
		bridge, sepulchre, sepulchral site and remains of excavated structure; pond, city-wall, wall, gateway, moat, fort and any remains thereof. o 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	
Energy	• Atomic Energy Law, 1998 • Electricity Act, 1910 • Electricity Law, 1984 • Law Amending the Electricity Law, 1990	• If radioactive materials are to be used (i.e. wireline logging), registration/application must be made to the Department of Atomic Energy before importing these materials.	• Atomic Energy Council • Ministry of Science and Technology • Department of Atomic Energy
Oil and Gas activities	• Myanmar Special Economic Zone Law, 2011 • 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	• 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

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
	• The Oilfield Rules, 1936 • The Petroleum Rules, 1937 • The Essential Supplies and Services 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.		

*) 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 of 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 summarize 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) (Revised in 2010)	Describes structure, objectives, membership and formation, duties and powers of Central Council and its Executive Committee.
Nation Drug Law (1992)	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) (Revised 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.
National Food Law (1997)	Enacted to enable public to consume food of genuine quality, free from danger, to prevent public from consuming food that may cause danger or are injurious to health, to supervise production of controlled food systematically and to control and regulate the production, import, export, storage, distribution and sale of food systematically. The law also describes formation of Board of Authority and its functions and duties.

Reference	Contents
Myanmar Medical Council Law (2000)	Enacted to enable public to enjoy qualified and effective health care assistance, to maintain and upgrade the qualification and standard of the health care assistance of medical practitioner, to enable studying and learning of the medical science of a high standard abreast of the times, to enable a continuous study of the development of the medical practitioners, to maintain and promote the dignity of the practitioners, to supervise the abiding and observing in conformity with the moral conduct and ethics of the medical practitioners. The law describes the formation, duties and powers of the Myanmar Medical Council and the rights of the members and that of executive committee, registration certificate of medical practitioners, medical practitioner license, duties and rights of registered medical practitioners and the medical practitioner license holders.
Traditional Medicine Council Law (2000)	Enacted to protect public health by applying any type of traditional medicine by the traditional medical practitioners collectively, to supervise traditional medical practitioners for causing abidance by their rules of conduct and discipline, to carry out modernization of traditional medicine in conformity with scientific method, to cooperate with the relevant government departments, organizations and international organization of traditional medicine. The law describes formation, duties and powers of the traditional medical council, registration as the traditional medical practitioners and duties and registration of the traditional medical practitioners.
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.

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

4.0 PROJECT DESCRIPTION AND ALTERNATIVE 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 PSC-K. Accordingly eni Myanmar BV has been onshore exploration activities in the block coded as PSC-K, an area of around 6558 km^2 located in the Mandalay Region, with small portions belonging to the Southern Shan State, and to the Naypyitaw State (Figure 4.1).

The hydrocarbon exploration is the research for hydrocarbon deposits beneath the Earth's surface, such as oil and natural gas. Areas thought to contain hydrocarbons are subjected to different surveys to detect features of the sub-surface geology; in particular, through seismic survey profile of the substructure is created. After identifying and evaluating a prospect, exploration wells are drilled in an attempt to conclusively determine the presence or absence of hydrocarbon.

The project foresees the acquisition of a gravimetric and magnetic survey in order to define the 2D seismic survey to be performed within the Block.

The series of surveys have the final aim to identify possible exploitable hydrocarbon traps within the Study Area.

The key project activities will be described in this chapter, including:

- ~6,500 km^2 gravimetric and magnetic aerial surveys (Grav-Mag);
- ~280 km 2D seismic survey.

4.1.1 Gravimetric and Magnetic Survey (Grav-Mag)

Grav-Mag surveys are two remote sensing techniques performed to investigate subsurface features. Grav-Mag measurements can be performed from the surface with portable devices or from airborne sensors. In the last years a few satellite sensors for gravimetric measurements have been launched. ESA GOCE is the most recent example.

Gravimetric measurements are sensitive to the density of rock bodies in the subsurface and they are expressed in units of acceleration called *milligals (mGal)*. Magnetometers measure the Earth's magnetic field in units called *gauss* or *nanoteslas (nT)*. These measurements are very sensitive to rocks containing the mineral *magnetite*. Such mineral is mainly contained in basement rocks; therefore, magnetometers are primarily used to detect variations in basement rocks composition and depth, as well as variations and displacements in basement rocks such as faults.

Grav-Mag surveys are often performed together, especially when carried out using airplane. They represent, together with other investigations, the preliminary step in Oil & Gas exploration. Usually, results from such investigations drive the planning of more detailed exploration activities such as the Seismic Survey.

During the Grav-Mag survey a LiDAR (LIght Detection And Ranging) instrument will be employed as well in order to provide a high resolution digital elevation model of the surveyed area.

4.1.2 Seismic Survey

The 2D seismic survey represents the second step of the planned exploration activities in the Block PSC-K. 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*.

The seismic survey has been designed on the basis of preliminary studies performed by eni specialists. The objective of the 2D survey is to give a deeper understanding of the subsurface geological features in the PSC-K block.

The seismic survey will be designed on the basis of the outcomes of Grav-Mag surveys, and further preliminary studies to be performed by *eni myanmar* specialists. The detailed location of the seismic survey will be provided accordingly to the outcomes of the foreseen Grav-Mag surveys.

The following chapters highlight the planned design characteristics and the possible impacts that such investigation technique could have on the overall Study Area as defined in Figure 4.1. Relevant assumptions adopted in the study will be clearly specified and detailed, whereas applicable.

4.2 PROJECT LOCATION

Block PSC-K is located in Mandalay Region, with small portions belonging to the Southern Shan State, and to the Naypyitaw State. (Figure 4.1).

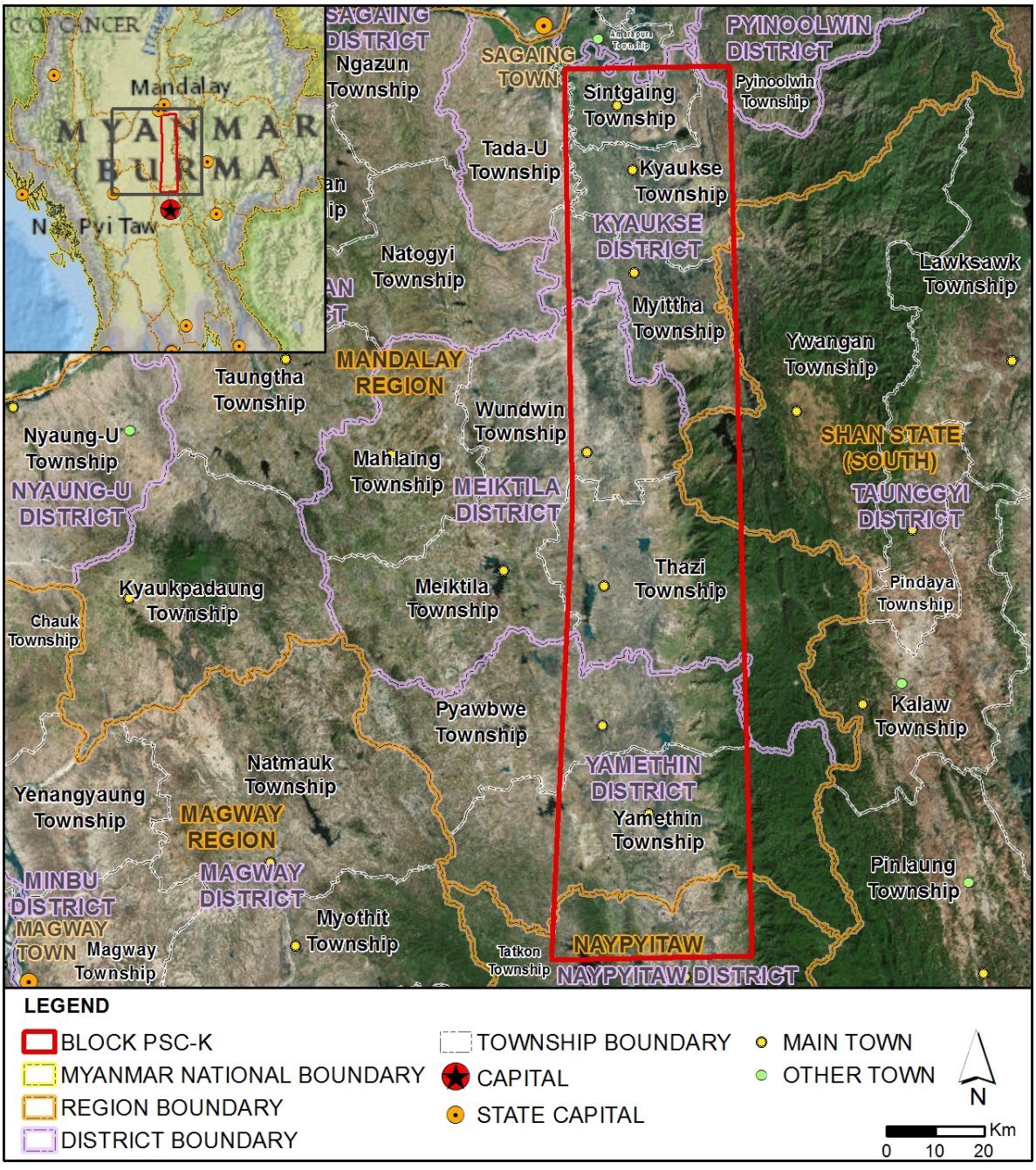
The full surface co-ordinates for Block PSC-K are presented below (Table 1.1).

Table 4.1 Coordinates for Block PSC-K

Point	Longitude (E)	Latitude (N)
1	96°00’00’’	21°48’00’’
2	96°19’29’’	21°48’00’’
3	96°20’00’’	20°10’00’’
4	95°56’32’’	20°10’00’’

Source: Myanmar Ministry of Energy, 2013

Figure 4.1 Location of Block PSC-K



Source: eni, 2014

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 PSC-K 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.

It is not possible to identify an alternative related to the PSC-K Block, because the Republic of the Union of Myanmar assigned to eni Block PSC-K for hydrocarbon exploration and therefore the Project activities can be developed only within the Block boundaries.

4.4 DESCRIPTION OF THE SELECTED ALTERNATIVE

The aim of this section is to describe the different components involved in the construction, operation and decommissioning of the hydrocarbon exploration activities that will be conducted within the Block PSC-K, and to provide an overview of the project construction and operation management, use of resources, and environmental interferences.

As reported in section 4.1, the Project will be divided in two main phases:

- grav-mag survey
- seismic survey.

4.4.1 Grav-Mag survey

Grav-Mag survey and the results will be used by *eni myanmar* scientists to identify the location of the seismic survey together with other investigation techniques. The two surveys (Grav-Mag measurements) will be performed simultaneously by using airborne instruments mounted on the same aircraft.

The different design and realization phases for the survey can be grouped into three main activities.

- Gravimetric data acquisition,
- Magnetic data acquisition,
- Logistic requirements.

Each one will be described in the following paragraphs.

4.4.1.1 Gravimetric Data Acquisition

Airborne Gravity Gradiometer is a multiple accelerometer moving platform that measures the full gravity gradient tensor. Full tensor gradient measurements provide more information about the gravity field from each measurement location than partial tensor gradient or single vector field. This facilities interpretation of sub-surface features

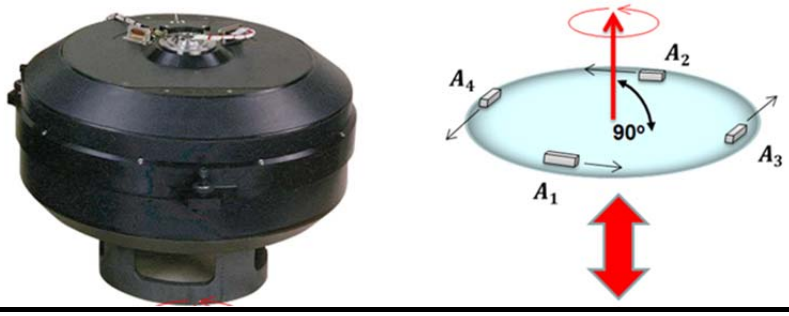
exhibiting a lateral density contrast to their surrounds. Gradients are measured in units of *eotvos* (*Eo*), with 1 *Eo* equal to 0.1 *mGal/km* *(source: http://www.gradiometry.com/home)*

Surveys are flown for both detailed and regional applications; with line spacing from 50 to 2,000 m. Processing and interpretation techniques utilize all components of the data to enhance signal to noise ratios. The adopted instrument is a Falcon gravimeter, designed with four accelerometers oriented nearly 90° from vertical to ensuring the minimum sensitivity to vertical aircraft turbulence (Figure 4.2).

The orientation of the flight paths is dependent on the geology of the area. The flight height is generally between 80m and 100m above ground using draped method.

Three survey design scenarios have been proposed as reported in Table 4.2. Smaller flight line spacing corresponds to a higher detail survey; while wider line spacing corresponds to lower detail survey.

Figure 4.2 Examples of gravimetric measurement instruments.



Source: eni

Table 4.2 Design scenarios for gravimetric survey

Characteristics	Scenario 1	Scenario 2	Scenario 3
Flight line spacing (m)	500	700	1000
Angle (°)	70	70	70
Tie line spacing (m)	2,500	3,500	5,000
Altitude (Draped – m)	80/100	80/100	80/100
Total lines (Km)	15,590	11,136	7,795
In-lines	338	241	169
X-cross lines	38	27	19
Survey duration (weeks)	~5	~4	~3

Other design scenarios could be evaluated according to topography issues. The final choice will be made according to time and budget availability. It is hereby anticipated that, given the nature of the activity, possible revision of design scenario should not change the level of impact assessed.

4.4.1.2 Magnetic Data acquisition

Cesium vapor magnetometers are the most widely used instruments for aeromagnetic surveys, whenever the highest resolution and/or cycling rates for measurement of the earth's magnetic field is required.

The output of a cesium sensor is essentially continuous in practice. Combined with the necessary electronics, it can operate at a resolution of up to 0.001 nT, at sampling rates of 10 readings per second or greater, throughout a range of 20,000 to 100,000 nT.

The magnetometers can be installed in fixed-wing aircraft or helicopters, in either "stinger" or "towed bird" configurations (Figure 4.3), and, in addition to measuring total magnetic field, can be used to make vertical, transverse and/or longitudinal gradient measurements by using two or more sensors.

Figure 4.3 Examples of magnetic measurement instruments (left: stinger; right towed bird configurations)

Source: left – Sander Geophysics Ltd; right – Terraplus

4.4.1.3 Logistic Requirements

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available: the Mandalay city International Airport, to the very north of the Block; the Shante city Airport located a few kilometres from the western boundary of the central part of the Block; the Helo city Airport at 50 km east of the eastern Block boundary (Figure 4.1). The airports can provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management.

The duration of the survey is expected to be from three to five weeks. No base camp is likely to be placed. The accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

4.4.1.4 Vehicles Requirements

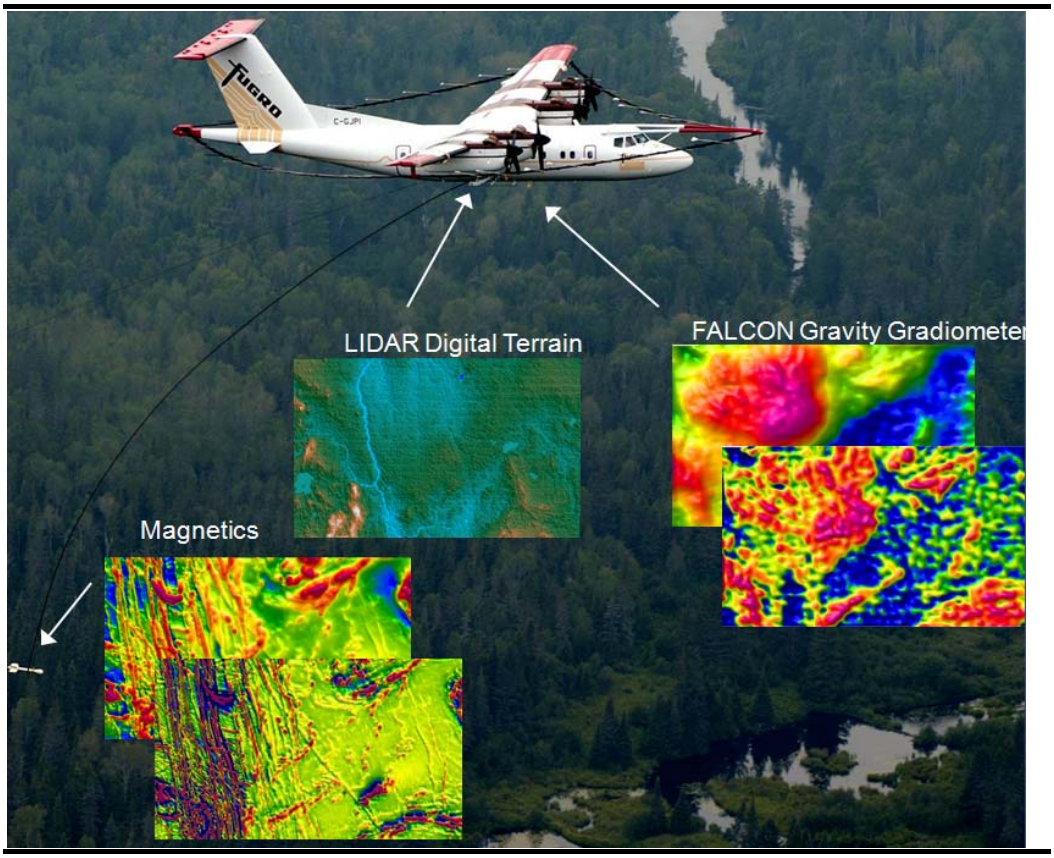
Cessna Caravan type carrying the three instruments (gravimeter, magnetometer and LiDAR sensor) at one time, which represents the currently preferred solution. Figure 4.4 provides an example of the Cessna aircraft in operational phase during a Grav-Mag

survey. There is the possibility to replace the airplane with a helicopter in case unexpected constraints or particular requirements are needed. The final decision will be taken as soon as the Grav-Mag contractor will be selected.

The detailed information concerning the involved staff and vehicles will be provided once the Grav-Mag contractor will be selected and the Seismic survey plan will be discussed and accepted by *eni myanmar* representatives.

Other support vehicles are not foreseen apart from possible 4WD jeeps for ground survey if required and a car for personnel transportation from/to the airport.

Figure 4.4 Example of aircraft in operational phase.



Source: eni

4.4.2 Seismic Survey

The 2D seismic survey represents the first step of the planned exploration activities in the Block PSC-K. Such activity was requested in the invitation to apply for hydrocarbon exploration authorizations and subsequent hydrocarbon exploitation license for Block PSC-K, awarded by the Republic of the Union of Myanmar to eni Myanmar BV on the 31st July 2014.

The seismic survey has been designed on the basis of preliminary studies performed by eni specialists. The objective of the 2D survey is to give a deeper understanding of the subsurface geological features in the PSC-K block.

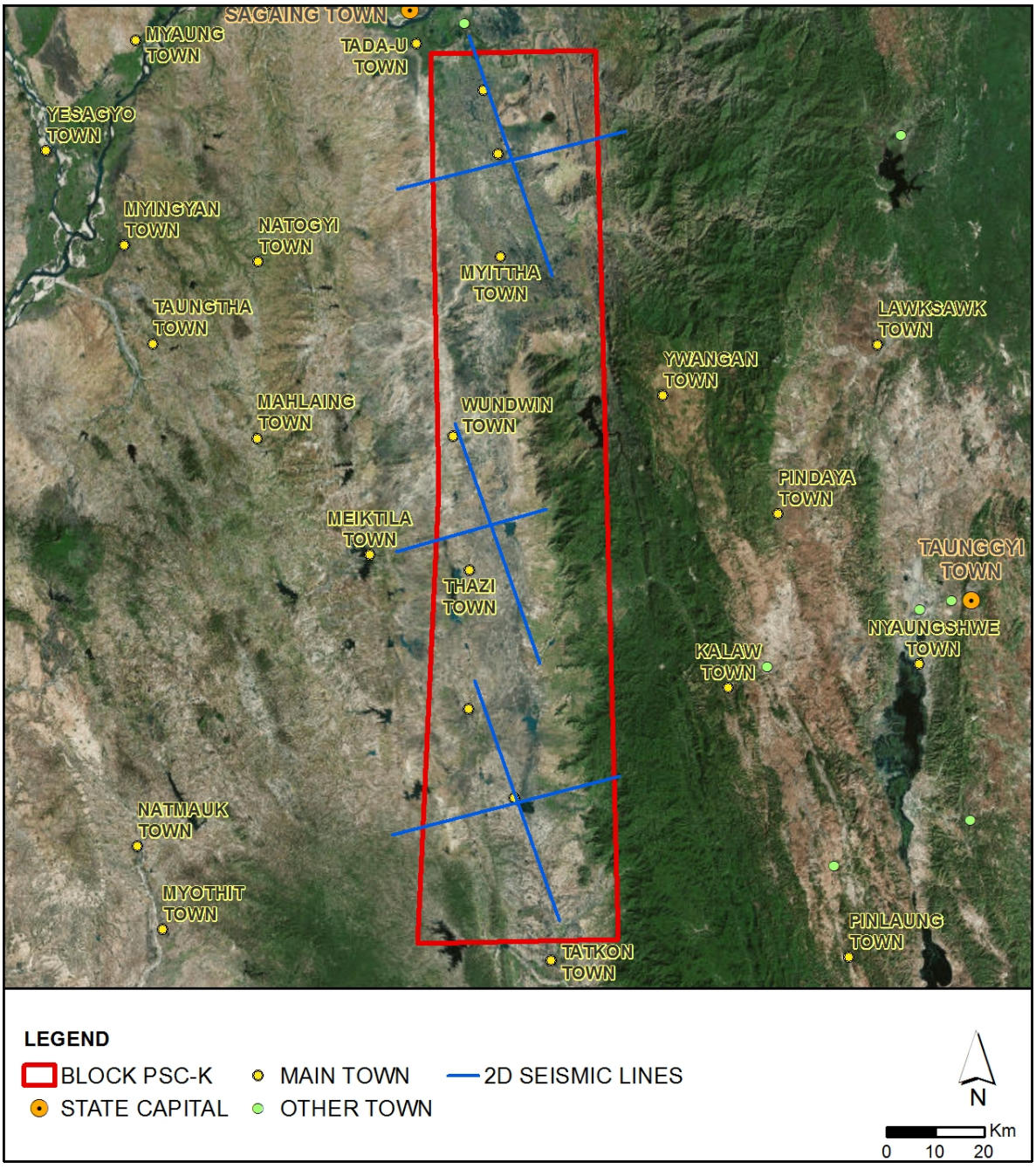
The following chapters include the planned design characteristics and the preliminary identification of the potential impacts that such investigation technique could have on the overall Study Area as defined in Figure 4.1.

4.4.2.1 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, areas of significant vegetation cover, sensitive cultivations, 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*. Offsets from the survey lines are not desirable but can, and will be made, when necessary, to avoid especially sensitive or inaccessible locations..

The locations of the 2D seismic survey has been defined and they are shown in Figure 4.5.

Figure 4.5 2D Seismic Lines in Block PSC-K



Source: eni, 2014

Block PSC-K 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 small proportion of the Study Area is characterized by the presence of forested hills. The absence of settlements, as well as of a well-developed road network, does not provide free access to vehicles in this portion of the

Study Area. For more information concerning the land cover of the area, refer to Chapter 6 Baseline.

The geophones will be laid by hand on the receiving lines. The geophones will be placed in rows with an interval of 50m. Strings are connected in series to each other along the length of the survey line and then to a recording module. Strings are connected in series to each other along the length of the survey line and then to a recording module. The receiver Centre of Gravity (COG) is centred over the strings and will progress down the active geophone line. As the survey progresses, geophone strings are removed from the surveyed lines and installed on successive ones.

Access in the 2D 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 PSC-K 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 forested hills) no major difficulties in routing are expected. A detailed planning of vehicles movement must be performed to consider the frequent presence of rivers and streams and the scarcity of river crossings in the area.

4.4.2.2 Line Clearance

The Seismic survey performed with micro-charges does not require main site clearance. The source locations will be selected in such 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. 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 QC and *eni myanmar* personnel from the Project.

If the seismic survey will be integrated with the use of vibroseis, it is likely that the survey lines will be cleared of vegetation and loose material.

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

The source lines 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).

Given the topography and surface conditions reported in the environmental baseline, it is anticipated that no bulldozing or invasive line clearance operations are expected so far.

At the end of the seismic survey, in the event of line clearance, restoration activities of the area to the previous condition will start. These activities shall include the following geomorphological and vegetational restoration measures:

- Topsoil, if previously excavated shall be restored in order to enable natural re-vegetation;
- Natural re-vegetation shall be promoted or, alternatively, seismic areas shall be reseeded with native species if natural re-growth is not sufficient.

4.4.2.3 Seismic Data Acquisition

2D surveys design and technical specifications are available and reported in the following Paragraphs. As previously described the detailed location of the 2D seismic survey is still under investigation and will be strictly connected to the outcomes of the Grav-Mag Survey. *eni myanmar* will provide the precise location within the Block PSC-K as soon as available.

Weather and environmental conditions suggest the use of explosive source supported by 4x4 vehicles and portable handling system. Quantity (kg) and depth (m) shall be tested before the beginning of the survey: 2kg dynamite for single shot can be used as reference, having been applied in the neighbour block in previous 2D acquisitions. The boreholes will be excavated with a small portable power rig (Figure 4.6) to minimize the impact on land cover.

The vibroseis source option can be possibly considered in the dry season in order to increase the average daily production: in such case vibroseis, with reduced environmental impact, are recommended.

Figure 4.6 Charge placement

Source: eni

4.4.2.3.1 2D Seismic Data Acquisition

The seismic acquisition will be carried out using charges every 50 m. The charges, placed in an in-line configuration, will be blasted with a remote control. The dimensions and the exact locations of charges will be finalised by a testing programme immediately prior to the 2D programme.

The receiving line comprises 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 interval between two receiving stations will be approximately 25 m.

The anthropogenic and environmental constraints, together with the predominant agricultural land use in the Study Area suggest the use of cable-less geophones (Figure 4.7) for the following reasons:

- Staff members' reduction and relevant positioning system equipment with consistent reduction of HSE risk and costs;
- Prevent the risk of cables cut during local agricultural activities (farming activity is intense during most of the year) and consequent loss of production time due to subsequent restoration;
- Guarantee the geophone lay-out with respect to the theoretical positioning allowing maintaining a uniform fold in areas close to the towns; and
- Reduce of the time (estimated 50%) necessary to prepare and lay-down receiver lines: not having cable connection between receiver lines, no need to wait active link for those receiver lines crossing roads and channels.

However, the cable less system needs adequate operative supports to:

- Monitor and limit the farming activity to maintain a low level of ambient noise and an acceptable data quality;
- Guarantee a constant GPS connection to record correct timing information;
- Organize a daily quality control of the equipment to verify the correct operation; and
- Plan a daily harvesting for the seismic data QC in "pseudo real-time".

Being in a mostly flat area, a receiver station will be composed by linear geophone array (not less than 12 units) positioned in inline direction. Such geometry will allow the ground roll filtering during recording phase.

Figure 4.7 Examples of cableless geophones

Source: GEOSPACE Technologies

The geophones will be carried to the receiving locations and placed on the ground by hand (Figure 4.7). The receiving line is laid-out so that the source location results to be in the middle of the active 'spread'. Source stations will be located at an interval of 50 m. As the source advances, geophones are removed from the back of the line and added to the front. This allows the survey line to roll forward of active spread at any one time.

The signal is recorded by a mobile recording unit *(Figure 4.8*) which is usually placed approximately 500 m away from the receiving and source lines to avoid any interference.

Figure 4.8 Mobile Recording Unit

Source: eni

4.4.2.4 Uphole Drilling

In order to calibrate the shallow seismic signal, upholes will be drilled along the survey lines. The location of upholes 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 PSC-K, 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.

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

4.4.2.6 Base Camp

The location of the camp bases has not yet been identified but it will be selected to avoid any identified environmental, social & cultural heritage sensitivities.

The camp bases will generally comprise the following facilities:

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

Figure 4.9 shows an example of a typical base camp layout.

Figure 4.9 Example of a base camp for seismic survey.

Source: eni

The Main explosive Storage will be located at the nearby Military Compound. In case 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) (Figure 4.10). The location of the structure will be defined by the contractor personnel and *eni myanmar* representatives during the camp preparation. For security purposes 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 reach the explosive.

Figure 4.10 Example of explosive storage in a base camp

Source: eni

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.

4.4.2.7 Provisions

All provisions will be imported from local commercial centres prior to the confirmation by *eni myanmar* of the good 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 survey camp prior to consultation of local Authorities. The drilling will follow the same preventive measures (type of muds, etc.) that apply to the uphole activities. A close control on water consumption will be followed during the project to ensure minimisation of water use

4.4.2.8 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.

4.4.3 Use of Resources and Environmental Interferences

4.4.3.1 Land Cover

4.4.3.1.1 Grav-Mag Survey

No land will be occupied for the realization of the Grav-Mag survey. Only small areas such as (hangar and airstrip) within the selected airports will be temporarily occupied. No construction of temporary airstrips is foreseen for the realization of the survey in the Study Area.

4.4.3.1.2 Seismic survey

The expected occupied land use for the seismic survey will be related to the temporary occupation of 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.

4.4.3.2 Materials

4.4.3.2.1 Grav-Mag Survey

No material will be used apart from the scientific equipment on-board of the aircraft.

4.4.3.2.2 Seismic Survey

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, ante operam conditions will be restored as much as possible.

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

4.4.3.3 Fuels

4.4.3.3.1 Grav-Mag Survey

Petrol fuel (100 octanes) will be used for the airplane. Diesel fuel will be used for cars and jeeps if they are involved in personnel and equipment transfer or possible minor field work activities (ground truths collection and instruments calibration).

4.4.3.3.2 Seismic Survey

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.

4.4.3.4 Energy

4.4.3.4.1 Grav-Mag Survey

No energy resource will be used for the Grav-Mag survey apart from the ones provided by the selected infrastructures (airport, hotels, etc.).

4.4.3.4.2 Seismic survey

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.

4.4.3.5 Water Consumption

4.4.3.5.1 Grav-Mag Survey

No water consumption will be required for the Grav-Mag survey apart from the resources available at the selected infrastructures (airport, hotels, local commercial activities, etc.)

4.4.3.5.2 Seismic Survey

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.

4.4.3.6 Transportation and Traffic

4.4.3.6.1 Grav-Mag Survey

No traffic or transportation will be foreseen to perform the survey. The only requirements will regard the personnel and equipment transfer from/to the airports.

4.4.3.6.2 Seismic Survey

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.

4.4.3.7 Air Emissions

4.4.3.7.1 Grav-Mag Survey

Air emissions will be limited to the aircraft exhaust emissions.

4.4.3.7.2 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.

4.4.3.8 Noise & Vibration Emission

4.4.3.8.1 Grav-Mag survey

During the survey no vibrations will be produced. The noise sources will be limited to the airplane engine. The noise level is not likely to create disturbance even if the flight height will be relatively low (80-200m).

4.4.3.8.2 Seismic Survey

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.

4.4.3.9 Waste Handling and Disposal

4.4.3.9.1 Grav-Mag Survey

No waste production is foreseen during the survey. Should there small amounts of normal waste be produced, they will be disposed by using infrastructures' facilities.

4.4.3.9.2 Seismic Survey

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 PSC-K Environmental Management Plan (EMP) that *eni myanmar* will provide on the basis of the sensitivities identified within the ESIA. 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 *eni myanmar* requirements as stated in the contract and EMP. 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 ES&SR Representative is located with the survey crew for the first period of operations as a minimum);
- *eni* ES&SR plan;
- EMP that will include requirements for waste management; and
- 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 ES&SR 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 Plan (EMP) 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.

4.4.3.10 Wastewater and Sanitary Waste

4.4.3.10.1 Grav-Mag survey

No waste water or sanitary waste production is foreseen during the survey.

4.4.3.10.2 Seismic Survey

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 an open pit where evaporation will take place. The pit 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.

In any case, septic tanks will be located away from areas with a high water table (i.e. floodplain areas) or from water abstraction wells.

4.4.4 Employment and Labour

4.4.4.1 Grav-Mag Survey

eni myanmar will contract a specialist survey company to undertake the work, including aircraft crew and scientists. In addition to the staff mentioned above, *eni myanmar* will appoint an ES&SR (Environment Safety and Social Responsibility) Advisor and Quality Supervisor, who will work with the survey contractor during the Grav-Mag survey programme.

4.4.4.2 Seismic Survey

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 an ES&SR Advisor and Quality Supervisor, who will work in the field with the survey contractor during the seismic survey programme.

4.4.5 Overall Duration and Timing

eni will perform the exploration project activities within the following preliminary time frame:

- Gravimetric and magnetic survey: 2 months;
- 2D seismic survey: 2-3 months.

4.4.6 Unplanned Events

4.4.6.1 Fire and Explosions

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.

4.4.6.2 Emergency Responses

Any incident or emergency that requires activation of the Emergency Management System will be identified into one of 3 categories as below:

- Level 1 Incident: An event that can be dealt with on site or at a location by the On-Scene Commander and/or Incident Control Team with their resources. Duty Manager is informed only. Site location is defined as Field Units; Residential areas; All Field Management individual offices.
- Level 2 Incident: An event that is beyond the resource capabilities of the On-Scene Commander and/or Incident Control Team: Duty Manager activates the Incident Management Centre to provide additional resources and support.
- Level 3 Incident: An event that is beyond the resource capabilities of the Incident Management Team and requires activation of the Crisis Management Team to provide additional resources and support or an incident that has the potential to escalate such that there may be damage to the Contractor reputation.

The Management shall ensure that the roles and responsibilities for personnel involved in the Emergency Management Team at all levels within the organisation are clearly defined, documented and implemented. Seni or Managers with responsibility for Contingency Planning and Emergency Response activities shall ensure that personnel are trained and competent to perform these activities.

Emergency Response (ER) shall primarily consist of:

- Emergency Communications Centre (ECC) as single emergency contact point for all emergency situations.
- Duty Manager for notification by ECC of all emergency situations, decision making on level of response, and information channel with incident site and subsequent response.
- On-scene Incident Control Teams for Well Operations and hydrocarbon production areas.
- Incident Support Team located at the Incident Support Centre.
- An Incident Management Team (IMT).
- A Crisis Management Team (CMT).
- A Public and Relative Information Service (PARIS) made up from Public Relations(PR) under their procedures, Human Resources (HR) under their procedures.

4.4.6.3 Technologies for Risk Control

Not Available

4.4.7 PRELIMINARY Identification of the Potential Environmental – Social – Health Interferences

The Preliminary Project Interferences Identification Matrix is shown in **Table 4.3**. 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 4.3).

Table 4.3 Environmental – Social - Health 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
		Grav-Mag Survey – Site preparation													
	1	Arrival of scientific instruments and flight preparation. Personnel transportation.													
		Grav-Mag Survey – Data acquisition													
	2	Flight and simultaneous data acquisition (Gravimetric – Magnetic – LiDAR)													
		Grav-Mag Survey – unplanned events													
	3	Fire and Explosions (airplane crash)													
		Seismic Survey – Site Preparation													
	4	Camps site clearance and preparation													
	5	Use of machinery and equipment (portable rigs and earthwork machinery, generators, transportation of personnel and materials)													
	6	Presence of workforce													

Table 4.3 Environmental – Social - Health 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	Use, storage and management of hazardous raw materials (diesel, explosive, *etc*.)													
	8	Production and management of domestic wastes (black/grey water, paper, *etc.*)													
		Seismic Survey – Line clearance													
	9	Lines survey													
	10	Source sites clearance and preparation													
	11	Management of hazardous raw materials (diesel, explosive, *etc*.)													
		Seismic Survey – 2D seismic data acquisition													
	12	Charges blast													

Table 4.3 Environmental – Social - Health 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	Movement of instruments (receivers) and personnel													
		Seismic Survey – Up-hole drilling													
	14	Site clearance and preparation													
	15	Use of machinery and heavy equipment													
	16	Production and management of waste drill cuttings and muds													
		Seismic Survey – Site closure													
	17	Decommissioning, Abandonment and Rehabilitation													
		Seismic Survey – unplanned events													

Table 4.3 Environmental – Social - Health 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	
	18	Fire and Explosions														
		Potential Risk or negative Impact														
		Potential positive impact														

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 data. More detailed and in-depth analysis will be provided in a future step of the Project, through specific environmental, social and health surveys, contacts and interviews with public and local stakeholders.

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 PSC-K.

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

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/burma.html*
- *Myanmar Protected Areas – context, Current Status and Challenges – 2011*
- *http://myanmarbiodiversity.org/index.php*
- *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/myanmar/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. WHO 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, 25th and 26th 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*

As mentioned above, missing information will be gathered in a future step of the Project, with specific environmental, social and health survey, and interviews with public and local stakeholder.

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 PSC-K, that has been identified as the Study Area of the Project.

In Block PSC-K eni will develop an hydrocarbon exploration Project, in particular the following activities are foreseen:

- Gravimetric and magnetic (grav-mag) aerial surveys;
- ~ 280 km 2D seismic survey.

As reported in the Project Description Section, the seismic survey will be designed on the basis of the magnetic and gravimetric (grav-mag) surveys, and further preliminary studies performed by eni scientists. The detailed location of the seismic survey will be provided as soon as possible, once performed the grav-mag surveys. The grav-mag and the seismic survey, as well as all the Project facilities will be located within the whole Block PSC-K. Therefore 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 an high level analysis of the environmental, social and health components. The most data analysed has been gathered at national and regional levels.

A site-specific analysis will be conducted before the beginning of the seismic activities; a detailed description is included in the Environmental, Social and Health Management and Monitoring Plan (Chapter 8). The land cover characteristics of an area, namely the physical land type such as forest or open water, are the base 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.

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

- Bare soil;
- Bush and Shrub;
- Low Laying Mixed Vegetation;
- Urban Area;
- Mixed Agriculture;
- Irrigated/Flooded Agriculture;
- Dry Forest;
- Green Forest;
- Water Bodies.

This land cover areas are described in detail in the Paragraph 5.3.5. 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

This Chapter presents an overview of the environmental physical 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 PSC-K is located Mandalay Region, as shown in Figure 5.1. This Region is situated in the centre of the country, bordering Sagaing and Magwe Divisions to the west, Shan State to the east and Bago Division and Kayin State to the South

Mandalay 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.

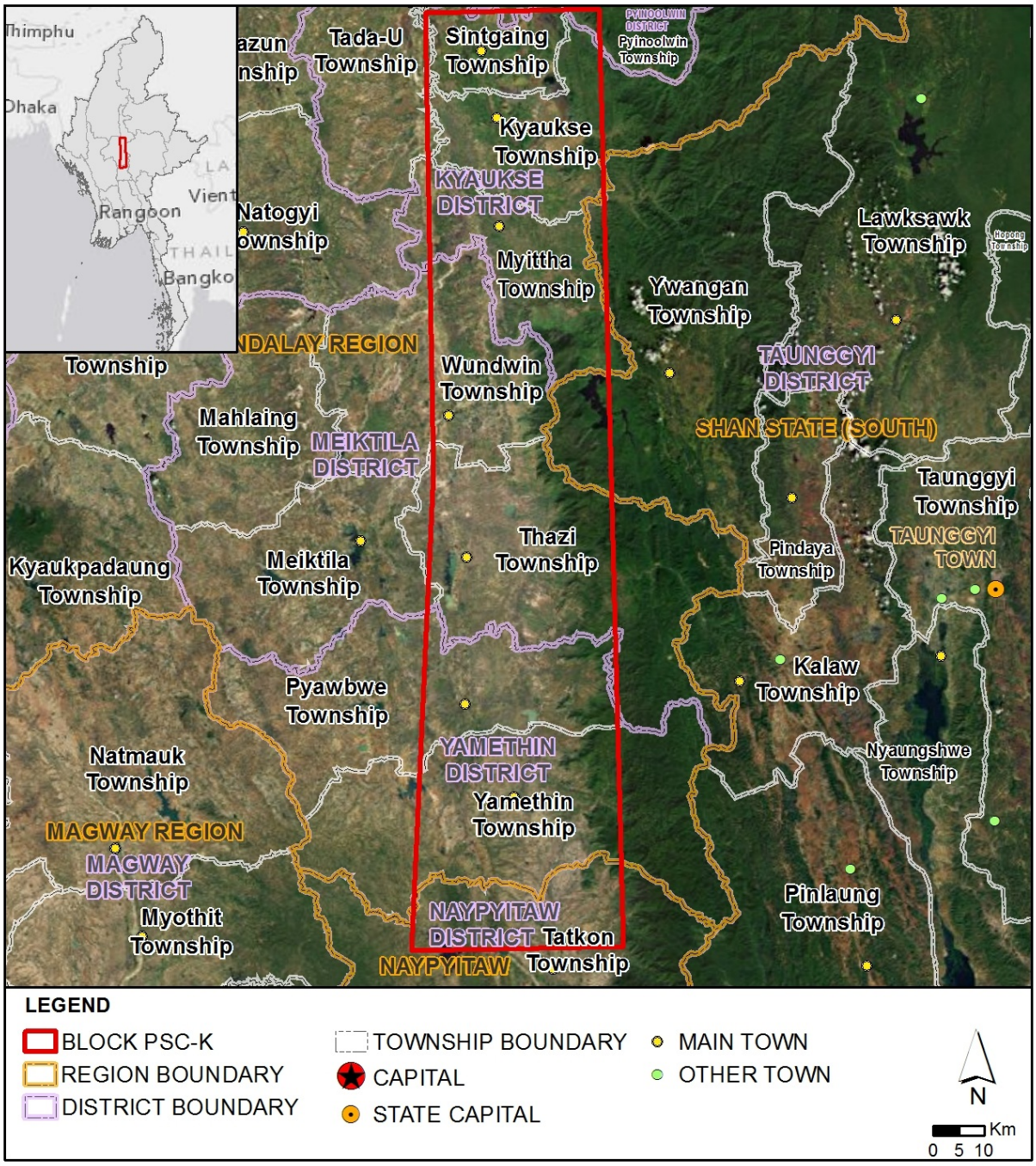
A description of the Study Area is presented in the following paragraphs :

- Atmosphere;
- Water;
- Soil and Subsoil.

5.3.2 Environmental Study Area

Figure 5.1 below presents the Environmental Study Area, that is equivalent to the whole PSC-K Block.

Figure 5.1 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 PSC-K.

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.

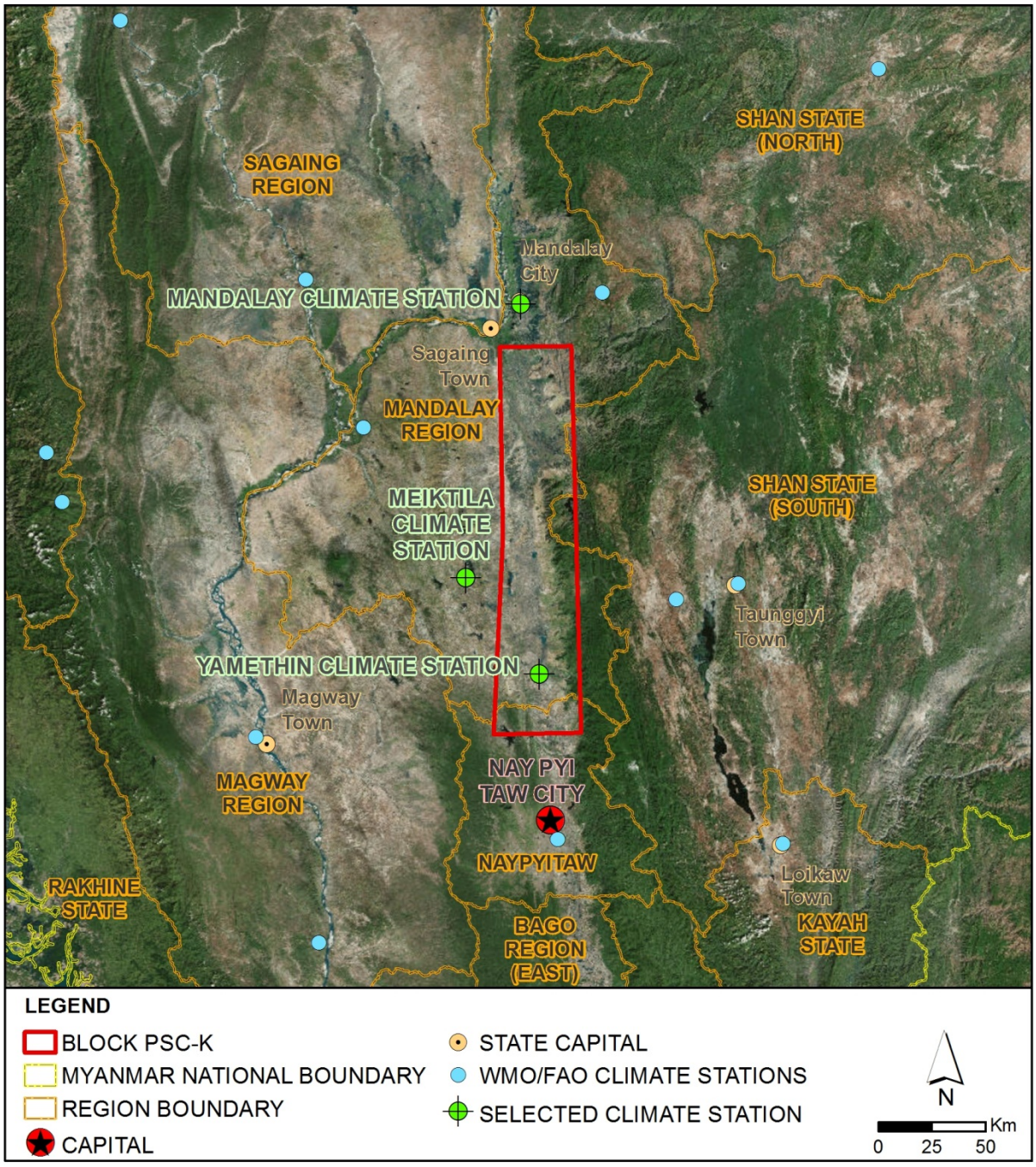
Block PSC-K is located between the following two climatic zones:

- 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;
- Subtropical Monsoon and subtropical mountain climates, with mean temperatures of January below 18° C and occasional frost during the winter months in the higher and northerly situated mountain regions.

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)

In all Myanmar territory 24 WMO/FAO (World Meteorological Organization/Food and Agriculture Organization) climate stations are located as shown in Figure 5.2. In the next paragraphs maps of distribution of annual average of maximum and minimum monthly temperatures and of annual average of monthly cumulative rainfall are presented.

Figure 5.2 Location of WMO/FAO climate stations in Myanmar



Source: eni, 2014

Three meteo stations are representative of the Block PSC-K, the available data are monthly means measurements of 30 years (1961-1990). Characteristics of those meteo stations are reported in Table 5.1 (both WMO and FAO codes are included).

Table 5.1 WMO and FAO station representative of Block PSC-K

Station Name	Wmo Code	Fao Station Id	Elevation (m a.s.l.)
Mandalay	48042	BU16MNDL	76
Meiktila	48053	BU05MKTL	220
Yamethin	48067	BU06YMTH	199

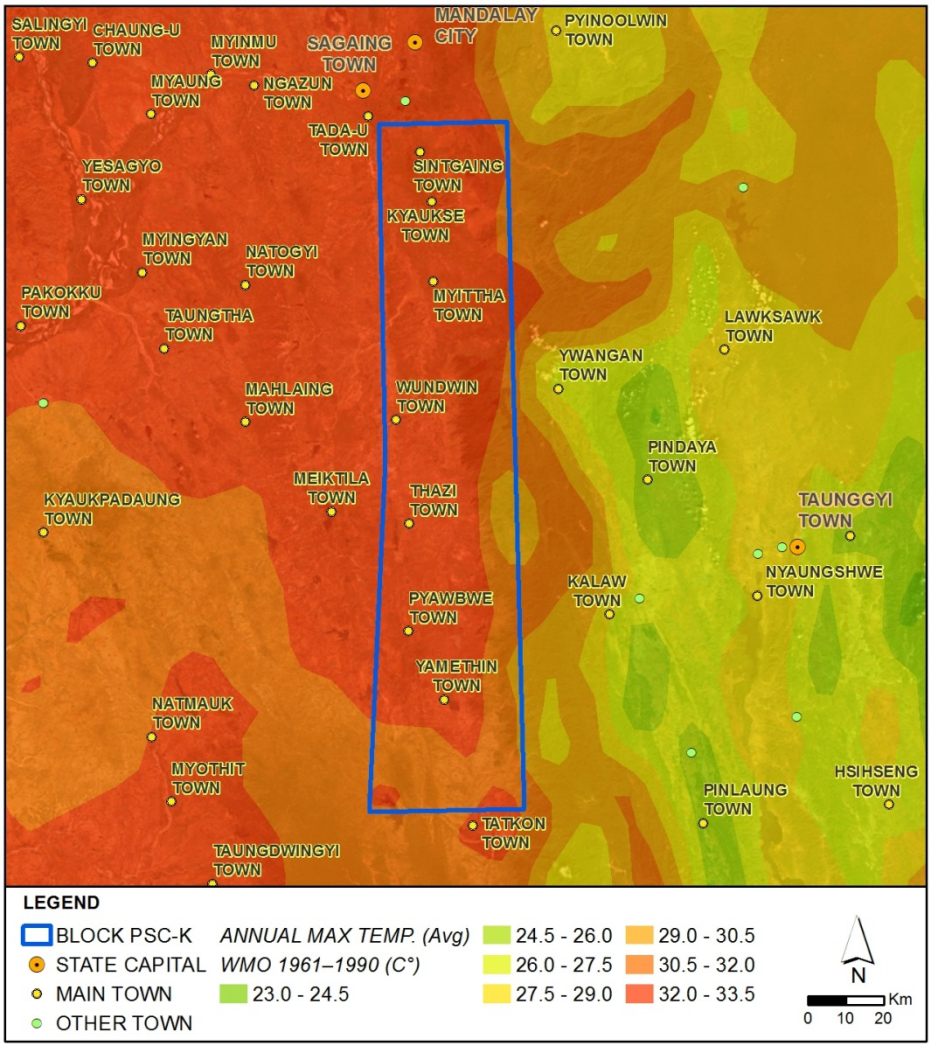
Source: Digital Agricultural Atlas of the Union of Myanmar, 2013

Air Temperature

The annual mean of maximum monthly temperatures for each station was used to generate an interpolated surface, which was then classified by using equal interval ranges (of 0.5 °C, from 20 to 33.5 °C) as reported in the Figure 5.3, that displays information on maximum temperatures distribution throughout the country.

Figure 5.3 and Figure 5.4 show respectively the average value of maximum and minimum monthly temperature for the Block PSC-K.

Figure 5.3 Distribution of annual average of maximum monthly temperatures (1961-1990)



Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

Table 5.2 Average value of monthly maximum temperature for Block PSC-K (1961-1990)

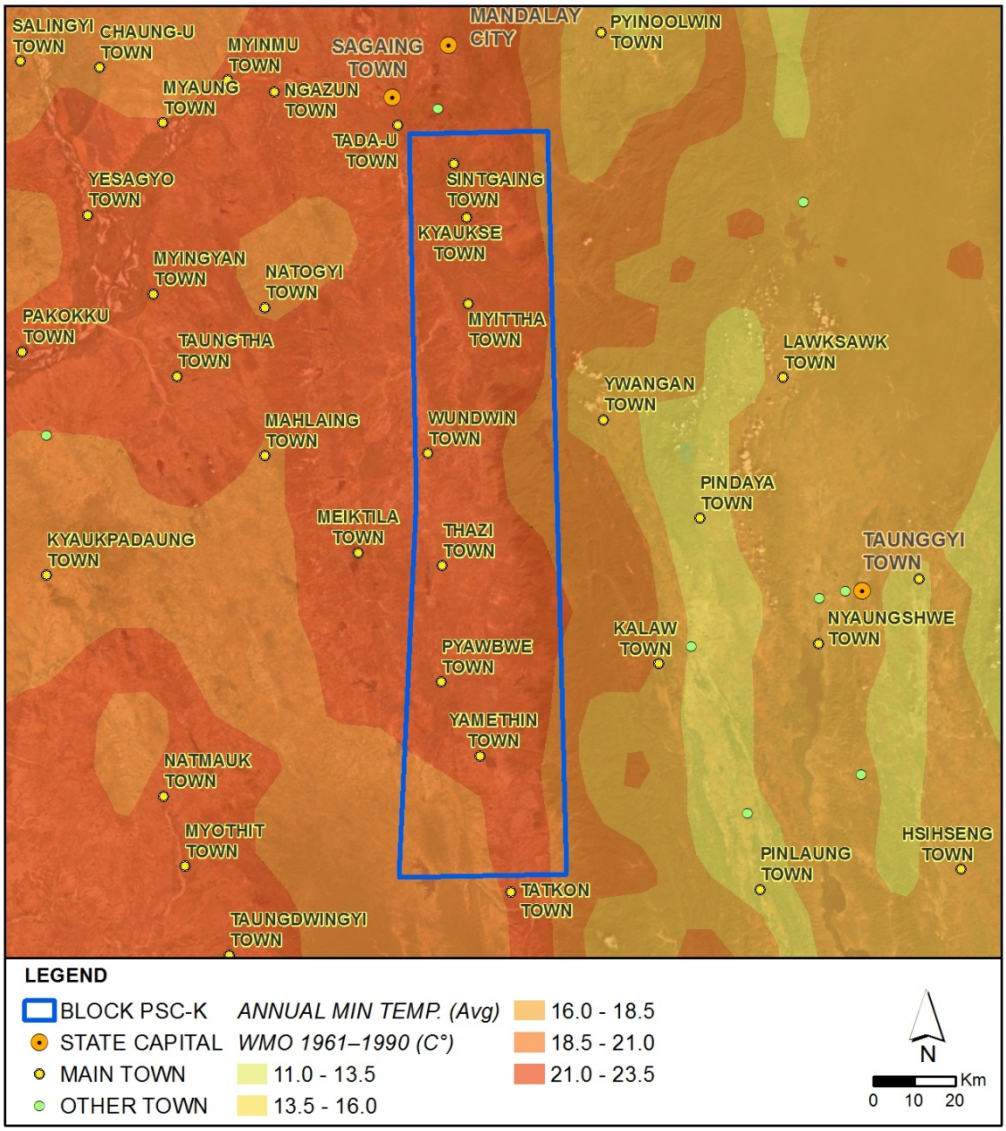
Month	Max Temperature monthly (°C)
January	28.7
February	31.9
March	36.1
April	38.0
May	36.2
June	33.2

Month	Max Temperature monthly (°C)
July	32.6
August	32.1
September	32.6
October	31.9
November	29.9
December	27.8

Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

In Block PSC-K the monthly maximum temperature ranges between 27.8 and 38. The highest temperature is measured in April.

Figure 5.4 Distribution of annual average of minimum monthly temperatures (1961-1990)



Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

As shown in the Figure above, in Block PSC-K the average value of minimum monthly temperature ranges between 18.5 and 23.5 °C.

Air Humidity

Data of monthly maximum humidity were elaborated to define the distribution within the Block PSC-K, thus it was possible to identify the average value of monthly maximum humidity, as reported in the following table (Table 5.3).

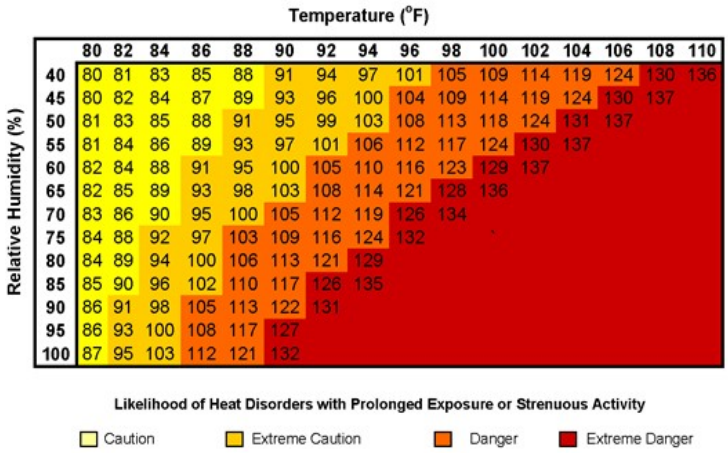
Table 5.3 Average value of monthly maximum humidity for Block PSC-K (1961-1990)

Month	Max humidity monthly (%)
January	63
February	55
March	48
April	50
May	64
June	73
July	76
August	78
September	80
October	81
November	76
December	73

Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

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 5.5. 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 5.4.

Figure 5.5 Heat index



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

Table 5.4 Potential effects of the Heat Index

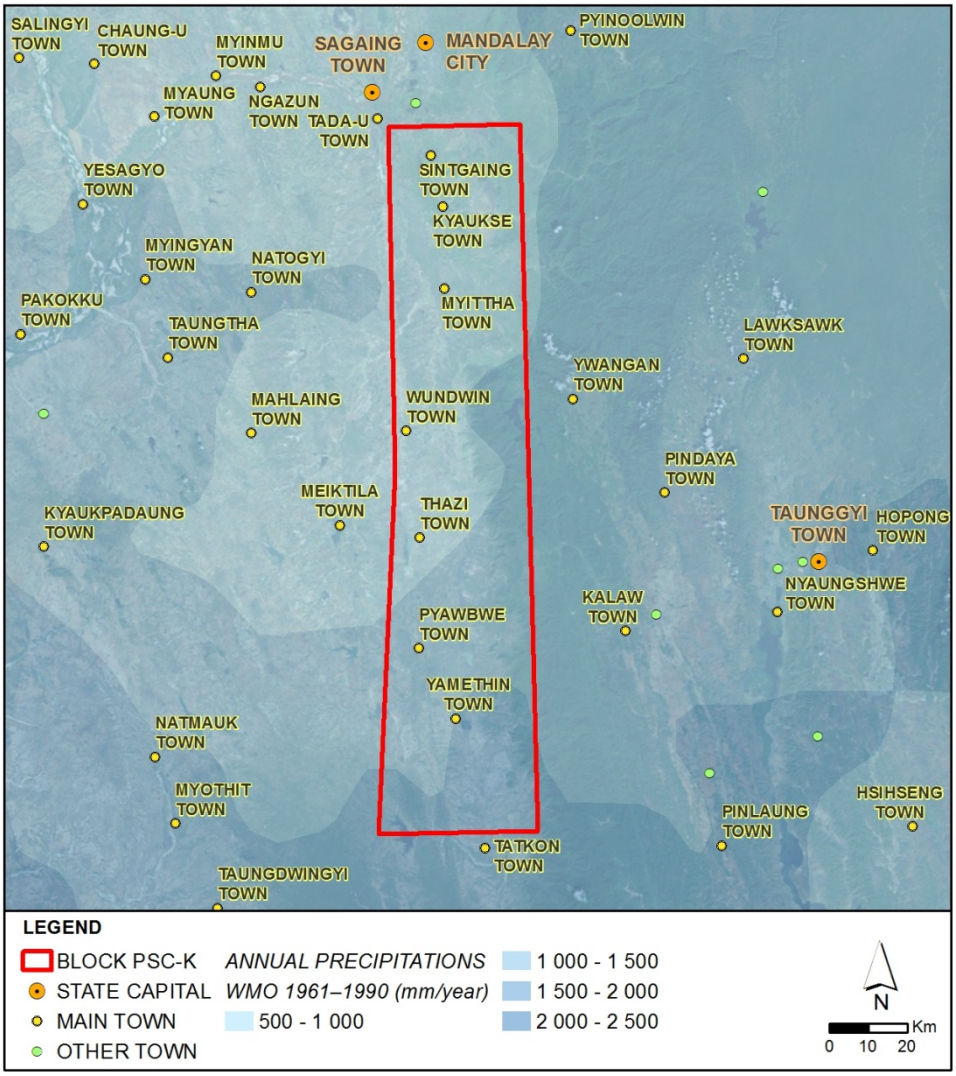
Celsius	*Fahrenheit*	*Notes*
27–32 °C	80–90 °F	Caution — fatigue is possible with prolonged exposure and activity. Continuing activity could result in heat cramps
32–41 °C	90–105 °F	Extreme caution — heat cramps and heat exhaustion are possible. Continuing activity could result in heat stroke
41–54 °C	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 5.4, the highest values of humidity are recorded from June to November that corresponds approximately to the cyclones season. Combining values of Table 5.4 and Figure 5.5, it deduces that during the wet season the heat index is located in the "Extreme Caution" section, it ranges between 84 and 121.

Rainfall

The annual mean of monthly cumulative rainfall for each station was used to generate an interpolated surface, which was then classified by using equal interval ranges (of 500 mm, from 500 to 2500 mm) as reported in Figure 5.6.

Figure 5.6 Distribution of annual average of monthly cumulative rainfall



Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

Data of monthly cumulative rainfall were elaborated to define the distribution within the Block PSC-K, thus it was possible to identify the average value of monthly cumulative rainfall, as reported in the following table.

Table 5.5 Average value of monthly cumulative rainfall for Block PSC-K (1961-1990)

Month	Monthly cumulative rainfall monthly (mm)
January	3
February	18
March	6

Month	Monthly cumulative rainfall monthly (mm)
April	42
May	138
June	115
July	86
August	122
September	168
October	131
November	40
December	15

Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

As shown in Table 5.5, the wettest months are those between May and October.

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 Minbu Meteorological Station during January is 0.8 mph (11ms-1) and that the wind direction is generally from the east and northeast.

The monthly mean of the wind speed measured at Mandalay, Meiktila and Yamethin meteorological stations is summarized in Table 5.6.

Table 5.6 Average value of monthly wind speed (1961-1990)

Month	Wind speed monthly (m/s)		
	Mandalay	Meiktila	Yamethin
January	0.8	0.5	1.1
February	0.9	0.7	1.5
March	1.2	1	2.1
April	1.4	1.6	3.2
May	1.7	2.2	3.7

Month	Wind speed monthly (m/s)		
	Mandalay	Meiktila	Yamethin
June	2.1	2.8	4.4
July	2.3	2.7	4.2
August	1.9	2.3	3.7
September	1.3	1.3	2.5
October	0.9	0.7	2.4
November	0.8	0.6	1.2
December	0.7	0.6	1.2

Source: WMO data in Digital agricultural Atlas of the Union of Myanmar

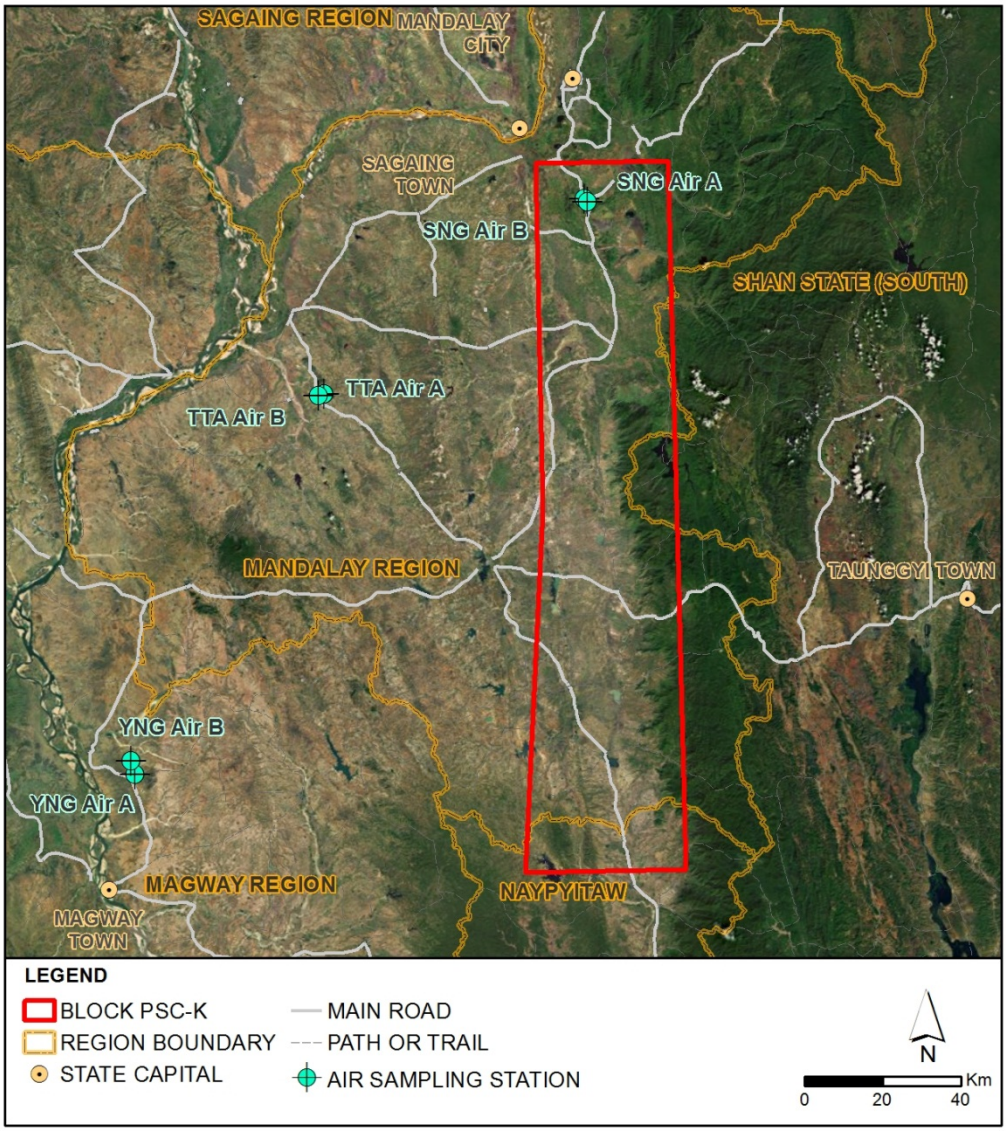
5.3.3.2 Air quality

The aim of this paragraph is to describe the air quality of the Project area, expressed in terms of main pollutant concentrations.

Given that no previous studies neither field survey activities has been performed within the Block PSC-K, the air quality analysis is based on secondary data measured in the Northern part of the Block and in Blocks adjacent to Block PSC-K carried out during a previous ambient air monitoring survey from December 2009 to January 2010 (*Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM*). The air quality measured during the above mentioned survey can be considered to be typical of the quality in areas characterized by the same topography, land cover and meteorological conditions, such as the Block PSC-K.

During the air ambient survey, performed in adjacent Blocks from December 2009 to January 2010 (as mentioned above), air pollutant and dust samples were collected mostly in rural areas. For air pollutants, two samples were collected per station, and for dust, one sample was collected per station. Locations of the sampling stations are shown in Figure 5.7 and results of the air quality survey are reported in Table 5.7.

Figure 5.7 Air quality sampling locations Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM



Source: eni, 2014

Table 5.7 Baseline Air Quality in stations in the Northern part of the Block PSC-K and in adjacent Blocks (December 2009 –January 2010)

Pollutant	Yenangyaung offload and compressor station[1]		Taungtha offload station[1]		Sintgaing offload station[1]		WHO guideline[2] [µg/Nm³]	NAAQS (USEPA)[2] [µg/Nm³]
	YNG-A [µg/Nm³]	YNG-B [µg/Nm³]	TTA-A [µg/Nm³]	TTA-B [µg/Nm³]	SNG-A [µg/Nm³]	SNG-B [µg/Nm³]		
Total NO_x	7.47.	7.81	10.62	12.49	8.90	21.65	NA	NA

Pollutant	Yenangyaung offload and compressor station[1]		Taungtha offload station[1]		Sintgaing offload station[1]		WHO guideline[2] [µg/Nm³]	NAAQS (USEPA)[2] [µg/Nm³]
	YNG-A [µg/Nm³]	YNG-B [µg/Nm³]	TTA-A [µg/Nm³]	TTA-B [µg/Nm³]	SNG-A [µg/Nm³]	SNG-B [µg/Nm³]		
NO_2	3.34	4.47	6.62	5.86	12.31	11.60	40	100
NO	4.13	3.34	4.00	6.63	<L.O.D.	10.05	NA	NA
SO_2	0.19	0.2.	1.66	3.00	0.75	2.08	NA	30
PM_{10} 24-hr avg (range)	154 (17-3382) 1213[3]		97 (10-295) 114[3]		80 (26-244) NA[3]		50	150
TSPM 24-hr avg (range)	120 (2-2649) 429[3]		80 (26-244) NA[3]		174 (2-8280) 1277[3]		100	*NA*

Note:
[1]One-month average concentration
[2] Annual mean
<L.O.D below detection limit
NA – Not Available
[3]S.T.E.L (Short Term Exposure Limit)

Source: Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM

The results of the survey mentioned above indicated that baseline NO_x, NO_2 and SO_2 levels near the Taungtha and Sintgaing offload stations were greater than those near Yenangyaing Station. The Taungtha and Sintgaing offload stations are in suburban areas and are closer to main roads and therefore probably have more mobile emissions.

Given that there are no air quality standard in Myanmar, both WHO air quality guidelines (2000, updated 2005) and NAAQS (USEPA) which were designed as limits for protection of public health, welfare and environment were used to compare with the results of the baseline survey and to determine the baseline status of air quality. Therefore the measured concentrations were compared to annual standards for a conservative comparison.

Baseline air quality concentrations (one month average) at all sample locations close to the Taungtha, Sintgaing and Yenangyaing Stations were found to be well below the annual mean WHO guideline (updated 2005) and the annual mean National Ambient Air Quality Standards (NAAQS, set by U.S. Environmental Protection Agency USEPA, 1990).

The baseline levels of PM10 close to Yenangyaung offload/compressor station, Taungtha offload station and Sintgaing offload station did not meet the WHO guideline; the PM10 level close to Yenangyaung offload/compressor station also did not meet the NAAQS (USEPA) standard. The baseline levels of TSPM close to Yenangyaung offload/compressor station and especially Sintgaing offload station did not meet WHO guideline. Sintgaing station is in a suburban area and close to a highway. The composition of aerosol particles was mainly from wind-blown dust of mineral oxides from natural sources, weather and local activities rather than from mobile emissions and industrial sources. In fact the soil types can be a predisposing factor to generate dust especially during dry conditions: dust generation, actually, is increased with increase of sand and clay proportion. Atmospheric dispersion is weaker in the winter due to low winds and low mixing height, contributing to less dilution of air pollutants, and resulting in higher particulate concentrations in the baseline sampling areas. Moreover the selected villages where the air quality samples were collected were generally small to medium–sized, in agri-

culture-based areas with only 100 to 300 households and an average population of 200 to 1,000 people each.

5.3.3.3 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 N2O 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: CO2 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 CO2 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 CO2 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*).

5.3.3.4 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.

The Environmental, Social and Health Management and Monitoring Plan (ESMMP, refers to Chapter 8) of the ESHIA will include and detail the noise and vibration monitoring.

5.3.4 Water

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

Most of the information reported in this Chapter is secondary data gathered at national and regional level.

5.3.4.1 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 5.8.

Table 5.8 Drainage Areas of Myanmar

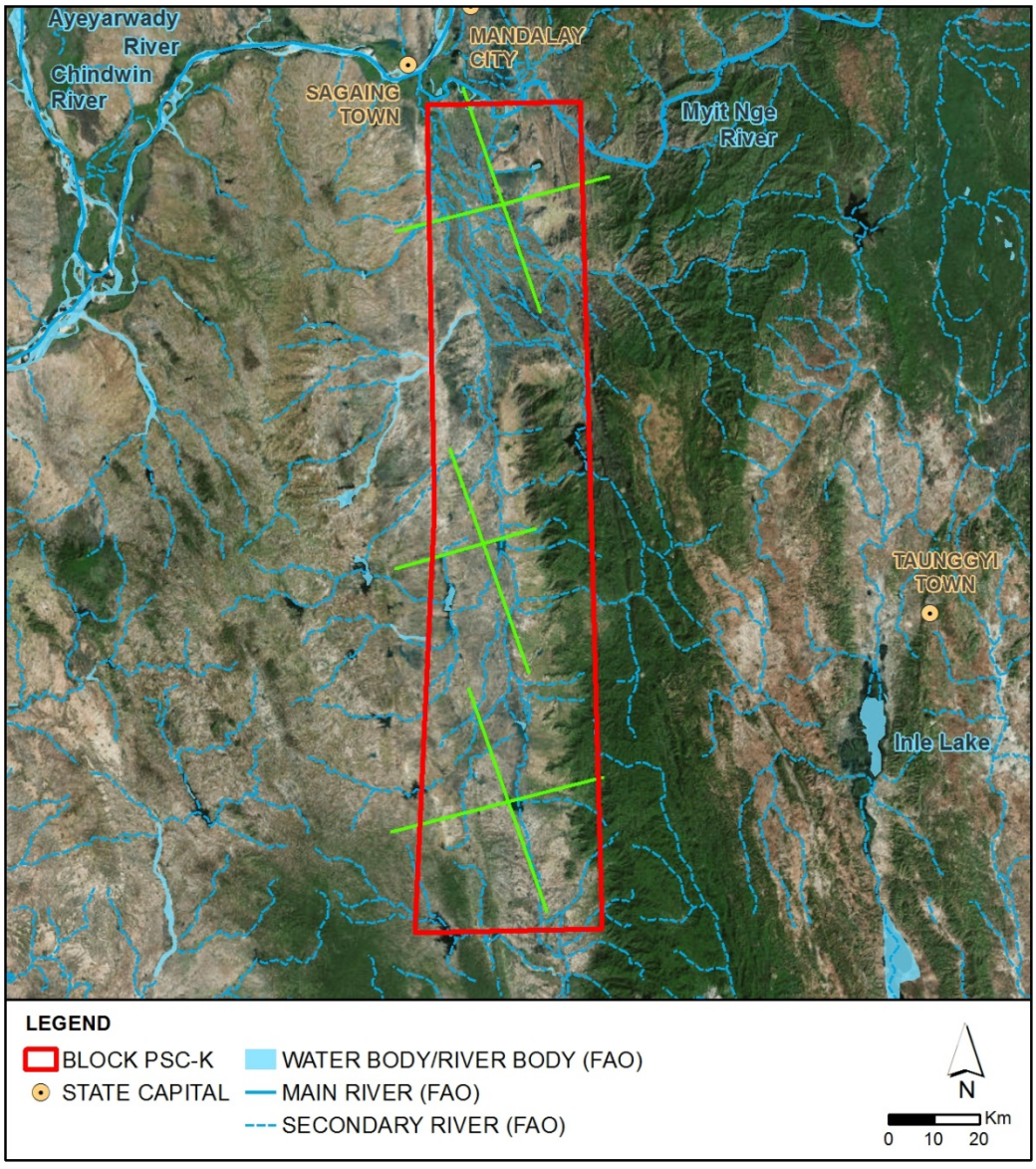
Drainage Area	%
Ayeyarwady and Chindwinn Rivers and tributaries	55.05
Thanlwin River and tributaries	18.43
Sittaung River and tributaries	5.38
Kaladan and Lemro Rivers and tributaries	3.76
Yangon River and tributaries	2.96
Tanintharyi River and tributaries	2.66
Minor coastal streams	11.76

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 main river that crosses Block PSC-K (in the Northern side of the Block) is the Mytinge River. It originates in Northern Shan State and it is named as Namtu River, at the middle part the course it is known as Doktawady River, and below the Yeywa it is known as MyitNger River. The river has moderate volume of water and moderately flows because of the YeYwa Dam. At Goktwin and Thibaw, high water flow is observed.

As shown in Figure 5.8 many secondary rivers are located within the Block PSC-K as well as some natural inland water bodies (perennial and non perennial) and many artificial water bodies, used for energy production and irrigation purposes. The water bodies surface within the Block PSC-K covers about 1.5% of the total area; Map 2 in Annex 2 shows also the water extent during the wet season, compared with water extent during the dry season.

Figure 5.8 River network Block PSC-K



Source: eni, 2014

Block PSC-K is subject to flood hazard. 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 PSC-K 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.

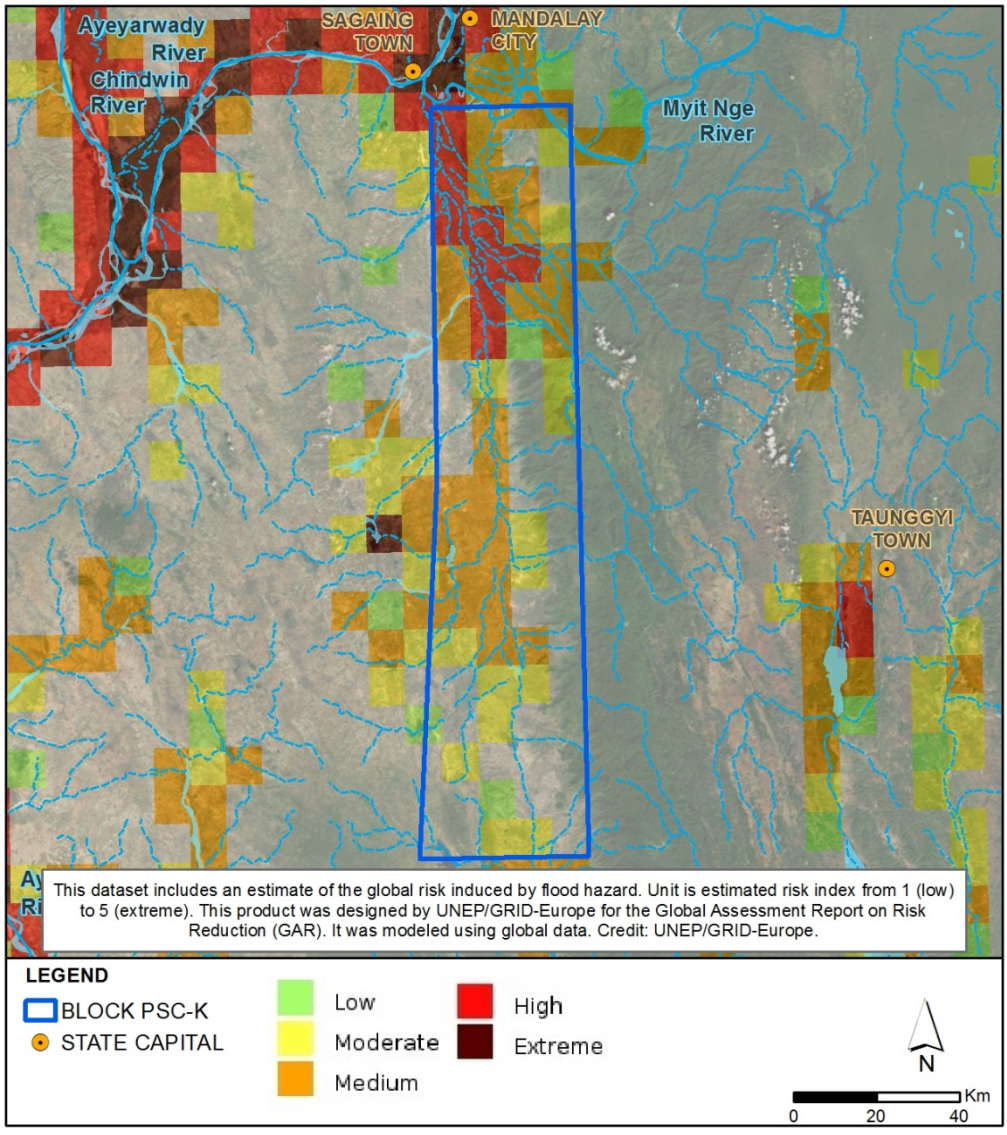
As reported in Table 5.9 and shown in Figure 5.9, a flood risk is present along all the secondary rivers, especially in the North-West part of the Block the flood risk is medium – high. Specific data on flooding seasonality will be collected in a future step of the Project, before the seismic campaign starts

Table 5.9 Percentage distribution of flood risk index in Block PSC-K

Low	Moderate	Medium	High	Extreme
3.09%	23.16%	41.69%	12.35%	3.09%

Source: AMTE, 2013

Figure 5.9 Flood risk in Block PSC-K



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.

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*).

Water sources of tube wells, Nandawshte lake,Yeni stream, Kindar and Sedawgyi dams provide the domestic water for Mandalay people

The Dry Zone Greening Department has been implementing the development of water resources program which is one of the main tasks of the department. Under this program it has constructed a number of ponds and check dams to collect rain water; tube wells to tap underground water; and river water pumping stations to pump water from Ayeyarwady river. Table 5.10 presents the water supply program for Mandalay region.

Table 5.10 Dry zone water supply program in Mandalay Region

Year	Ponds	Tube Wells	Check Dams
1997-1998	13	1	-
1998-1999	68	4	-
1999-2000	71	3	72
2000-2001	71	3	36
2001-2002	60	-	20
Total	283	11	128

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

To address the problem of the shortage of drinking water supply, the Water Resources Utilization Department has installed some drinking water supply facilities in Mandalay Division till late 2000 to promote the socio-economic status of rural communities (Table 5.11).

Table 5.11 Rural Drinking Water Supply facilities and beneficiaries (people in number) in Mandalay Region

Types of water supply facilities	Per	Quantity	Beneficiaries
Groundwater (Deep Tube well and sludge well)	No.	4266	2254055
Pipe Water Reticulation	No.	9	36290
Gravity Flow	syst	7	9798
Tapping Dam	No.	7	18241
River Pumping	No.	1	110000
Total		4290	2428384

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

Water Quality Monitoring and surveillance program in collaboration with UNICEF currently concluded, covered 15 townships in Mandalay , encompassing the parameters of turbidity, Ec, pH, Fl, Cl, NO_3, Fe, Ca, As, total Coliform and Faecal Coliform. A total of 578 in Mandalay Division were tested.

Further information at local level will be collected during a specific site visit, which will be conducted in a future step of the Project ,before the beginning of the seismic activities, in order to understand the potential water supply for domestic use in the Block PSC-K.

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 (Table 5.12).

Table 5.12 Irrigation Projects in Mandalay region (completed)

Dams		Weirs	
Quantity	Beneficiaries (acres)	Quantity	Beneficiaries (acres)
6	13,250	1	5,000

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

Water Resources Utilization Department has been implementing pump irrigation water supply program using high discharge capacity pumps since 1995 (Table 5.13).

Table 5.13 Irrigation Projects in Mandalay 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	16465	1	4128	52	22997	68	43590

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

The deep tube wells and irrigation water supply facilities have also been installed in places where the groundwater potential has existing access for exploitation and worthy for commercial production (Table 5.14).

Table 5.14 Groundwater Irrigation Facilities in Mandalay region

Tube Wells	Cluster Wells	Beneficiaries (Acres)
789	851	10817

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

Further information at local level will be collected during a specific site visit, which will be conducted in a future step of the Project, before the beginning of the seismic activities, in order to understand the potential water supply for irrigation in the Block PSC-K.

5.3.4.2 Water quality

River Water Quality

From a literature review, no data of the river water quality in the Study Area are available. Information will be gathered in a future step of the Project, during a specific field survey to be conducting before the beginning of seismic activities.

The purposes of the surface water quality survey, the sampling locations and the methodology applied are detailed in a dedicated Water Monitoring Plan, included in Chapter 8 (Environmental Management and Monitoring Plan, § 8.8.5).

Ground Water Quality

From a literature review, no data of the groundwater quality in the Study Area are available. Information will be gathered in a future step of the Project, during a specific field survey to be conducted in a future step of the Project, before the beginning of seismic activities..

The purposes of the groundwater quality survey, the sampling locations and the methodology applied are detailed in a dedicated Water Monitoring Plan, included in Chapter 8 (Environmental Management and Monitoring Plan, § 8.8.5).

5.3.4.3 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 PSC-K cover part of the Ayeyarwady aquifer and part of the artesian 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 PSC-K 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.

5.3.5 Land Cover

The Study Area, as shown in Map 1 in Annex 2, includes mostly agricultural areas (about 57% of land in the Block PSC-K), forested areas (21% of land) and shrub and mixed vegetation areas (20% of land). Urban areas are limited to 0,2% and water bodies amount to about 1.5%. This information is derived from the *Medium Resolution Multispectral Images* (see Table 5.15).

Table 5.15 Land Cover Typologies within the Block PSC-K

Land Cover Category	Area (Ha)	(%)
Bare soil	5.477	0,74
Bush/Shrub	92.249	12,53
Low Laying Mixed Vegetation	53.801	7,31
Urban Area	1.524	0,21
Mixed Agriculture	405.306	55,05
Irrigated/Flooded Agriculture	13.075	1,78

Land Cover Category	Area (Ha)	(%)
Dry Forest	130.457	17,72
Green Forest	23.579	3,20
Water Bodies	10.806	1,47
Total	736.278	100

Source: Medium Resolution Multispectral Images

5.3.6 Soil & Subsoil

The aim of this Chapter is to provide an exhaustive characterization of the soil and subsoil status of the Block PSC-K 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.

5.3.6.1 Soil quality

From a literature review, no data of the groundwater quality in the Study Area are available. Information will be gathered in a future step of the Project, during a specific field survey.

For more details, refers to Chapter 8 (Environmental Management and Monitoring Plan).

5.3.6.2 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

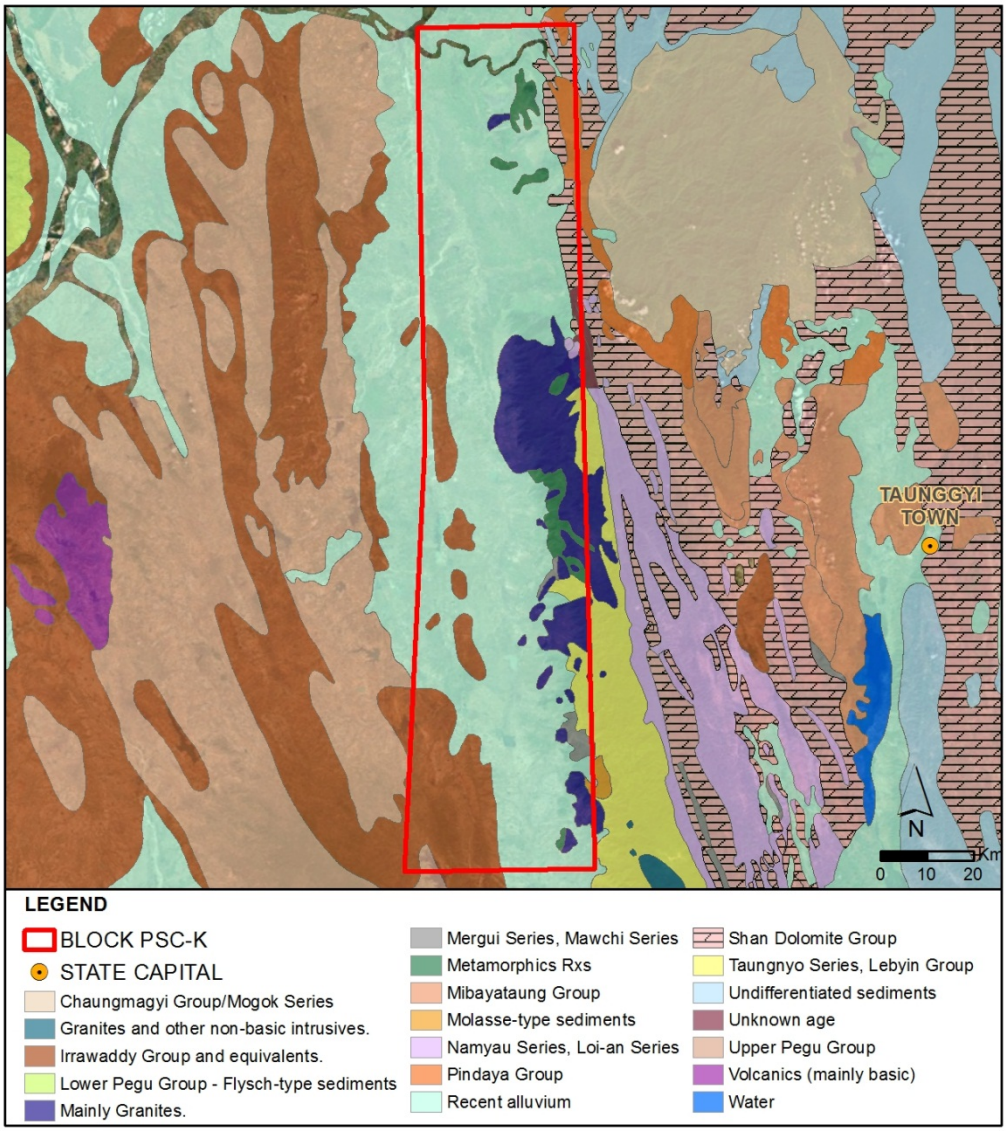
As mentioned above, Block PSC-K is located in the Central Lowlands, that is a relatively low-lying terrain drained by the Ayewarwady River. It is characterized by a fertile alluvial plain, intermittently cropped out by the mountain range and hills running in North South direction and also enhanced by 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 5.10, Block PSC-K is mainly characterized by the Recent alluvium unit, that is made up by sediments, deposited side by side since the beginning of Holocene to form the present landscape of Myanmar. Other geological units in Block PSC-K are listed below:

- Metamorphics Rxs;
- Mainly Granites;
- Irrawaddy Group and equivalents;
- Lower Pegu Group and marine, brackish and terrestric equivalents;
- Margui Series, Mawchi Series;
- Molasse-type sediments.

At the end of the seismic survey, a site-specific geological and geomorphological characterization of the Study Area will be provided.

Figure 5.10 Geologic Map of Study Area



Source: eni, 2014

Altitude

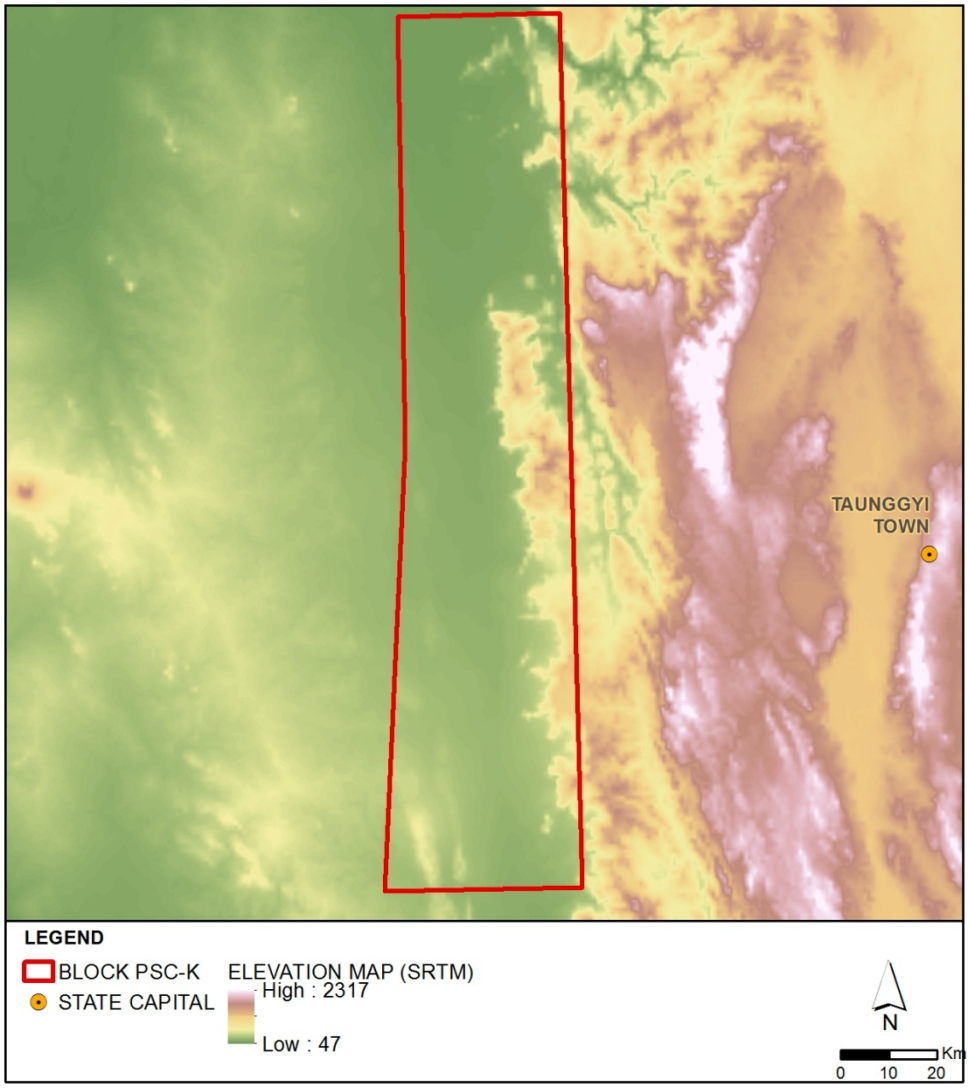
Altitude information in the Study Area was derived by Shuttle Radar Topography Mission (SRTM) elevation data, presented in the Digital agricultural Atlas of the Union of Myanmar.

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 5.11. The percentage distribution of each class in Block PSC-K is reported in the Table 5.16.

Figure 5.11 Altitude map of the Block PSC-K



Source: ENI, 2014

Table 5.16 Percentage distribution of altitude classes in Block PSC-K

<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
75.06%	16.55%	4.65%	3.34%	0.40%

As reported in the previous table, most of the Block PSC-K 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 5.17)*, proposed by the Soil Conservation Service,.

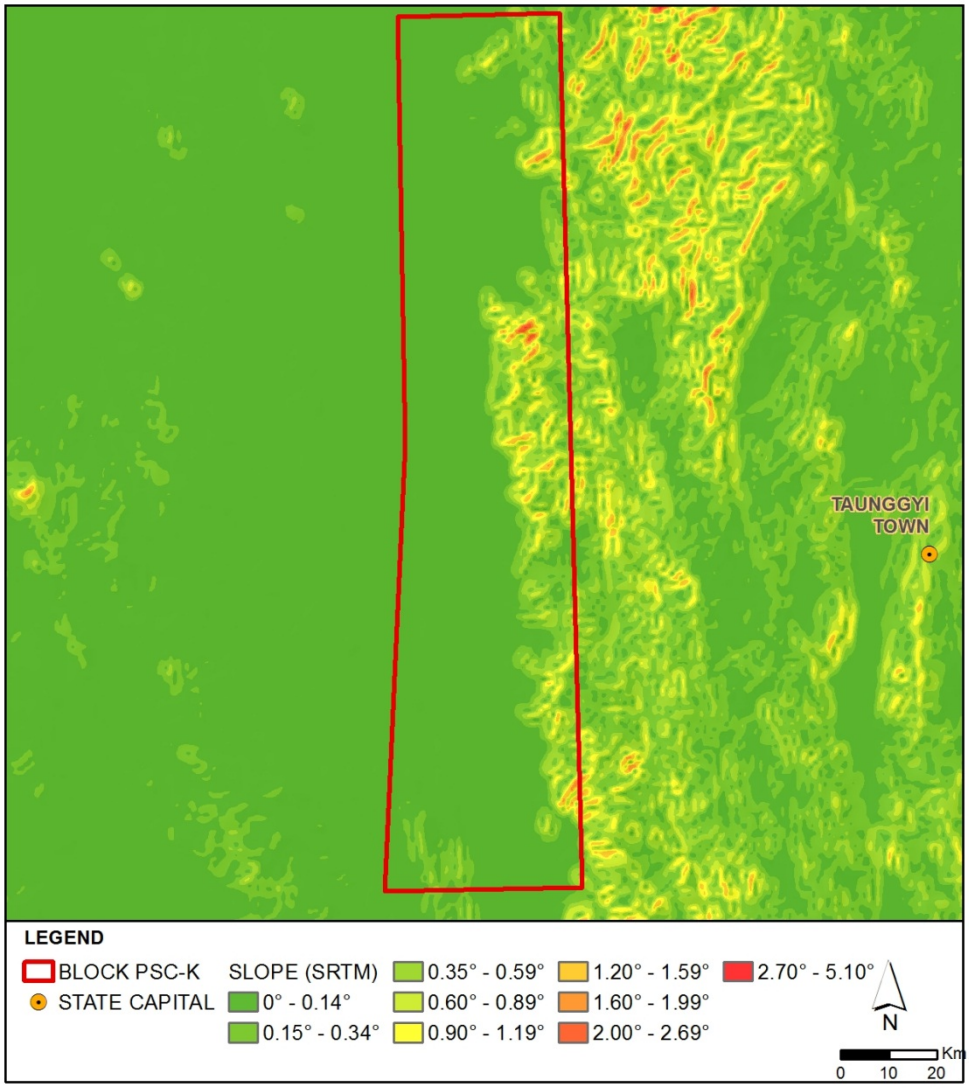
Table 5.17 Classification of degree of slope

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 5.12.

Figure 5.12 Slope map in the Block PSC-K



Source: ENI, 2014

As reported in Figure 5.12, almost the whole Block PSC-K is located in an area with a slope degree included between 0° and 5.10°.

5.3.6.3 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 PSC-K are classified as (*Figure 5.13*):

- 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).

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.

Red Brown Forest Soils (Rhodic Ferralsol)

The Red Brown Forest soils are the typical soils of tropical evergreen forest of Myanmar. They occur on the well-drained hill slopes at the elevation between 1000 and 4000 feet above sea level. These soils also occur in the northern hilly region and on the hill slopes of Rakhine mountain range, Taninthari and Donna range.

These soils are formed under the influence of tropical evergreen forests with the annual rainfall of about 80 to 200 inches. Some are also found at the low uplands. The soils are well structured and have a good drainage. The soil is slightly acid with the pH value ranging from 5.5 to 6.5. Usually these soils have medium to heavy loamy texture. The soils contain moderate amount of plant available nutrients. These soils can be regarded as forest land of good productivity; however, the soils on the lower elevation are suitable for gardens and plantation.

Yellow Brown Forest Soils (Xanthic Ferralsol)

The Yellow Brown Forest soils widely occur in Myanmar covering the low hills of Pegu Yoma, foot hills of Tanintharyi Yoma, Rakhine Yoma and sloping areas at the bottom of northern hilly region up to the approximate latitude of 25º. They are closely connected with the Red Brown Forest soils in their distribution and usually replacing them down the slope. They mainly occur in the region of gentle slopes of low hills and foot hills at the elevation of 300 to 1500 feet above sea level. These soils are typical for the monsoon or tropical mixed deciduous forests.

These soils contain more percentage of clay and humus than the Red Brown Forest soils. However, in some places of the slopes, the soils are shallow due to the presence of pisolithic lateritic layer. According to the land use classification, the great majority of these soils are classified as good garden lands. They are suitable for rubber, oil palm and orchards.

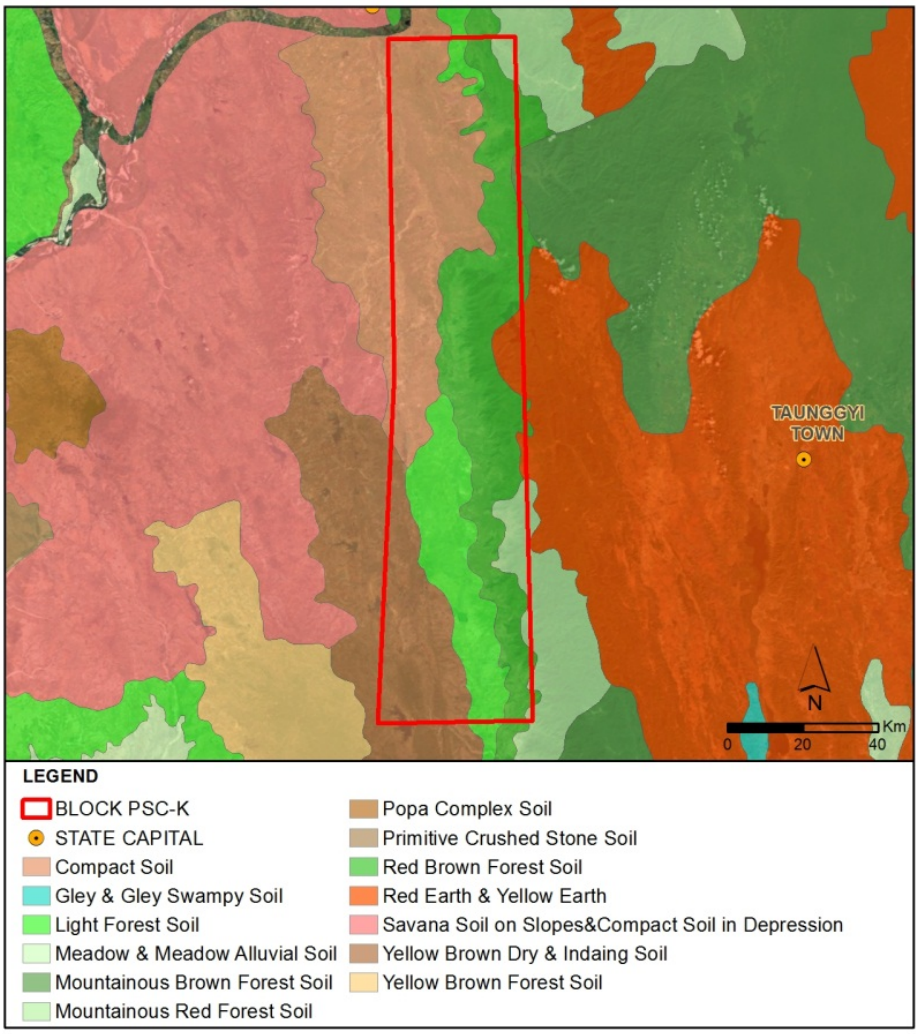
Red Earths and Yellow Earths (Acrisol)

The Red Earths soils are the most dominating soils of Shan Plateau and of the northern mountainous region at the elevation of more than 3000 feet above sea level. The Shan Plateau is about completely covered with these soils. The Yellow Earths occur on the level lower slopes in the Shan Plateau. They occupy a relatively small area, changing the Red Earths down the slopes. The Red Earths have a very deep profile having the texture varying sandy and silty to silty clay loam and with good structure. They are well drained and easy to plough.

The soil reaction is slightly acid to neutral with pH ranging from 6 to 7. However, the Yellow Earths soils are more acidic and have more clay percentage. Iron and aluminium contents are also very high. The humus contents of Yellow Earths are more than that of the Red Earths. The soils are deficient in nitrogen and phosphorus. The content of potassium is high in the Red Earths.

The Red Earths is the typical soils for agriculture in Shan state. They are well drained, having good structure and easy to plough so they are very suitable for cultivation of seasonal and perennial crops. However, due to relief and slopes, erosion control measures are required. The Yellow Earths soils can only be utilized for gardens, flowers and forests.

Figure 5.13 Soil Types in Myanmar



Source: ENI, 2014

5.3.6.4 Seismicity and Volcanism

Earthquakes

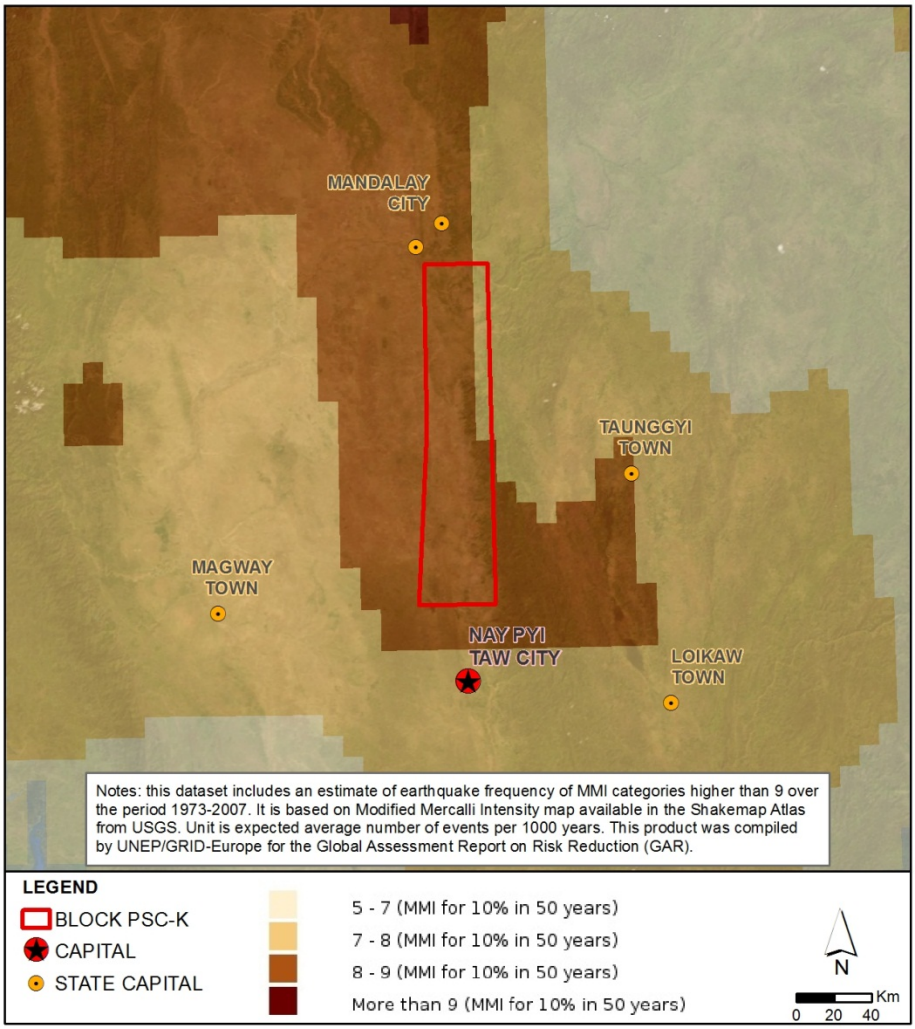
According to Theilen and Pararas-Carayannis (2009): "Myanmar is seismologically unstable and vulnerable to earthquakes due to its proximity to boundaries of major interacting tectonic plates. Specifically, the eastern Himalayan belt marks the collision boundary of the Indian tectonic plate underthrusting 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 PSC-K is shown in Figure 5.14.

Figure 5.14 Earthquakes intensity in Block PSC-K



As reported in Figure 5.14 Block PSC-K is mainly located in 8-9 MMI and in part located in 7-8 MMI (according to MMI Modified Mercalli Intensity) areas.

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-trachyandesite 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 PSC-K, however Mount Popa is North of the PSC-K Northern border.

5.3.6.5 Subsidence

At the end of the seismic survey, local information of the subsidence phenomena in the Study Area will be provided.

5.3.6.6 Agriculture

Agriculture is the principal economy of the Mandalay region. Main crops grown being paddy, wheat, maize, groundnut, sesame, cotton, pulses, chili, onion, Myanmar tobacco, Virginia tobacco, Mahuya sunflower and toddy palm. Mondaing Dam, Kyetmauktaung Dam, Pyaungpya Dam, Yenichaung Dam, Thitson Dam, and Yezin Dam are reliable sources of water for irrigated agriculture. There are also the Sedawgyi Reservoir and Chaungmagyi Embankment, with work in progress on Kinda Dam for completion by 1985-86. Click here for a larger viewProminent industries are Mandalay Brewery and Distillery, Meiktila Textile Mill, Canning Factory, Myitnge Loco Workshop, Paleik Textile Mill and Pyinmana Sugar Mill. In handicrafts, the Weaving School and silk weaving in Amarapura, braziers, stone carving, wood carving and gold-leaf manufacturing industries are famous (Myanmar Net, 2012).

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 PSC-K is located in Mandalay Region, which is presented in the previous paragraph.

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 PA 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 PSC-K Block, is presented in Figure 5.1, at the previous paragraph 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.For more data about protected areas in Myanmar, see at 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 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, the Bago Yoma Range terrestrial corridor is about 3 km from the Block PSC-K and the Western Shan Yoma Range terrestrial Corridor is partially included in the block.

5.4.3.2 Protected Areas at National Level

A total of 43 protected areas have been established in Myanmar, as shown in 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.

5.4.3.3 Protected Areas at Project Level

In Table 5.18 legally protected areas and other areas important for biodiversity that are located within the Block, are listed.

Table 5.18 Presence of legally protected areas and other areas important for biodiversity conservation in block PSC-K

Biodiversity Area name	Legally protected	Type of Area	Overlap
Panlaung-Pyadalin Cave	National	IUCN IV	Partial
Myittha Lakes (Yit Kan, Yewei Kan, Yathar Kan, Myin	No	KBA	Partial
Nyaung Yan - Minhla Kan	No	KBA	Total
Kyee-ni Inn	No	KBA	Total
Irrawaddy plains	No	EBA	Partial
Indo-Burma	No	BIOD HS	Partial

Panlaung-Pyadalin Cave

Panlaung-Pyadalin Cave is a Wildlife Sanctuary lassified as legally protected area at national level. It was established with the purpose of preserving the archaeological site of the Pyadalin limestone caves, to conserve the surrounding environment and habitat for mammals like Wild Elephants, Gaur, Leopard, Banteng, Sambar, many species of monkeys and many species of birds. Detailed information about the Panlaung-Pyadalin Cave are reported in Annex 1 (§ 1.5).

Myittha Lakes (Yit Kan, Yewei Kan, Yathar Kan, Myin)

It is a Key Biodiversity Area and is also classified as an Important Bird Area, where two trigger bird species live (Baer's Pochard *Aythya baeri* and Ferruginous Duck *Aythya nyroca*). It is 10,000 ha wide and is located at 150 m a.s.l.. It is characterized by wetlands (inland) habitat. It is not legally protected (*BirdLife International (2014) Important Bird Areas factsheet*).

Nyaung Yan - Minhla Kan

It is a Key Biodiversity Area and is also classified as an Important Bird Area, where trigger bird species live (Ferruginous Duck *Aythya nyroca* and waterbirds). It is 2,033 ha wide and is located at 160 m a.s.l. It is characterized by wetlands (inland) habitat. It is not legally protected (*BirdLife International (2014) Important Bird Areas factsheet*).

Kyee-ni Inn

It is a Key Biodiversity Area and is also classified as an Important Bird Area, where one trigger bird specie lives (Baer's Pochard *Aythya baeri*). It is 617 ha wide and is located at 200 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

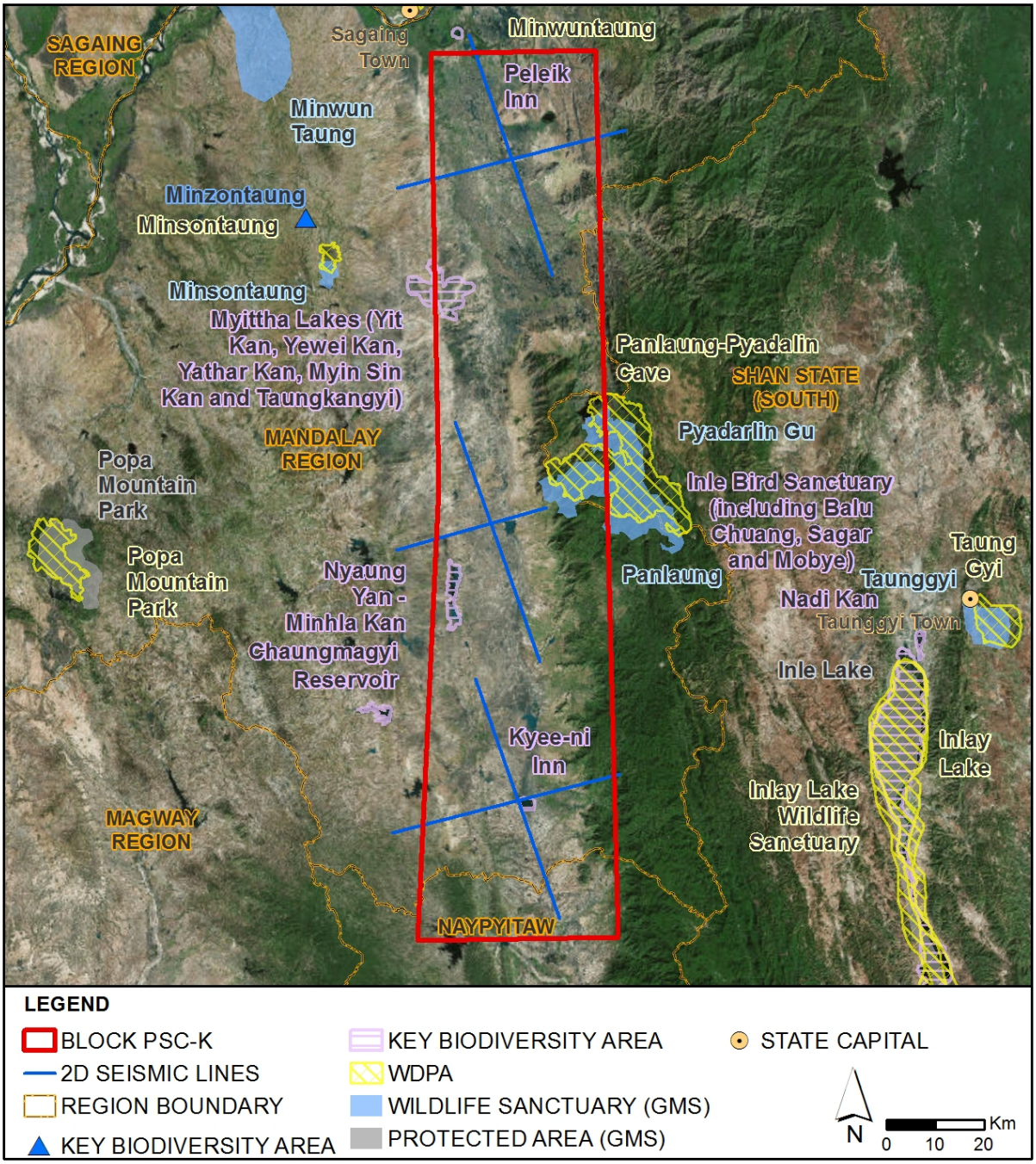
As reported in the BirdLife International (2014) Endemic Bird Area factsheet, the plains of the Irrawaddy river in central Myanmar have a dry and seasonal climate, as it lies in the rain-shadow of mountain ranges which run from north to south through the western part of the country. The natural habitats 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 5.15 shows the location of the protected areas and the areas important for biodiversity near and within the Block.

Figure 5.15 Protected Areas and areas important for biodiversity conservation within the Block PSC-K



Source: ENI, 2014

5.4.4 Species

The following table summarizes the globally threatened animals in Myanmar.

Table 5.19 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. 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 Indawgyi 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.

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 5.16 IUCN Red List System Categories

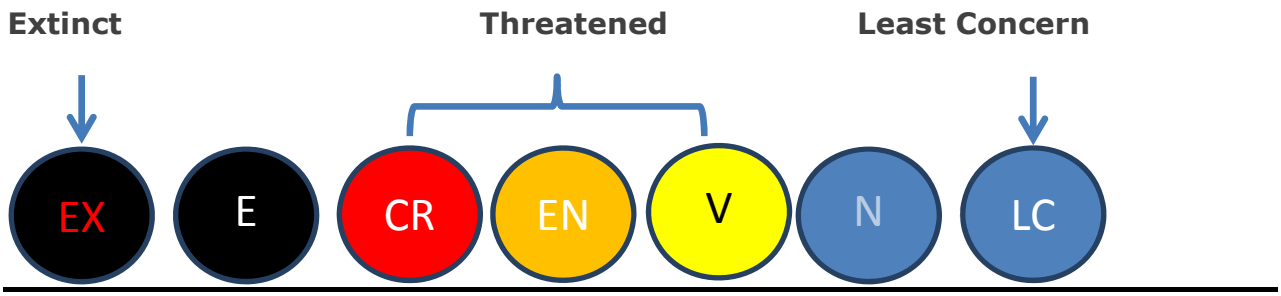


Table 5.20 Presence of Critically Endangered species according to the IUCN Red List of Threatened Species in the block PSC - K

Vertebrates / Invertebrates	Class	Genus	Species
V	REPTILIA	*Gavialis*	*gangeticus*
V	AVES	*Aythya*	*baeri*
V	AVES	*Eurochelidon*	*sirintarae*
V	AVES	*Gyps*	*bengalensis*
V	AVES	*Gyps*	*tenuirostris*
V	AVES	*Sarcogyps*	*calvus*
Number of Critically Endangered species in Block PSC-K			6

Table 5.21 Presence of Endangered species according to the IUCN Red List of Threatened Species in in the block PSC–K

Vertebrates / Invertebrates	Class	Genus	Species
V	MAMMALIA	*Axis*	*porcinus*
V	MAMMALIA	*Cuon*	*alpinus*
V	MAMMALIA	*Elephas*	*maximus*
V	MAMMALIA	*Manis*	*javanica*
V	MAMMALIA	*Manis*	*pentadactyla*
V	MAMMALIA	*Panthera*	*tigris*
V	MAMMALIA	*Prionailurus*	*viverrinus*
V	MAMMALIA	*Trachypithecus*	*phayrei*
V	AVES	*Pavo*	*muticus*
V	AVES	*Sterna*	*acuticauda*
Number of Endangered species in Block PSC-K			10

Table 5.22 Presence of Vulnerable species according to the IUCN Red List of Vulnerable Species in the block PSC-K

Vertebrates / Invertebrates	Class	Genus	Species
V	AVES	*Aquila*	*clanga*
V	AVES	*Emberiza*	*aureola*
V	AVES	*Mulleripicus*	*pulverulentus*
V	AVES	*Rynchops*	*albicollis*
V	MAMMALIA	*Bos*	*gaurus*
V	MAMMALIA	*Helarctos*	*malayanus*
V	MAMMALIA	*Lutrogale*	*perspicillata*
V	MAMMALIA	*Macaca*	*leonina*
V	MAMMALIA	*Naemorhedus*	*griseus*
V	MAMMALIA	*Neofelis*	*nebulosa*
V	MAMMALIA	*Nycticebus*	*bengalensis*
V	MAMMALIA	*Orcaella*	*brevirostris*
V	MAMMALIA	*Pardofelis*	*marmorata*
V	MAMMALIA	*Rusa*	*unicolor*
V	MAMMALIA	*Ursus*	*thibetanus*
V	MAMMALIA	*Viverra*	*megaspila*
V	REPTILIA	*Ophiophagus*	*hannah*
Number of Vulnerable species in Block			17

5.4.5 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.

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.

5.4.5.1 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 5.23 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
Bush/Shrub	Grassland habitat
Low Laying Mixed Vegetation	Grassland habitat
Urban Area	Settlements (*)
Mixed Agriculture	Cultivated habitat
Irrigated/Flooded Agriculture	Cultivated habitat

Land Cover Category	IPIECA's Habitat Type
Dry Forest	Forest area
Green Forest	Forest area
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.

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.

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.

The forest resource assessment (FRA – 2005) conducted by the Food and Agriculture Organization (FAO) in cooperation with the Forest Department indicated that Myanmar is still endowed with a forest covered area of about 50% of the country's total land area of 676,577 km^2.

Table 5.24 Forest cover status of Myanmar in 2008

Forest Category	Area (km^2)	% of Total Land Area
Forests	322,218.6	47.62
Other wooded land	108,339 .5	16.01

Forest Category	Area (km^2)	% of Total Land Area
Other land	226,989 .0	33.55
Inland water bodies	19,029 .9	2.82
Total	**676,577.0**	**100.00**

Source: *Forest Department,2008*

Table 5.25 Major forest types in Myanmar

Forest Type
1 Tidal Forest, Beach and Dune Forest, Swamp Forest
2 Tropical Evergreen Forest
3 Mixed Deciduous Forest
4 Dry Forest
5 Deciduous Dipterocarp Forest
6 Hill and Evergreen Forest
7 Fallow Land

Source: *Forest Department,2008*

Table 5.26 Permanent Forest Estates (PFE) in Myanmar

Category	Area (km^2)	% of land area
Permanent Forest Estates	206,615	30.53
1. Reserved Forests	121,911	18.02
2. Protected Public Forests	35,248	5.21
3. Protected Area Systems	49,456	7.30

Source: *Forest Department,2008*

Forest depletion and degradation are major threats to biodiversity. Encroachment into forests is another threat to wildlife. Forest fires become more severe these days killing wildlife.

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 Study Area by Habitat type are presented in the following Table.

Table 5.27 Ecosystem Services identified by Habitat Type

Ecosystem Services	Forest area	Wetland, river and lake habitat	Cultivated habitat	Grassland habitat
Provisioning				
Crops			XX	
Livestock				X
Capture fisheries		XX		
Aquaculture				
Wild foods	XX	X		XX
Timber and other fibres	XX	XX		X
Fibres 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

Ecosystem Services	Forest area	Wetland, river and lake habitat	Cultivated habitat	Grassland habitat
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 the review of the available information, mainly at national and regional levels; below an analysis of the main social key topics in the Block PSC-K is provided.

Information at national level and some data at regional level has been gathered from secondary sources using publicly available information as well as previous studies performed by ENI.

Block PSC-K is located Mandalay Region, as shown in Figure 5.17. This Region is situated in the centre of the country, bordering Sagaing and Magwe Divisions to the west, Shan State to the east and Bago Division and Kayin State to the South.

Mandalay 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 Are 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

5.5.2 Social Study Area

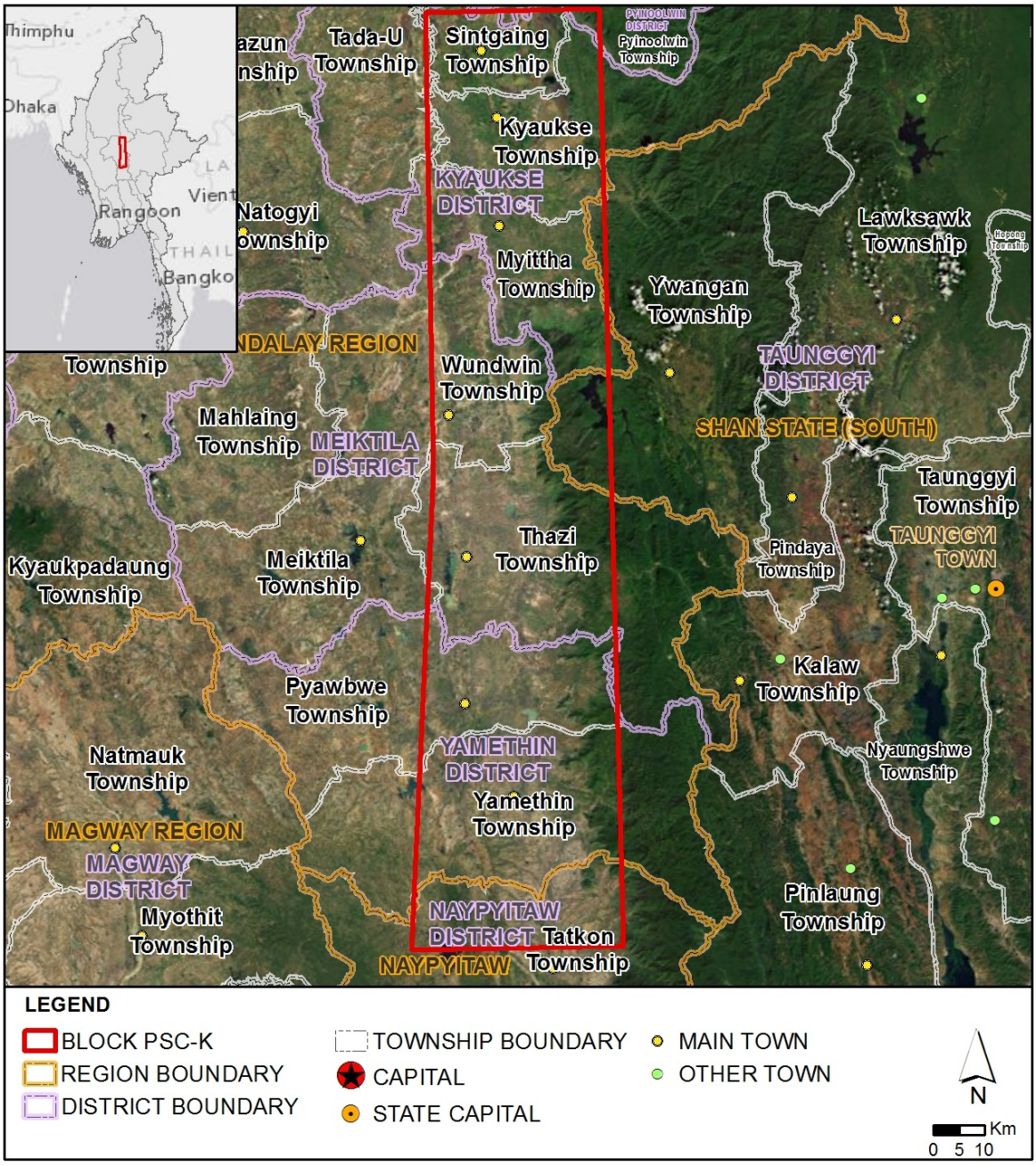
The Study Area for the socioeconomic baseline is equivalent to the whole PSC-K Block and spans across 1 region (Mandalay), 1 union territory (Naypyitaw) and 1 state (Shan State). They are further split up in 7 districts and 13 townships, as shown in the following Table 5.28.

Table 5.28 Social Study Area for Block PSC-K

Region/State/Division	District	Township
Mandalay Region	Kyaukse	Sinkaing
		kyaukse
		Myittha
		Tada-U
	Meiktila	Wundwin
		Thazi
		Meiktila
	Yamethin	Pyawbwe
		Yamethin
	Pynoolwin	Pynoolwin
	Mandalay	Amarapura
Naypyitaw Union Territory	Naypyitaw	Tatkon
Shan State	Taunggyi	Ywangan

Figure 5.17 below presents the Social Study Area, that is equivalent to the whole PSC-K Block.

Figure 5.17 Social Study Area



Source: ENI, 2014

Considering a buffer of 2 km around the 2D seismic survey as the area potentially affected by project activities, settlements identified in this buffer are 97. Information on the population potentially involved will be collected during the site visit which will be conducted in a future step of the Project, before the beginning of seismic survey.

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 5.19 presents the Myanmar population density map in 2013.

The age structure is reported in the following Table 5.29.

Table 5.29 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 5.30 shows the sex ratio by age.

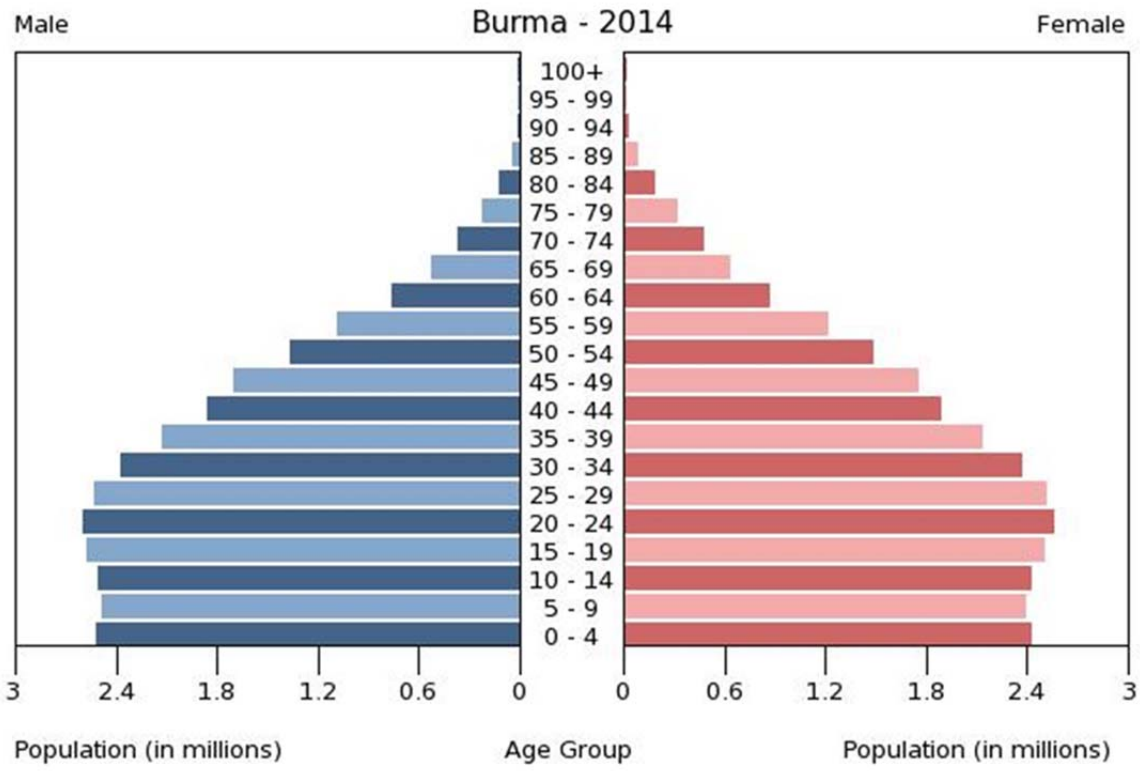
Table 5.30 Sex Ratio by Age

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 5.18.

Figure 5.18 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 5.31; they are compared with data of neighbouring countries.

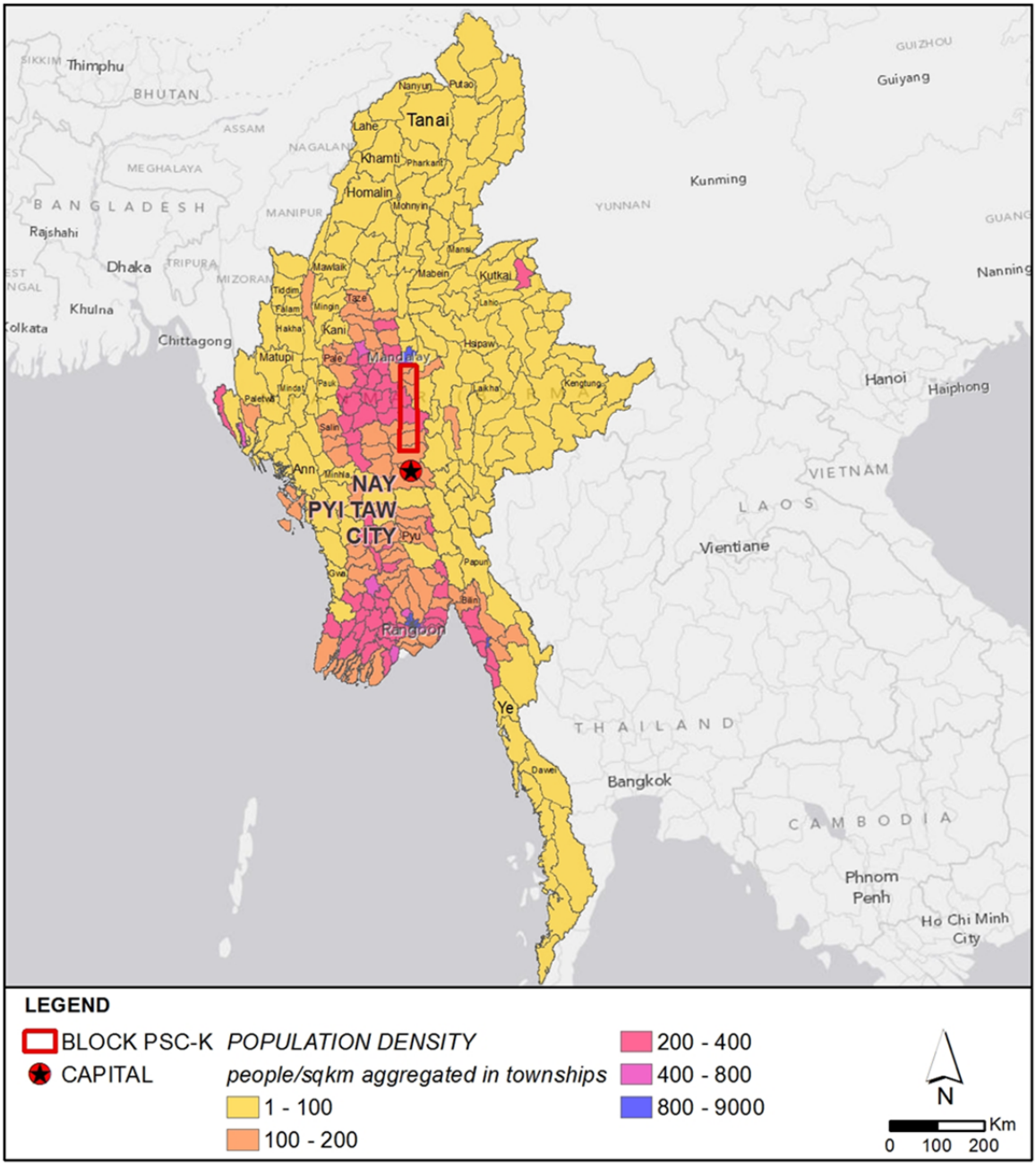
Table 5.31 Population Statistics

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 5.19 shows the population density on the national territory. The population density of territories included in the block PSC-K is, on average, higher than that of other regions.

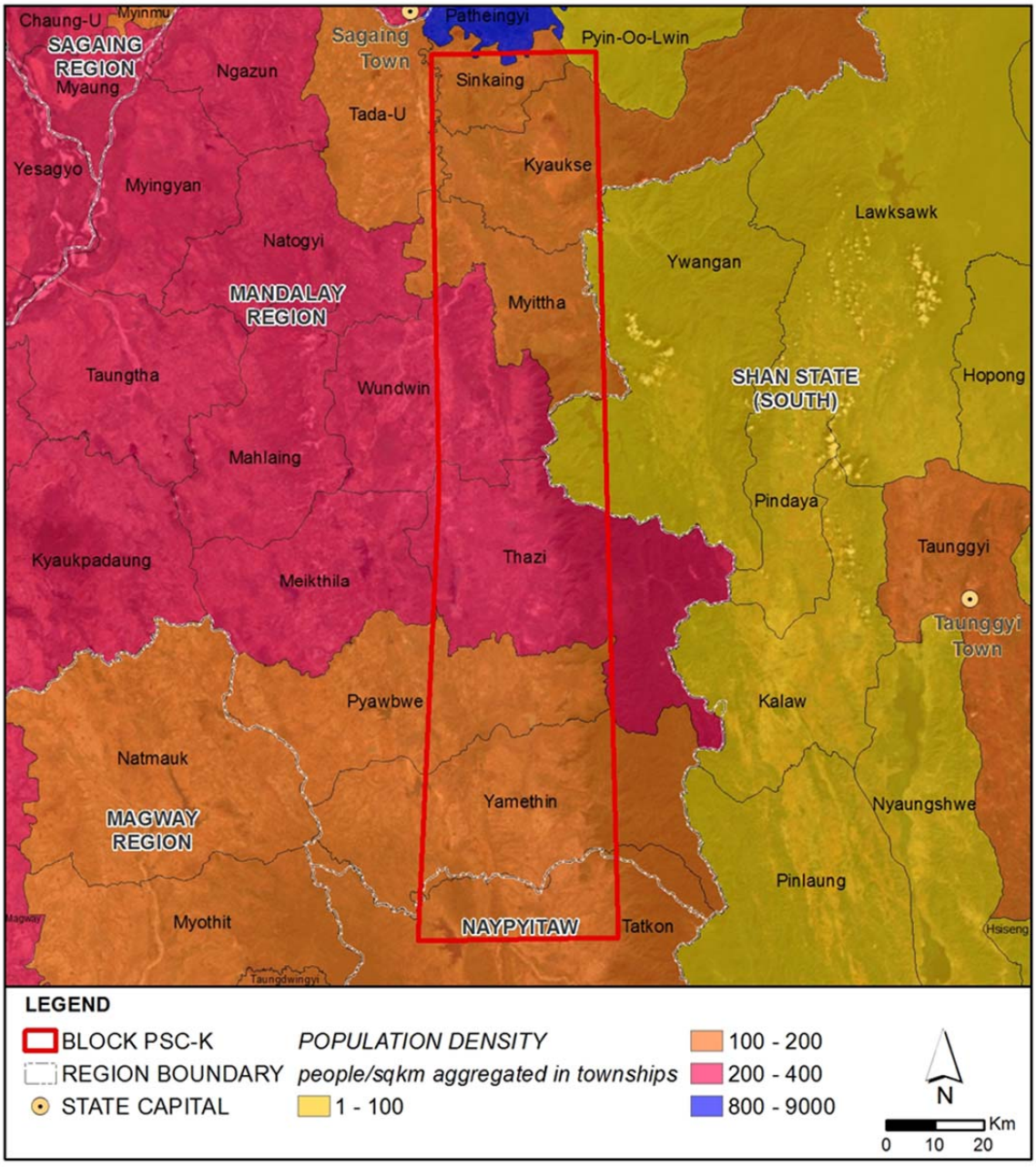
Figure 5.19 Myanmar Population Density Map, 2013



Source: ENI, 2014

With reference to the project block PSC-K, the Figure 5.20 show a detail of the population density map.

Figure 5.20 Population Density Map in the Block PSC-K, 2013



Source: eni, 2014

The population density of the 13 township involved by the block PSC-K, presented in the previous Figure 5.20, is summarized in the next Table 5.32.

Table 5.32 Population Density in each Township

Township	Population density
Sinkaing	188.97 people/km^2
kyaukse	188.97 people/km^2
Myittha	188.97 people/km^2
Tada-U	188.97 people/km^2
Wundwin	201.62 people/km^2
Thazi	201.62 people/km^2
Meiktila	201.62 people/km^2
Pyawbwe	136.87 people/km^2
Yamethin	136.87 people/km^2
Pynoolwin	95.32 people/km^2
Patheingyi	1,284.06 people/km^2
Tatkon	136.87 people/km^2
Ywangan	23.93 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 5.33 main data related to migration are summarized.

Table 5.33 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.

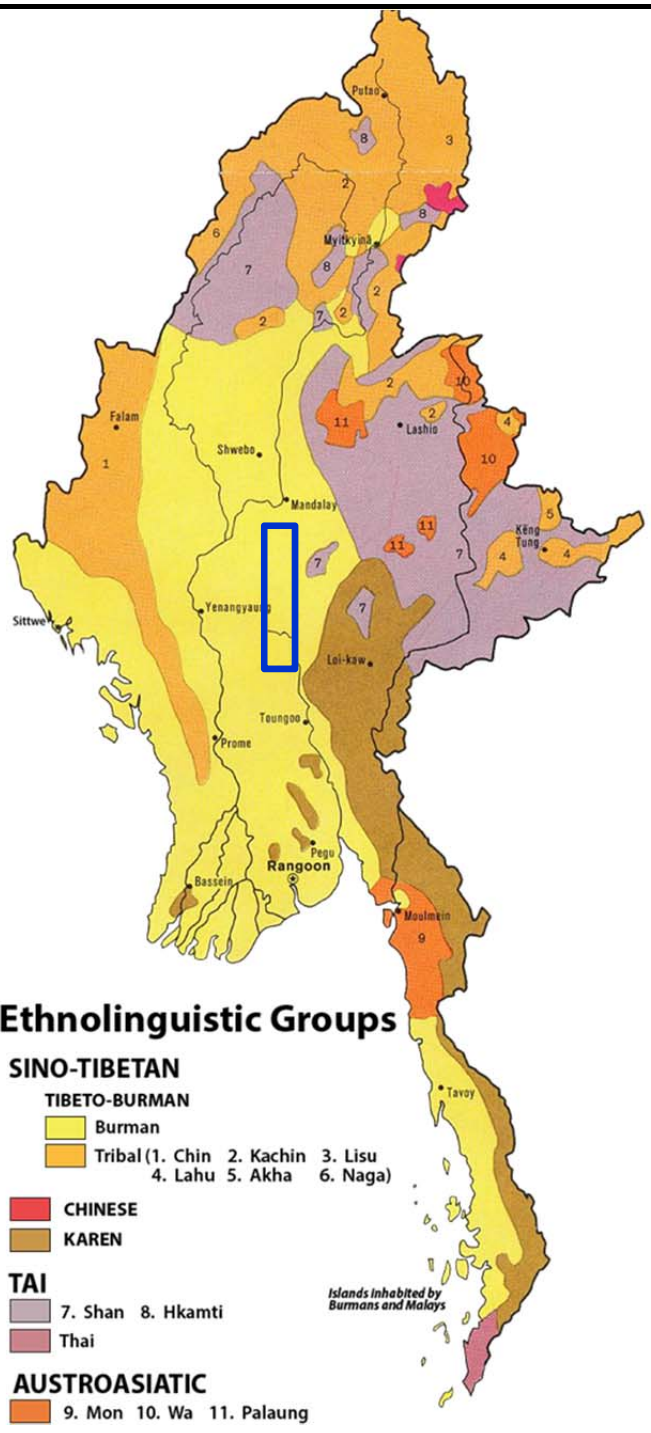
Table 5.34 Main ethnic groups

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

The following Figure shows the distribution of major ethno-linguistic groups.

Figure 5.21 Ethnolinguistic Groups (in Blue the PSC-K Block)



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 City (which is only about 20 km from the northern boundary of the block PSC-K), 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 the following Table, some educational indicators are reported.

Table 5.35 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 slightly higher, in the amount of 26.9% (Table 5.36).

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 5.36 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 5.37 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 similar to the Mandalay Region's one (91.7%). 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.

The secondary school net attendance ratio in Myanmar is presented in Table 5.38. Only 58.3% (59.3% in Mandalay 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 5.37 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

Table 5.38 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 5.39. Overall, 87.8% of young Myanmar women (88.4% in Mandalay 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 5.39 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 5.40 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)

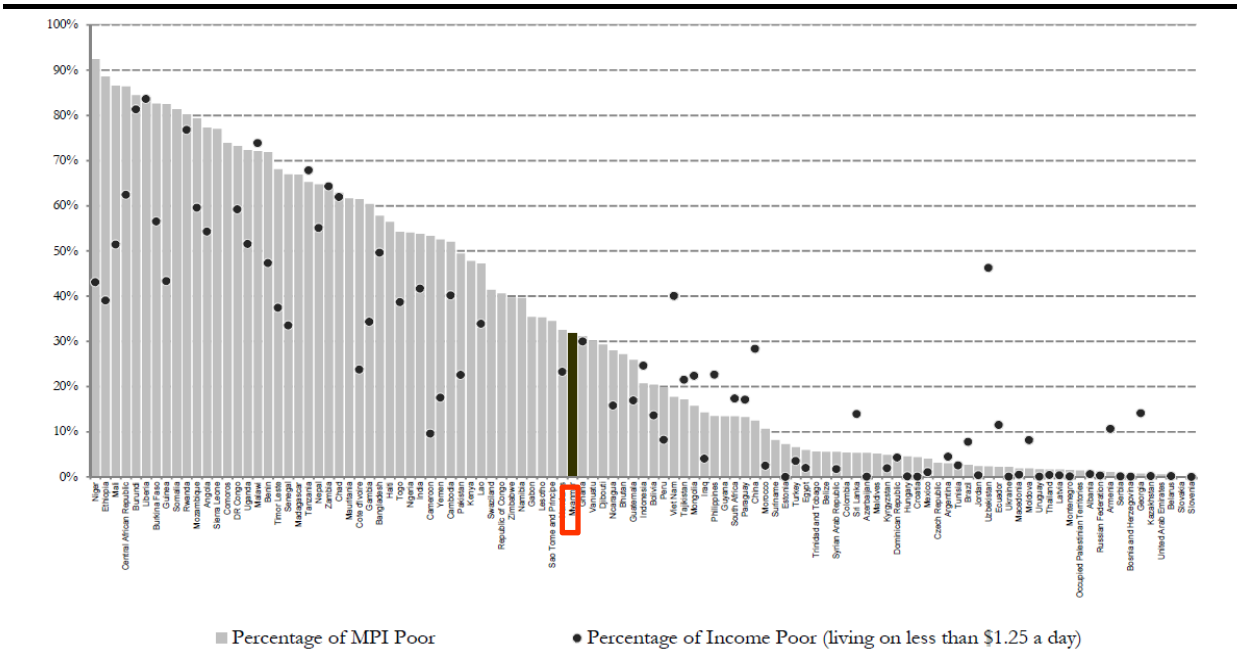
The Multidimensional Poverty Index of Myanmar during the year 2011 was 0.154. This index was developed in 2010 and it replaced the previous Human Poverty Index.

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 5.22 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 5.22 Percentage of MPI Poor



Source: University of Oxford, OPHI Country Briefing 2011, Myanmar

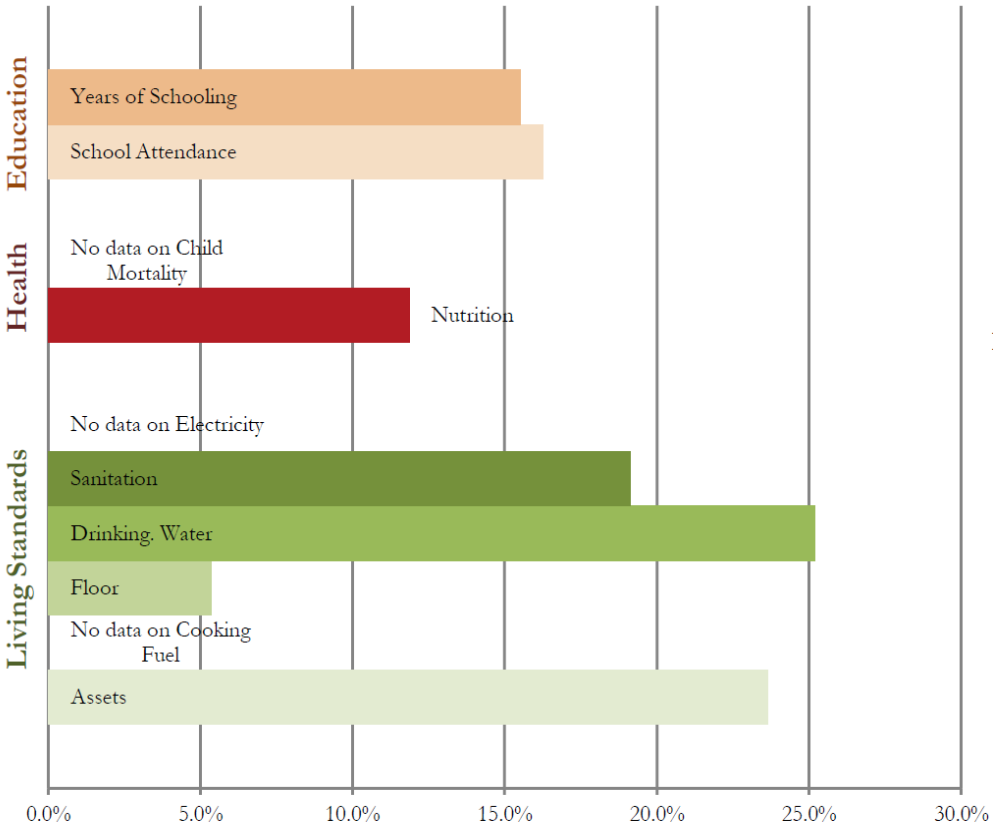
The MPI uses 10 indicators to measure poverty in three dimensions: education, health and living standards. The indicators are (*Source: OPHI, Multidimensional Poverty Index 2011: Brief Methodological Note*):

- *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 5.23 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).

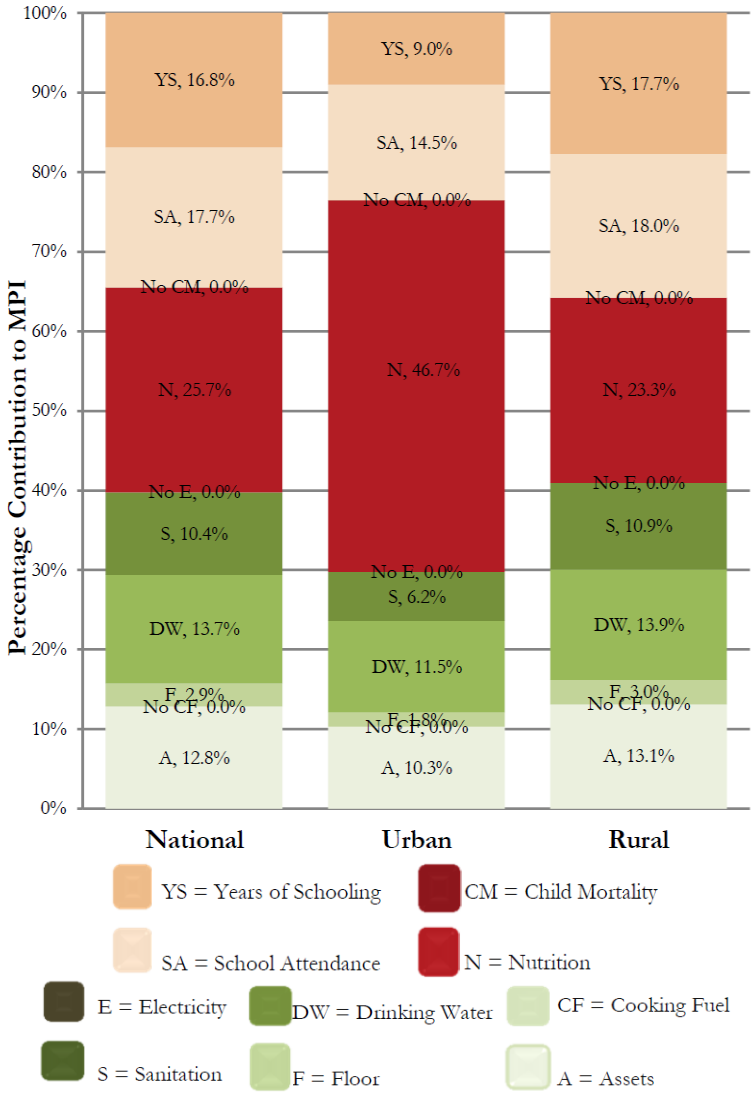
Figure 5.23 Percentage of the Myanmar Population who are MPI Poor and Deprived in each Indicator



Source: University of Oxford, OPHI Country Briefing 2011, Myanmar

Finally, Figure 5.24 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 5.24 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 5.41 presents some statistics related to the national transportation system.

Table 5.41 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 (located near the block PSC-K boundary). The state-run 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. 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. It crosses from South to north the block PSC-K. 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 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 5.42. 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 Mandalay Region the coverage of improved sanitation facilities and water sources is 76.6%.

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 5.42 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 5.43 reports some data about number of registered vehicles and road length in the last 12 years.

Table 5.43 Statistical Data of Vehicles and Roads Length

Year	Registered 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 5.44 shows some features of the Asian Highway in Myanmar.

Table 5.44 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)

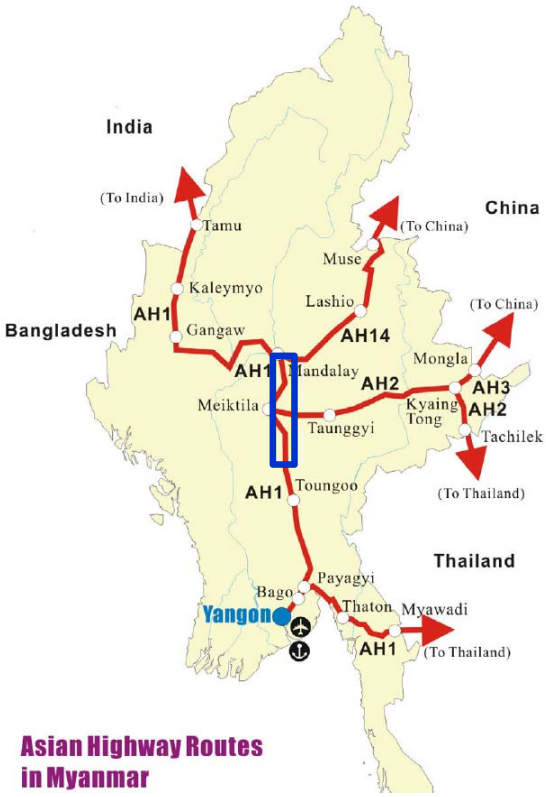
Figure 5.25 The Asian Highway in Myanmar

AH1 Yangon to Bago

AH1 near Tamu

Source: United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)

Figure 5.26 The Asian Highway Routes in Myanmar (in Blue the PSC-K Block)



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 5.45 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

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.

Since 1963, 132 KV Takhundaing main power station, with apparent power 18 MVA, has been running for power supply in Mandalay. In 2012, The Ministry of Electric Power No. 2 put into service 230 KV Shwesaryan-Myaukpyin power grid and 230 KV 200 MVA Myaukpyin main power station in Patheingyi Township in Mandalay District in Mandalay Region.

Myaukpyin main power station provides emergency power to a total of 7 townships with full electricity in Mandalay District. It is the second facility of its kind installed by the Ministry of Electric Power No.2, and has a 100 MVA Three Phase Transformer.

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. In Mandalay (upper Myanmar) 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 (*Source: National Commission for Environment al Affairs, 2006*).

In the Mandalay Region, 91.1% use sanitary means of excreta disposal. In terms of improved sanitation facility, respectively 0%, 17.5 %, 8.5 %, 65% and 0 % use flush/pour flush to: piped sewer system, septic tank, Ventilated Improved Pit latrine, pit latrine with slab toilet and composting toilet.

In terms of unimproved sanitation facilities in Mandalay Region, respectively 0.2%, 1.5 %, 0%, 0 %,6.9 % and 0.2% use flush/pour flush to somewhere else, pit latrine without slab/open pit, bucket, hanging toilet, hanging latrine, other and no facilities, (*Source: DOH, 2010*).

The Engineering Department (Water Supply and Sanitation) under the Mandalay City Development Committee (MCDC) of the Mandalay Regional Government is solely responsible for the systematic disposal of the municipal wastewater of Mandalay people, including wastewater production and treatment. For industrial zones, the industrial zone supervision committee of capital city Mandalay and MDCD is jointly responsible for the systematic disposal and treatment of the industrial wastewater. The construction of wastewater treatment plants for the municipality and industries has been under arrangements of MDCD and the Mandalay Regional government (Myanmar- UNW-AIS).

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 5.46 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
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 Commission, 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.

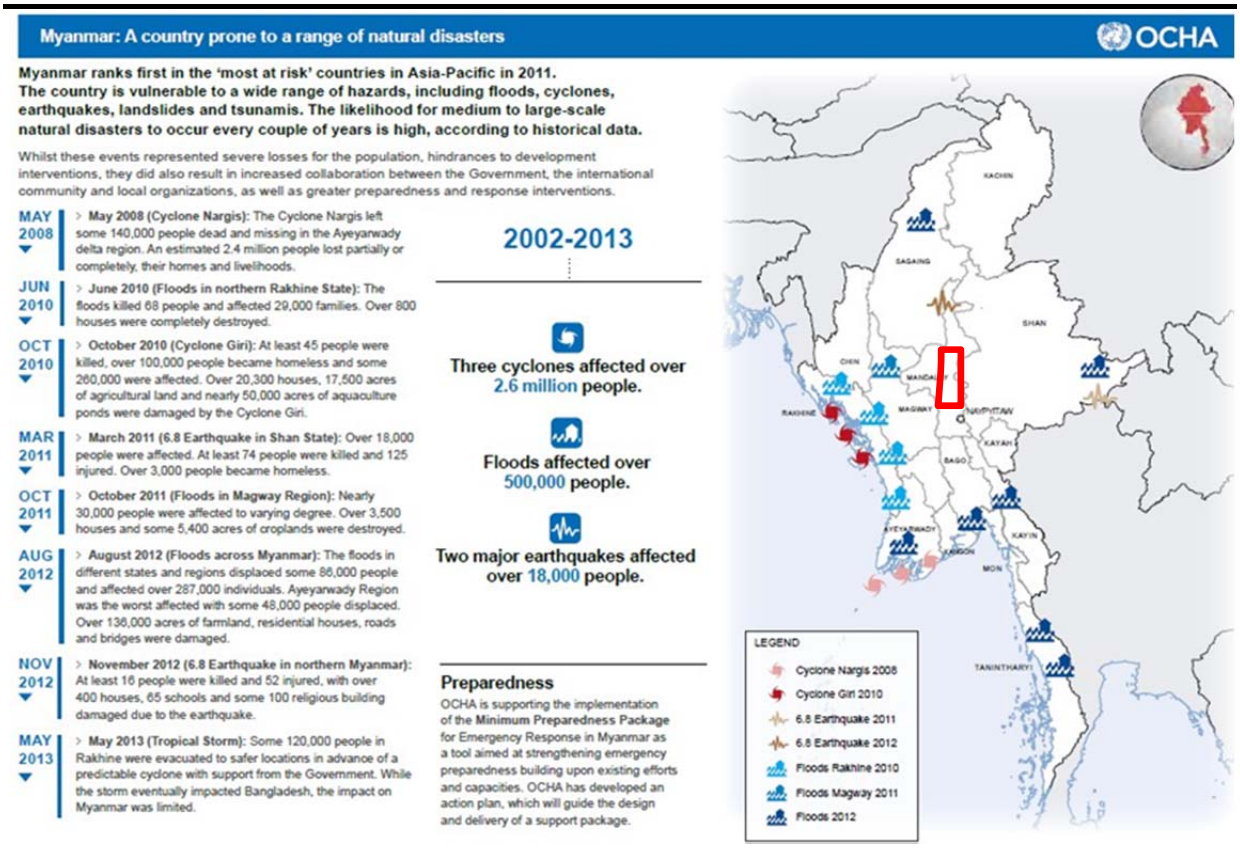
Economic and Human Loss due to Natural Disaster

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. Mandalay region and the area of block PSC-K haven't been interested by such natural disasters.

Figure 5.27 OCHA snapshot on 2002-2013 natural disaster in the country (in Red the PSC-K Block)



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.

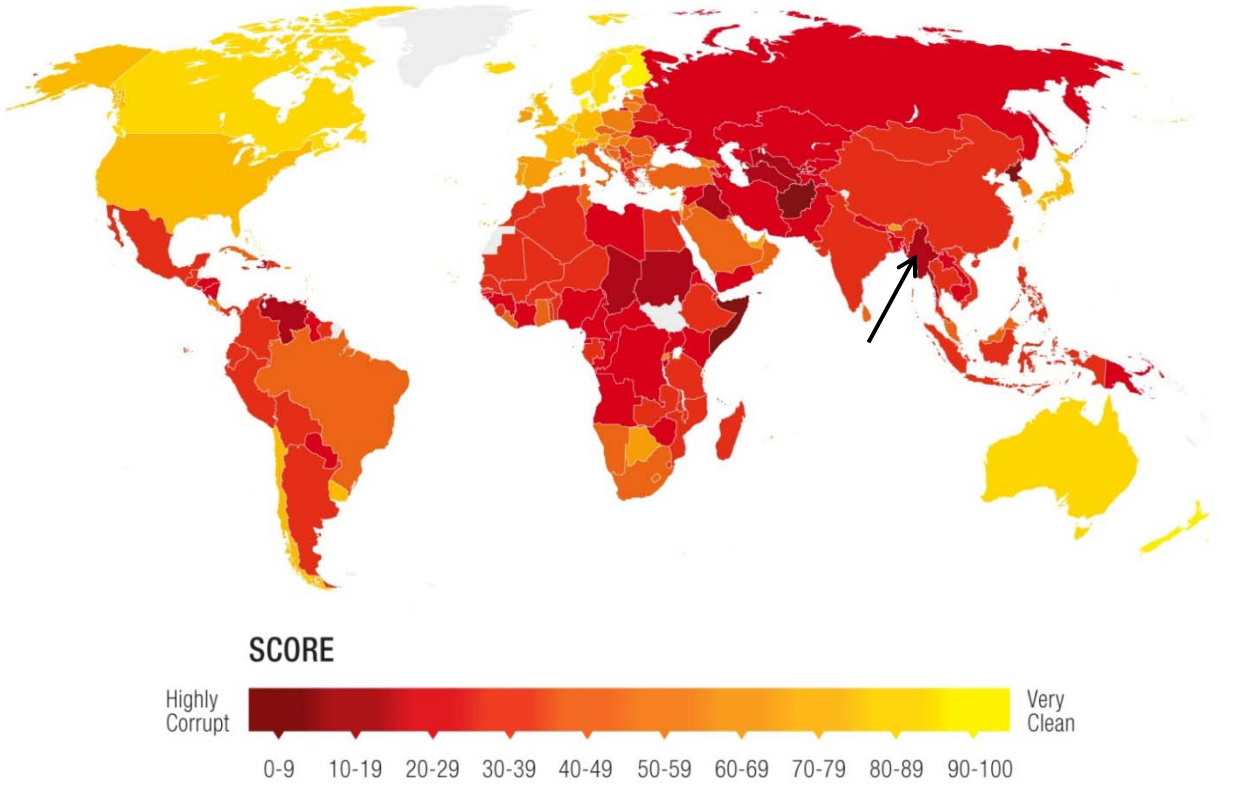
The age for voluntary military service is 18-35 years of age for men and 18-27 years of age for women. Service obligation is 2 years for male (ages 18-45) and female (ages 18-35), whereas professionals (including doctors, engineers, mechanics) serve up to 3 years. Service terms may be stretched to 5 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 5.28 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 5.47 reports the main commodities production in Myanmar.

Table 5.47 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 is $59.43 billion, 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%.

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 5.48 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.
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 5.49 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 Land Cover

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 (about 57% of land in the Block PSC-K), forested areas (21% of land) and shrub and mixed vegetation areas (20% of land). Urban areas are limited to 0,2% and water bodies amount to about 1.5%. This information is derived from the *Medium Resolution Multispectral Images* and is reported in Table 5.15 (§ 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:

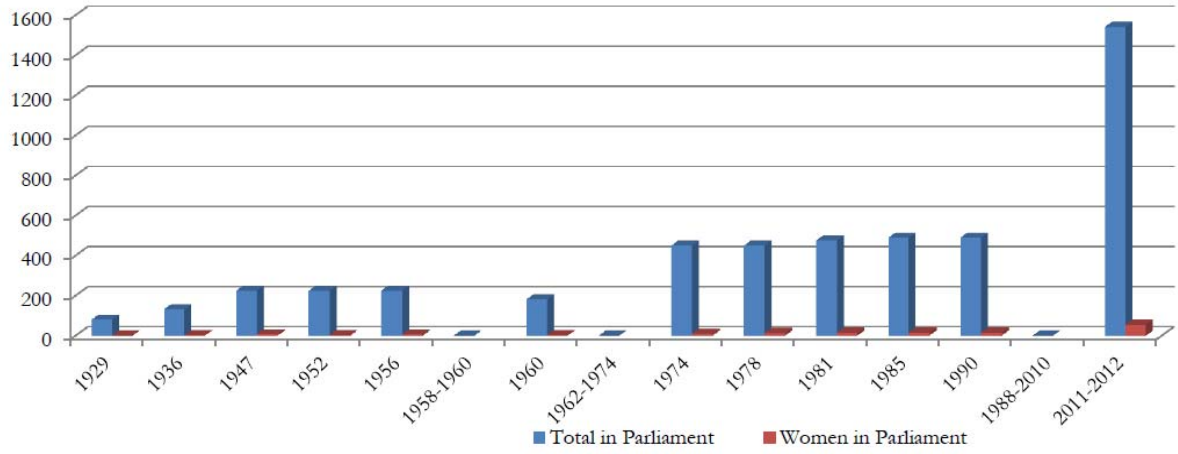
- "*Citizens shall enjoy equal rights in the following areas: (a) civil service; (b) occupation; (c) trade; (d) business; (e) technical know-how and profession; (f) exploration of arts, science and technology*" (art. 5).

- "*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 5.29 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 5.29 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 5.50 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 5.51 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.

International Treaty	Description
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.
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.

5.6 CULTURAL 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 has no sites on the World Heritage List (*Source: UNESCO, 2014*). However properties 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);
- Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra) (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 5.30. Only the site nr. 2 (Badah-lin and associated caves) is located on block PSC-K boundary; other cultural heritage sites, in a buffer of 30 km around block PSC-K, are nr. 1 and from 3 to 6 (Ancient cities of Innwa, Amarapura, Mingun, Mandalay) and nr. 20 (Wooden Monasteries of Shwe-Kyaung). They are described in the following sections.

Figure 5.30 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

1, from 3 to 6 - Ancient cities of Upper Myanmar: Innwa, Amarapura, Sagaing, Mingun, Mandalay

Subsequent foundations ort residences of Myanma kings: Sagaing from 1315 to 1364, Innwa from 1364 to 1841. Amarapura from 1841 to 1857, Mingun in 1810-1819, Mandalay after 1857. They are close to each other, inside a span of 30 km on both banks of the Ayeyawady River. Innwa, Amarapura and Mandalay are noteworthy instances of city planning. The royal palace is located in a corner of the city wall at Innwa, at its centre in Amarapura and Mandalay. Numerous religious monuments, temples, stupas and monasteries. A giant stupa was started at Mingun, intended to become the highest monument of Buddhism, but was never finished. Its base, severely cracked by an earthquake in 1819, is still an impressive mass of brick. The royal palace at Mandalay was destroyed during the 2nd world war, but the city wall is still in fair condition. The cultural and religious life is still very active in these cities, with numerous Buddhist institutions. Collections of paintings, manuscripts, art objects and inscriptions are housed in various monasteries and museums. Traditional artefacts and handicrafts are produced in specialized streets in Amarapura and Mandalay.

2 - Badah-lin and associated caves

Padah-Lin Caves are limestone caves located in Taunggyi District, Shan State, Myanmar (Myanmar). It is located near a path from Nyaunggyat to Yebock, on a spur of the Nwalabo mountains within the Panlaung Reserved Forest. There are two caves; the smaller of the two contains paintings from between the Mesolithic and early Neolithic periods.

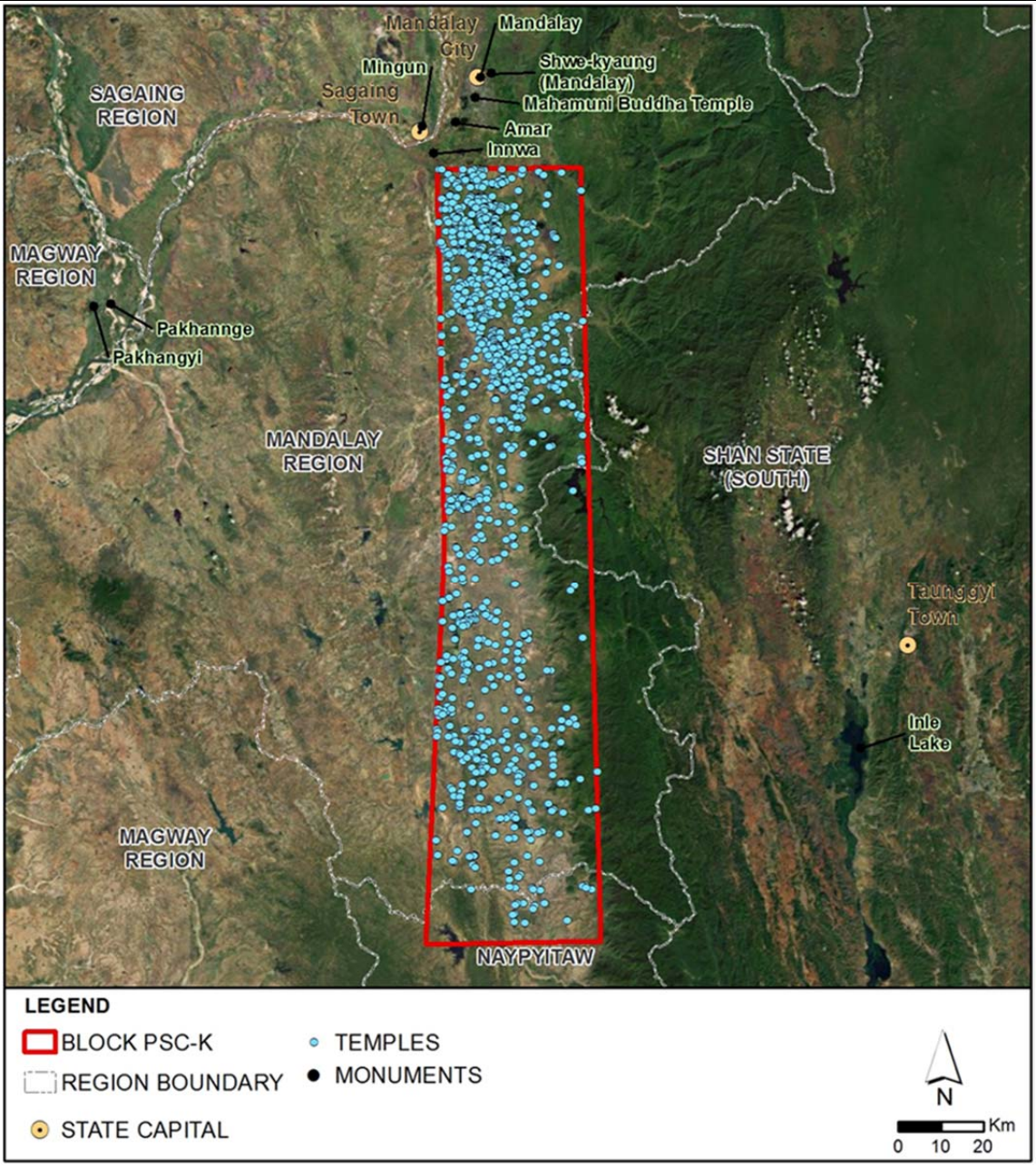
Cave 1, excavated 1969-72, have yielded a rich prehistoric material. Carbon 14 analysis of charcoal pieces has provided dates of 13000 years before present time. Numerous stone implements, ringstones and animal bones were unearthed during excavation. 14 rock-paintings in red ochre (representation of animals and of human hands, and symbolic motives) were discovered on walls and ceiling. The large number of unfinished pieces indicates that the cave was used as a workshop for stone tools. As the cave provides evidence of the transition from Palaeolithic to Neolithic implements, it represents a determining milestone in the prehistory of south-east Asia.

20 - 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 PSC-K, finally, there are 1,284 temples, as shown in Figure 5.31. An exact mapping of the location of these temples has been carried out only within the block PSC-K's boundary.

Figure 5.31 Location of Cultural Heritage Sites and Temples in the block PSC-K (blue circles)



Source: eni, 2014

5.7 VISUAL COMPONENTS

The territory of the whole Block PSC-K, 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;
- Natural forest;
- 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, small to big settlements, and the crop themselves. These areas are served by a complex artificial drainage network that is regulated by a series of dams on major rivers. The main features of these areas are summarized in the following table.

Table 5.52 Characteristic of Agricultural Areas in the Block PSC-K

Land Cover Features	Agricultural plots with dimension varying from 0.2 ha to 10 ha
Drainage Network	Complex artificial dikes, channels and trenches connecting crops
Road Network	Intricate network of trails connecting all crops. Major road system connecting settlements
Natural Vegetation	Low presence of natural vegetation; isolated adult trees within fields and small trees lines along road and channels; forest patches adjacent to rivers and channels
Accessibility	Very accessible on foot and with vehicles
Built-up	Small to big settlements, sparse houses, farms and barns
Topography	Mainly flat areas; agricultural land cover reaches hills sides

Natural forest areas are natural remote areas covered by a uniform canopy cover with no or very few access roads. Settlements are absent or very rare. The superficial waters are organized in typical dendritic drainage networks made of small rivers and streams. Some wide water bodies are present. The topography is irregular. These are mountain areas with a wide internal relief. The main features of these areas are summarized in the following table.

Table 5.53 Characteristic of Natural Forest Areas in the Block PSC-K

Land Cover Features	Dense to sparse forest. Very few isolated crops. Settlements are absent or very rare
Drainage Network	Dendritic pattern made of small rivers and streams. Wide natural water bodies
Road Network	Absent. Only isolated major roads
Natural Vegetation	Mainly dense forest. Patches of sparse forest and shrubs
Accessibility	Very difficult. Many areas are inaccessible

Built-up	Absent
Topography	Hilly and mountainous areas with high internal relief

Floodplains areas are dominated by intensive agriculture (probably two or more harvests a year). Agricultural areas are alternated to vigorous natural vegetation patterns: mainly small trees forest patches close to channels and rivers. Where they preserve the natural characteristics, rivers are originally braided; therefore their beds are characterized by the presence of wide sand dunes and small islands. Where possible they are cultivated. The main features of these areas are summarized in the following table.

Table 5.54 Characteristic of Floodplains Areas in the Block PSC-K

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 and sand islands
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 *erosional landforms* areas are dominated by the presence of shrubs and bush with forest patches located close to minor tributaries and streams, which shaped in the south-western part of the Study Area a well-developed dendritic drainage system. These landforms occupy hilly areas. 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 5.55 Characteristic of Erosional Landforms Areas in the Block PSC-K

Land Cover Features	Erosional features: continuous succession of small valleys and edges
Drainage Network	Well-developed dendritic drainage system; in some spots it develops to trellis drainage system due to the local geological setting
Road Network	No main road network seems to be present
Natural Vegetation	Mostly shrubs and bush and forest patches
Accessibility	Scarce
Built-up	Very few small and isolated settlements and sparse houses
Topography	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 the review of the available information, mainly at national and regional levels; below an analysis of the main health key topics in the Block PSC-K is provided.

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 PSC-K is located Mandalay Region, as shown in Figure 5.32. This Region is situated in the centre of the country, bordering Sagaing and Magwe Divisions to the west, Shan State to the east and Bago Division and Kayin State to the South.

Mandalay 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
- 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

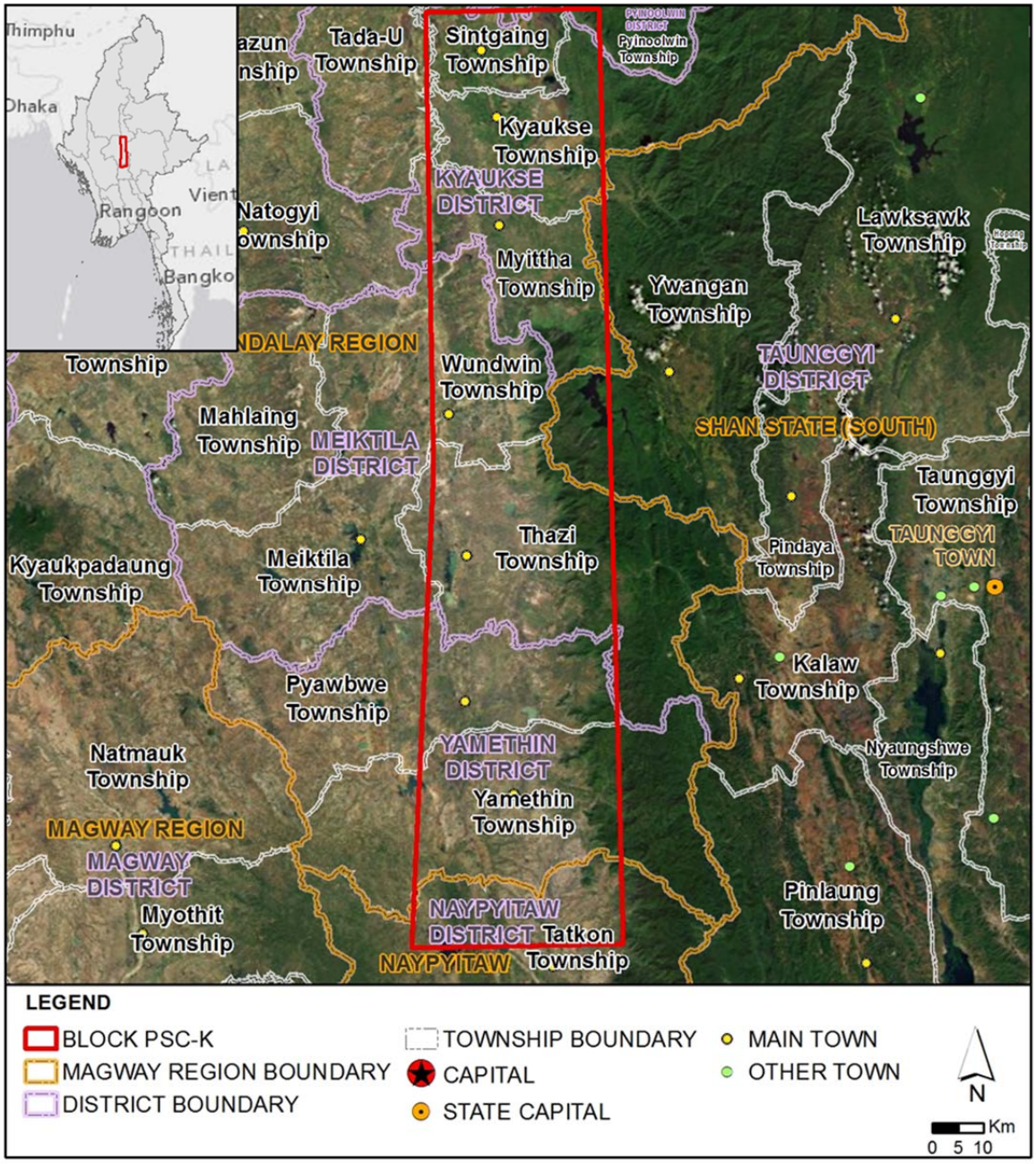
The Study Area for the health baseline spans across 1 region (Mandalay), 1 union territory (Naypyitaw) and 1 state (Shan State). They are further split up in 7 districts and 13 township, as shown in the following Table 5.56.

Table 5.56 Health Study Area for Block PSC-K

Region/State/Division	District	Township
Mandalay Region	Kyaukse	Sinkaing
		kyaukse
		Myittha
		Tada-U
	Meiktila	Wundwin
		Thazi
		Meiktila
	Yamethin	Pyawbwe
		Yamethin
	Pynoolwin	Pynoolwin
	Mandalay	Amarapura
Naypyitaw Union Territory	Naypyitaw	Tatkon
Shan State	Taunggyi	Ywangan

Figure 5.32 below presents the Study Area for the health baseline.

Figure 5.32 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.

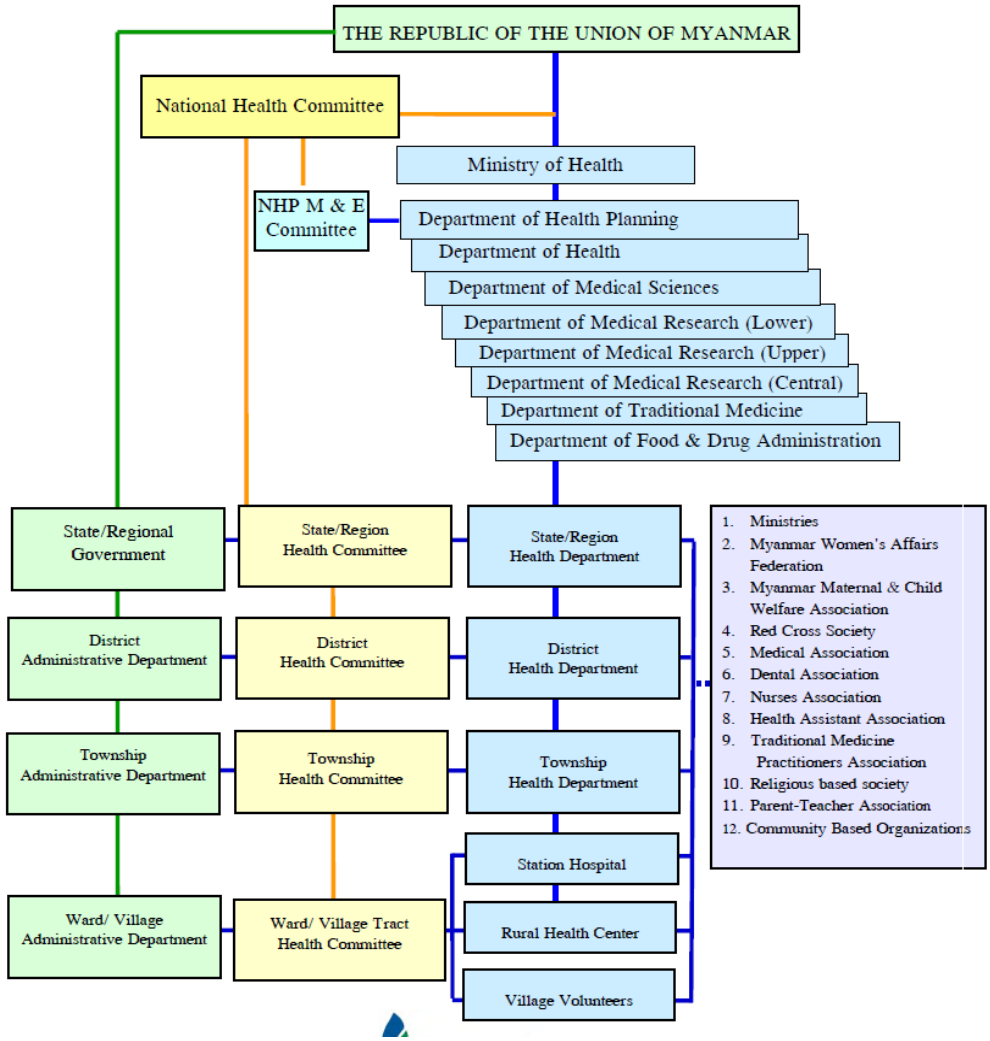
The Ministry of Health has seven departments:

- 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 5.33 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 5.57.

Table 5.57 Undergraduate at February 2013 (Universities in Mandalay 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 5.58 the composition of the National Health Committee is reported.

Table 5.58 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

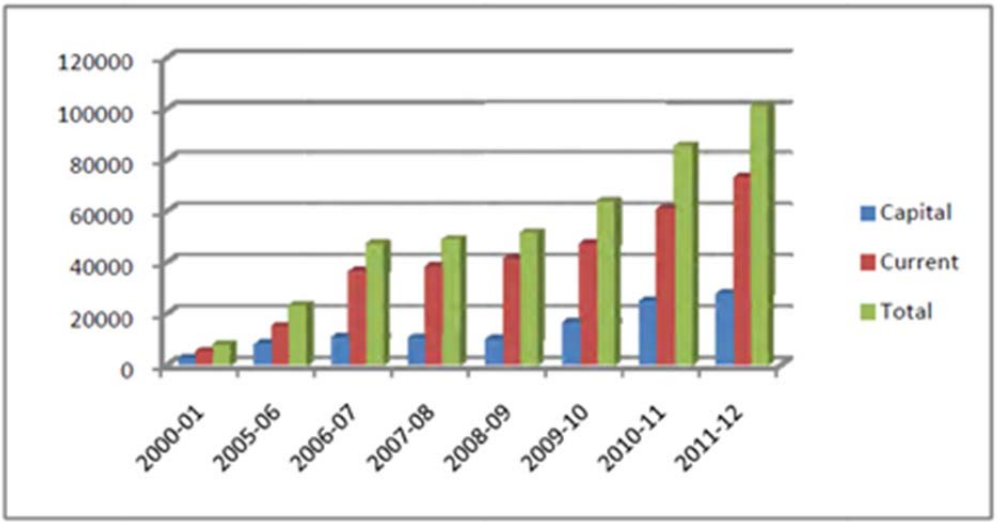
Source: Health in Myanmar (2013), Ministry of Health

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 5.34 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 5.59.

Table 5.59 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:

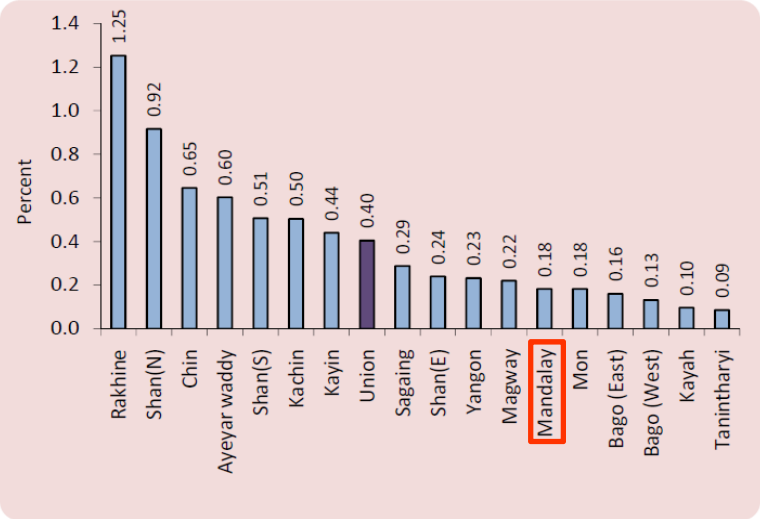
- an increase of Life Expectancy at Birth from existing (2001-02) 64-64 years to 75-80 years;
- a decrease of Infant Mortality Rate/1000 LB from existing 59.7 to 22;
- a decrease of Under five Mortality Rate/1000 LB from existing 77.77 to 29;
- a decrease of Maternal Mortality Ratio/1000 LB from 2.55 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 5.35 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% (Mandalay region value is 0.18%). Among them, Rakhine was the one that recorded more than threefold of the union level (1.25%).

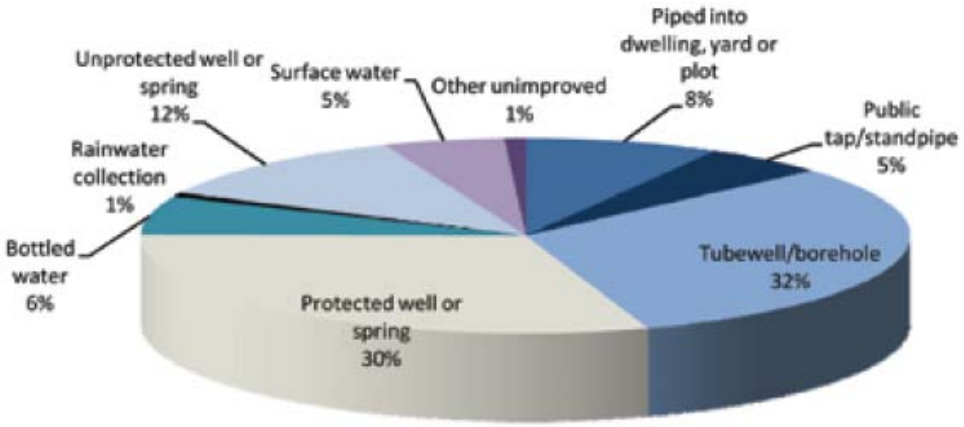
5.8.7.2 Water, Water Sanitation and Treatment and Food Hygiene Issues

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 5.36. 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 5.36 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 5.60). 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. Mandalay Region has a 6.5% 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 Mandalay Region 7.9% rely on unprotected wells and 9.3% on surface water.

Table 5.60 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 5.61. 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 Mandalay is 23.1%.

Table 5.61 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 5.62). 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. 91.1% of the population in Mandalay 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 5.62 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

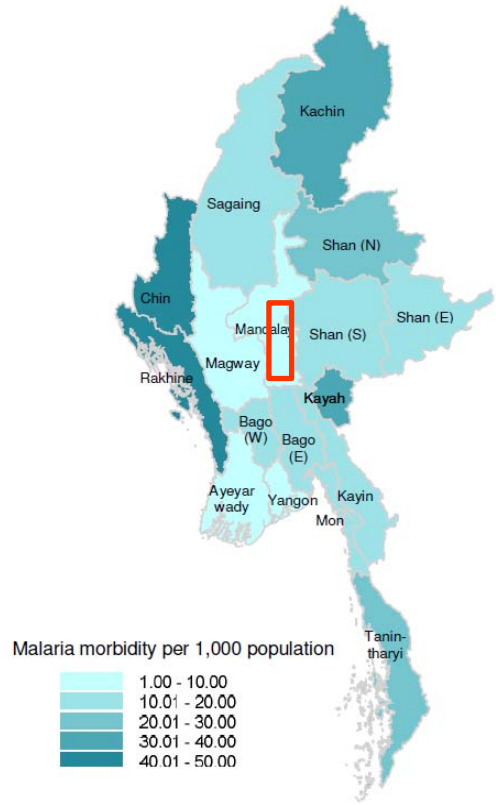
In this section, the main endemic diseases are examined, at national and regional level. Further information about morbidity status in the Study Area will be gathered in a future step of the Project, before the beginning of the seismic activities, during a specific field survey.

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.

Mandalay Region shows one of the lower incidence rate (defined as the number of new cases per 1,000 population), as shown in Figure 5.37.

Figure 5.37 Malaria Morbidity Rate by State and Division, 2008 (in Red the Block PSC-K)



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 5.38 shows new case detection rate (defined as the percentage of newly notified tuberculosis cases on the total estimated cases) in Myanmar.

Figure 5.38 Tuberculosis Case Detection Rate by State and Division, 2008 (in Red the Block PSC-K)

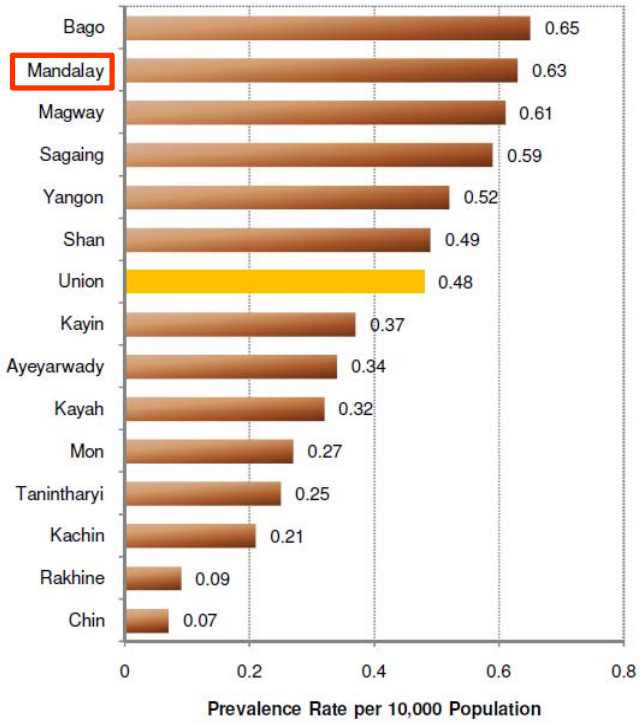
Source: Ministry of Health, Myanmar Health Statistics, 2010

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 5.39 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 5.63 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 5.63 Single Leading Causes of Morbidity (2011)

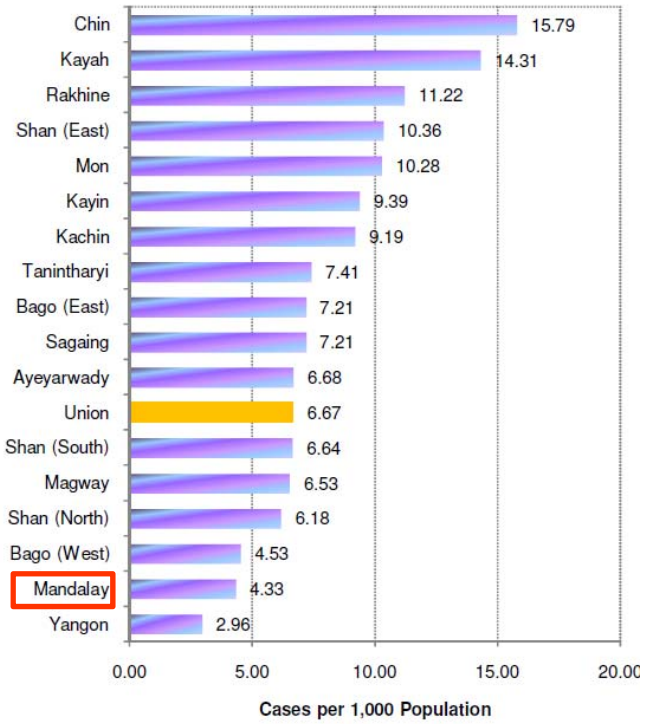
Causes	Percent
1 Other injuries of specified, unspecified and multiple body regions	10.6%
2 Other complications of pregnancy and delivery	6.7%
3 Single spontaneous delivery (*)	6.0%
4 Diarrhoea and gastroenteritis of presumed infectious origin	5.4%
5 Malaria	3.2%
6 Other pregnancies with abortive outcome	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 5.40. Overall, it was found that all states and divisions which had higher sanitary latrines coverage experience low diarrhoea morbidity.

Figure 5.40 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 5.64 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 5.64 Statistics on Mortality Rates

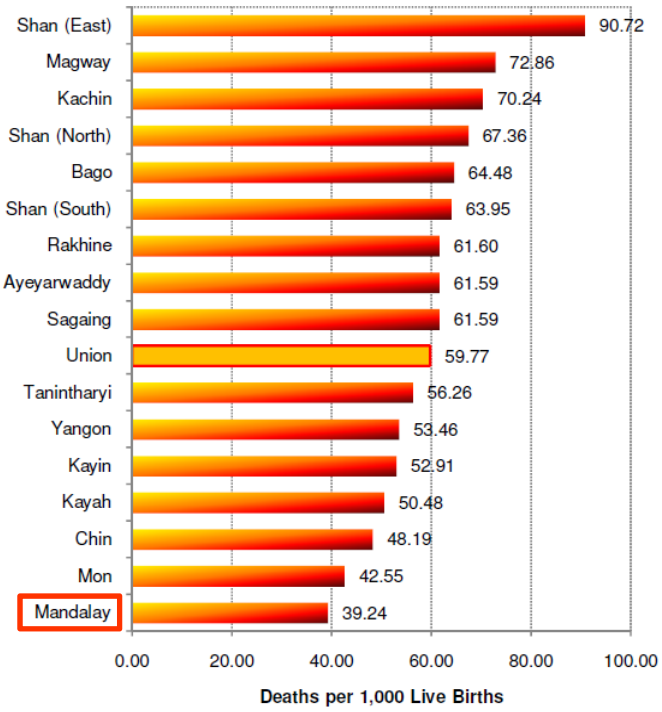
Mortality rates	1988	1999	2005	2006	2007	2008	2009	2010
Crude Death Rate (per 1,000 population):								
- Urban	8.9	6.0	5.5	5.3	5.3	7.6	5.1	5.2
- Rural	9.9	7.8	6.4	6.3	5.9	8.7	5.8	6.1
Infant Mortality Rate (per 1,000 live births):								
- Urban	47.0	55.1(*)	45.1	44.9	43.4	28.2	25.7	25.6
- Rural	49.8	62.5(*)	47.0	46.9	46.3	30.0	27.8	27.8

Mortality rates	1988	1999	2005	2006	2007	2008	2009	2010
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

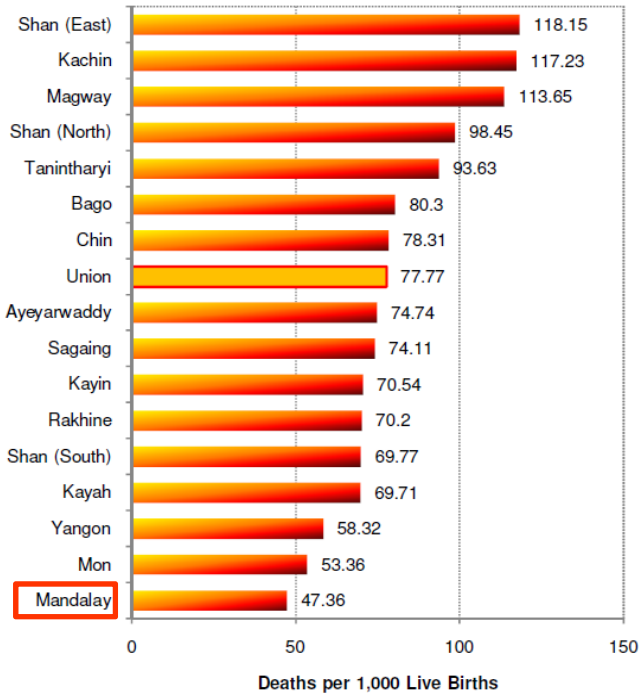
The following Figure 5.41, Figure 5.42 and Figure 5.43 shows mortality rates by State. Mandalay Region has the lowest infant mortality rate and under five mortality rate of Myanmar (respectively 39.24 deaths per 1,000 live births and 47.36 deaths per 1,000 live births). Also maternal mortality ratio is low, 1.76 deaths per 1,000 live births.

Figure 5.41 Infant Mortality Rate by State and Division (National Mortality Survey, 1999)



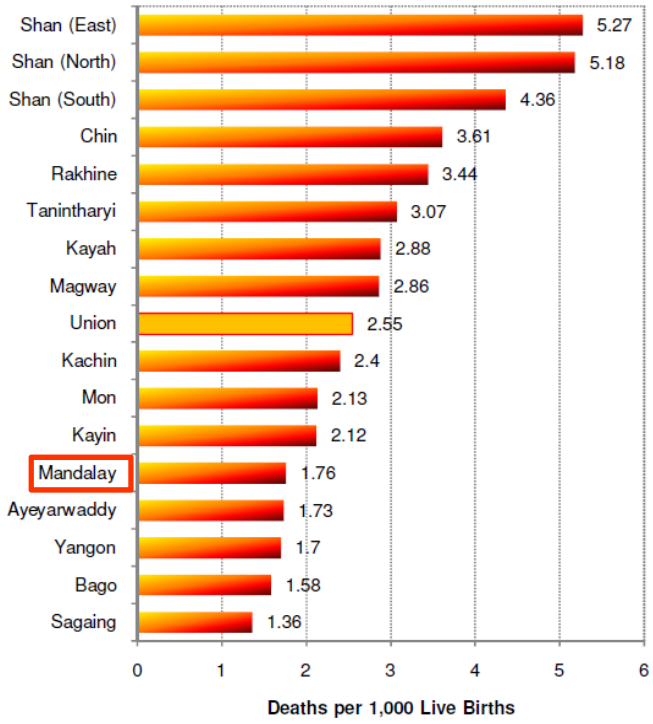
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.42 Under Five Mortality Rate by State and Division (National Mortality Survey, 1999)



Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.43 Maternal Mortality Ratio by State and Division (National Mortality Survey, 1999)



Source: Ministry of Health, Myanmar Health Statistics, 2010

In the following Table 5.65 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 5.65 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%
10 Other heart diseases	2.3%

Causes	Percent
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 5.66 reports data on life expectancy, stratified for sex and area (urban or rural).

Table 5.66 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 5.67, 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 5.67 Health Manpower Development in Myanmar

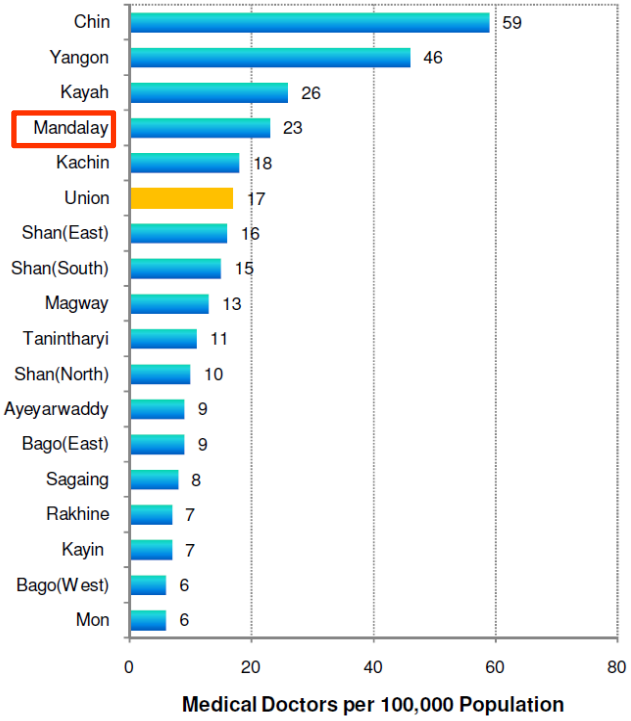
Health Manpower	1988-89	2008-09	2009-10	2010-11	2011-12	2012-13
Total No. of Doctors	12,268	23,740	24,536	26,435	28,077	29,832
- Public	4,377	9,583	9,728	10,450	11,675	12,800
- Cooperative & Private	7,891	14,157	14,808	15,985	16,402	17,032

Health Manpower	1988-89	2008-09	2009-10	2010-11	2011-12	2012-13
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

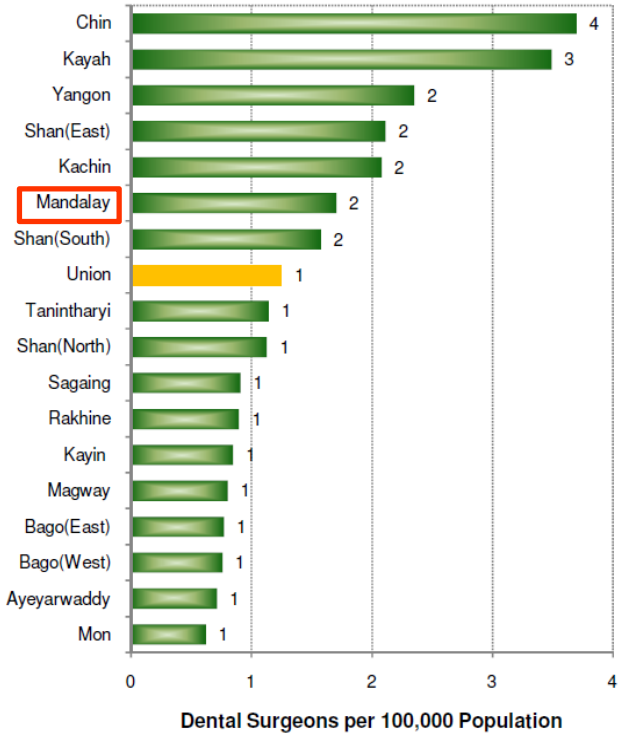
The following Figures shows the distribution of health manpower by State. Mandalay Region has, compared with the other State, an higher presence of Medical Doctors (23 per 100,000 population), Dental Surgeons (2 per 100,000 population) and Nurses (39 per 100,000 population), whereas the distribution of Midwives is one of the lower (18 per 100,000 rural population).

Figure 5.44 Distribution of Medical Doctors by State and Division, 2009



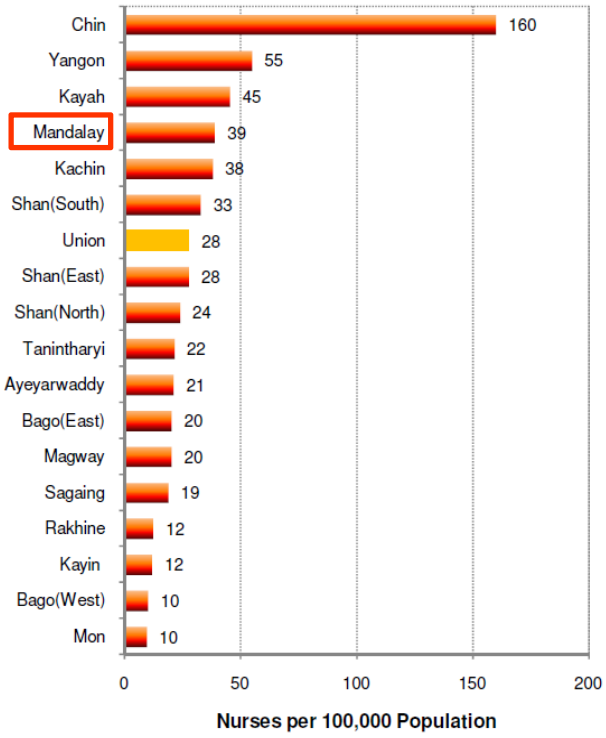
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.45 Distribution of Dental Surgeons by State and Division, 2009



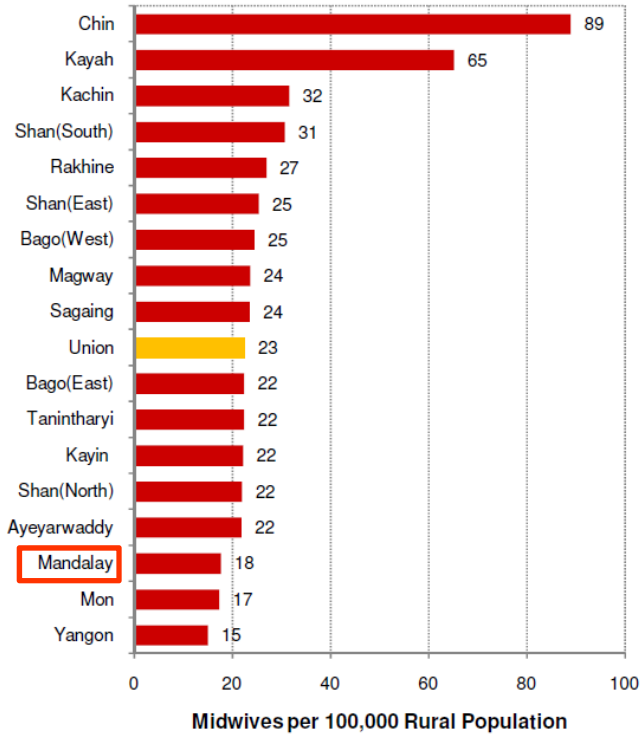
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.46 Distribution of Nurses by State and Division, 2009



Source: Ministry of Health, Myanmar Health Statistics, 2010

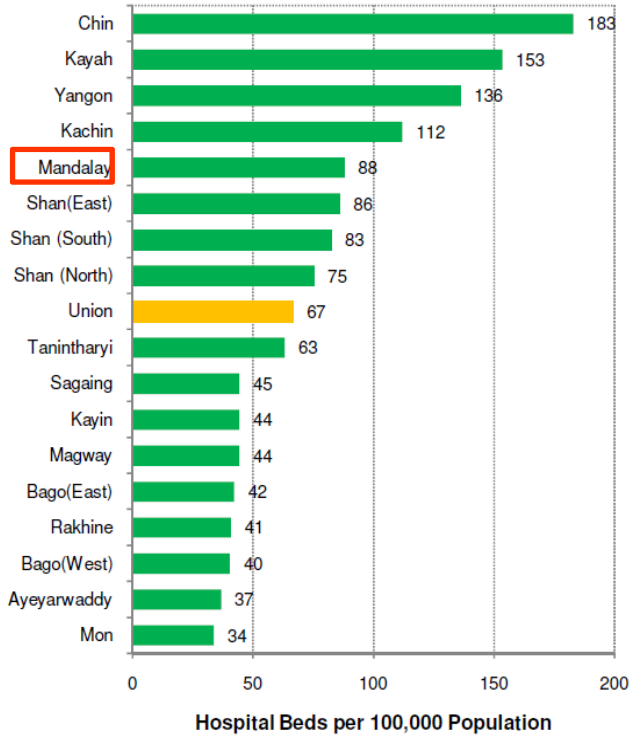
Figure 5.47 Distribution of Midwives by State and Division, 2009



Source: Ministry of Health, Myanmar Health Statistics, 2010

Also referring to the hospital beds, the Mandalay Region value is one of the higher in Myanmar (88 hospital beds per 100,000 population), as shown in Figure 5.48.

Figure 5.48 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 5.68 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%
Health related services	1.98%	1.82%	1.81%	2.23%

Providers (%)	2008-09	2009-10	2010-11	2011-12
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 5.69 outlines the national development of health facilities since 1988.

Table 5.69 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

Further information about health facilities, such as number of hospital and hospital beds in the Study Area, will be gathered in a future step of the Project, before the beginning of the seismic activities, during a specific field survey.

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:

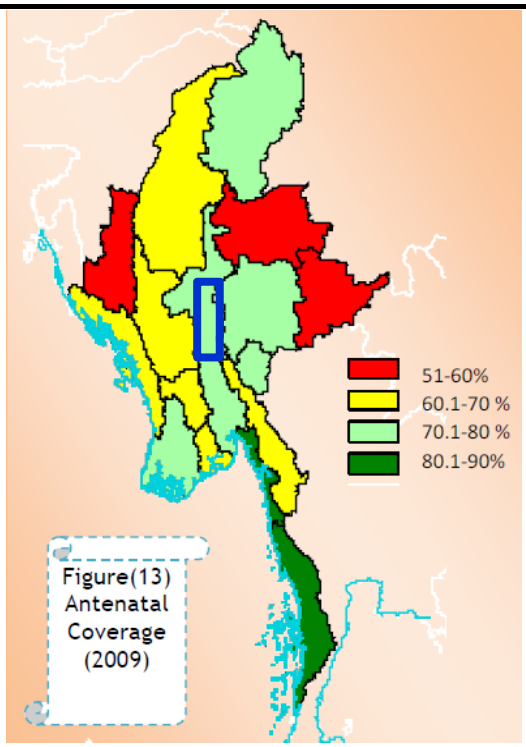
- *Hospital Information System* is a facility based monthly reporting system from all types of hospitals (i.e. Station Hospital, Township Hospitals, State and Divisional Hospitals and Specialist Hospitals). A total of 832 hospitals all over the country send the information as reports and returns to the 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 inFigure 5.49. 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 5.70.

Figure 5.49 Antenatal Coverage, 2009 (in Blue the Block PSC-K)

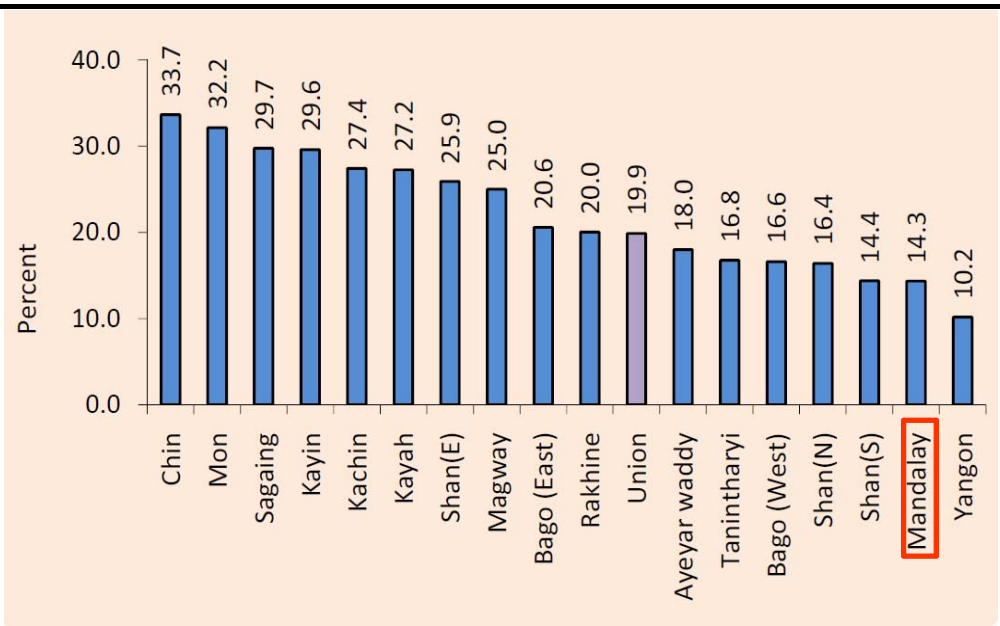


Source: Ministry of Health, Annual Public Health Statistics Report, 2011

Average frequency of AN care was 3.3 times per pregnant mother; and PN care was 6 times in puerperium period.

The following Figure 5.50 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 more accessible the advanced health care is, the lesser is the attendance rate, as in Mandalay Region, where attendance is 14.3%.

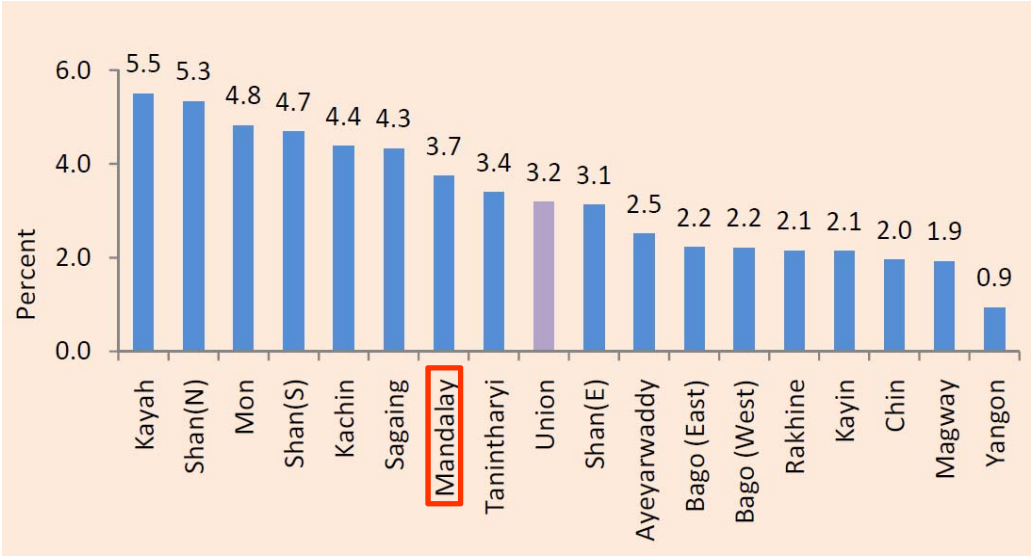
Figure 5.50 Under 5 clinic attendance rate by Regions and States (2009)



Source: Ministry of Health, Annual Public Health Statistics Report, 2011

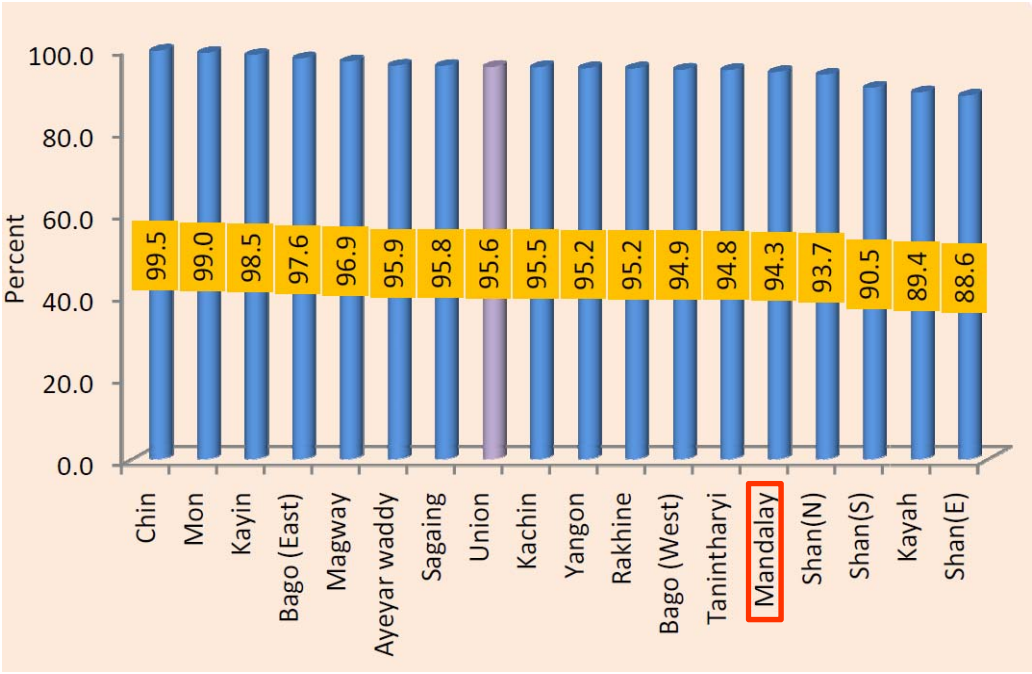
Now-a-days, preventable and curable diseases such as Acute Respiratory Tract Infection (ARI), Diarrhoea and Malaria are still leading causes of under five deaths. The relation of diarrhoea cases and utilization of Oral Rehydration Therapy (ORT) among under five years old children in 2009 was shown in Figure 5.51 and Figure 5.52. Mandalay region has 3.7% of under five diarrhoea cases with severe dehydration, and the utilization of ORT is 94.3%.

Figure 5.51 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 5.52 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 5.70 and Table 5.71 report some indicators relating to maternal and child health activities.

Table 5.70 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 5.71 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

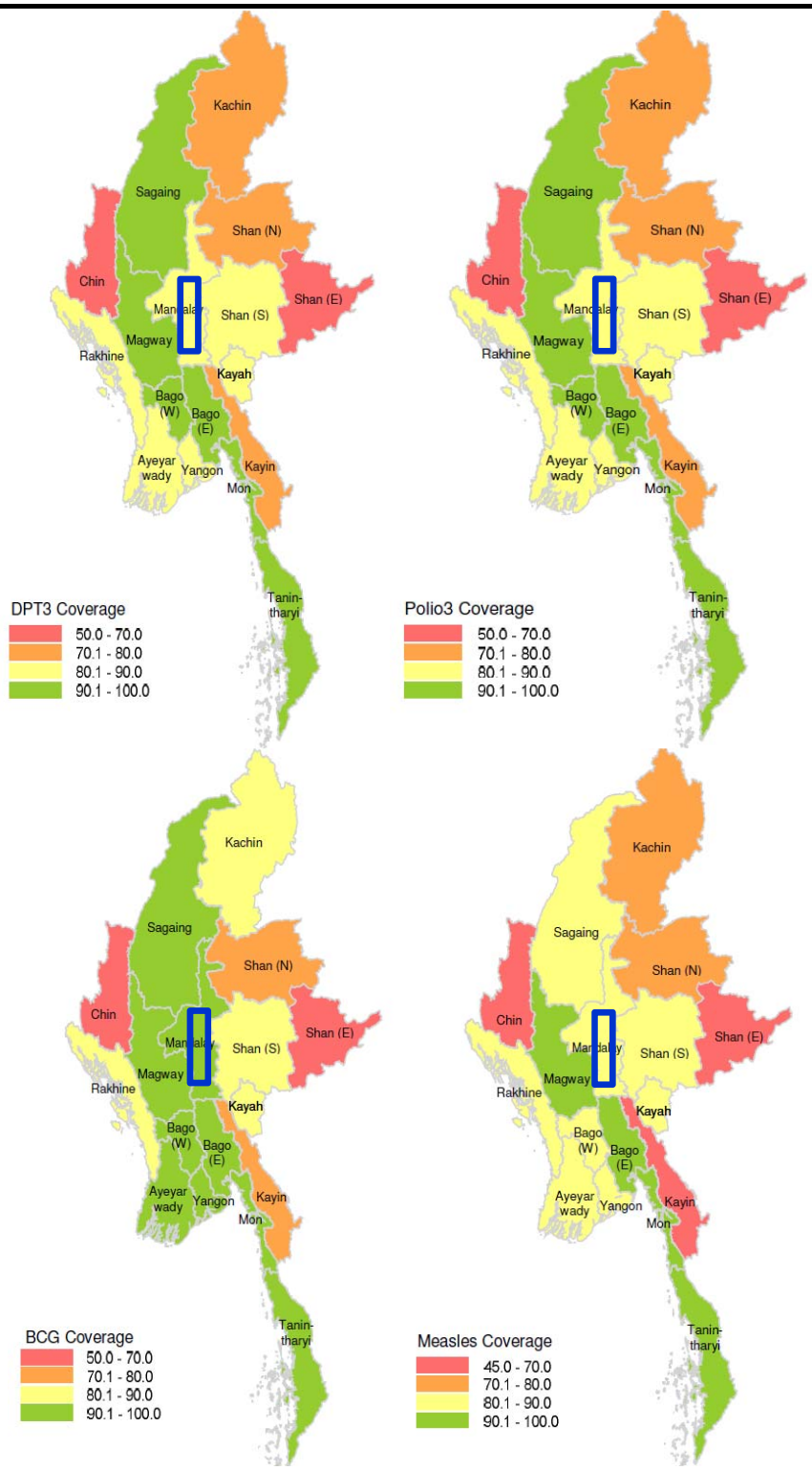
Source: Ministry of Health, Annual Public Health Statistics Report, 2011

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.

Mandalay Region has an immunization coverage between 80 and 90% for all vaccines except BCG coverage, which is between 90 and 100%.

Figure 5.53 Immunization Coverage by State and Division, 2008 (in Blue the Block PSC-K)



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.

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 in a phased approach applied throughout all the different phases of the Project (Grav-mag and Seismic Survey), 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 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 Standard - Doc n° 1.3.1.47*):

- 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 should be defined and undertaken.

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	
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	*Ranging from 4 to 16*
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 two activities of the Project (Grav-Mag and 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

- *Grav Mag Survey*: emissions from aircraft during the data acquisition phase (flights)
- *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 camp 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

Grav-Mag Survey	*Seismic Survey*
• Negligible impacts on local air quality due to atmospheric emissions from the aircraft during the data acquisition phase. This survey will affect mainly NO_2 and CO_x atmospheric concentration.	• An increase in atmospheric concentrations of dust particles due to dust emissions. Dust emissions will arise from earthwork activities (e.g. site clearance, scrapping and levelling) and from re-suspension due to wind and vehicle transit on unpaved roads. • An increase in atmospheric concentrations of air pollutants such as carbon monoxide (CO), nitrogen oxides (NOx) and sulphur dioxide (SOx) from exhaust emissions (use of vehicles and engine-driven machinery e.g. cars, trucks, generators, etc.)

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 air quality in the areas potentially affected by the Project, was investigated through on direct measurements of the main air pollutants, and comparison of the sampling results with the quality standards established by WHO and NAAQS (see Table 6.5).

The results of the survey performed in from December 2009 to January 2010 highlights that baseline NO_x, NO_2 and SO_2 levels near the Taungtha and Sintgaing offload stations were greater than those near Yenangyaing Station. The Taungtha and Sintgaing offload stations are in suburban areas and are closer to main roads and therefore probably have more mobile emissions.

Baseline air quality concentrations (one month average) at all sample locations close to the Taungtha, Sintgaing and Yenangyaing Stations were found to be well below the annual mean WHO guideline (updated 2005) and the annual mean National Ambient Air Quality Standards (NAAQS, set by U.S. Environmental Protection Agency USEPA, 1990).

The baseline levels of PM_{10} close to Yenangyaung offload/compressor station, Taungtha offload station and Sintgaing offload station did not meet the WHO guideline; the PM_{10} level close to Yenangyaung offload/compressor station also did not meet the NAAQS (USEPA) standard. The baseline levels of TSPM close to Yenangyaung offload/compressor station and especially Sintgaing offload station did not meet WHO guideline. Sintgaing station is in a suburban area and close to a highway. The composition of aerosol particles was mainly from wind-blown dust of mineral oxides from natural sources, weather and local activities rather than from mobile emissions and industrial sources. In fact the soil types can be a predisposing factor to generate dust especially during dry conditions. Atmospheric dispersion is weaker in the winter due to low winds and low mixing height, contributing to less dilution of air pollutants, and resulting in higher particulate concentrations in the baseline sampling areas. Moreover the selected villages where the air quality samples were collected were generally small to medium–sized, in agriculture-based areas with only 100 to 300 households and an average population of 200 to 1,000 people each.

Table 6.5 Baseline Air Quality Data

Substance ($\mu g/m^3$)	**Monitored Air Pollutant Concentration ($\mu g/m^3$) (a)**						**Air Quality Guidelines (b)**	
	Yenangyaing station		Taungtha station		Sintgaing station		WHO guideline	NAAQS (USEPA)
	Site A	Site B	Site A	Site B	Site A	Site B		
Nitrogen Oxides (total NO_x)	7.47	7.81	10.62	12.49	8.90	21.65	NA	NA
NO_2	3.34	4.47	6.62	5.86	12.31	11.60	40	100
NO	4.13	3.34	4.00	6.63	< L.O.D.	10.05	NA	NA
SO_2	0.19	0.2	1.66	3.00	0.75	2.08	NA	30
PM10	154 (17-3382) 1213*		97 (10-295) 114*		80 (26-244) NA*		50	150
TSPM	120 (2-2649) 429*		80 (26-244) NA*		174 (2-8280) 1277*		100	NA

Notes:

(a) One month average concentration for NOx, NO2, NO and SO2; 24-hr average (range) for PM10 and TSPM.

(b) Annual mean for NOx, NO2, NO and SO2; 24-hr for PM10 and TSPM.

< L.O.D below detection limit

* S.T.E.L. (Short Term Exposure Limit)

NA – not available

Source: *Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM.*

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Low**.
- In *urban areas*, the sensitivity has been evaluated as **High**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Low**.
- In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Low**.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Low**.

It is to be highlighted that the value of the sensitivities reported above has been assessed throughout the analysis of the currently available data and should be confirmed/reviewed in the further stage of the project by means of field surveys.

6.2.1.3 Grav-Mag Survey

Regarding the Grav-Mag Survey, the following source of impact has been identified.

Table 6.6 Air Quality Impacts

Source of Potential Impact	Potential Impact
Use of aircraft	Atmospheric emissions, affecting mainly NO_2 and COx atmospheric concentration.

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

The survey will be carried out with the use of an aircraft. The vehicle is likely to be a Cessna Caravan type carrying the three instruments (gravimeter, magnetometer, and LiDAR sensor) at one time, which represents the currently preferred solution. Adjacent to the Block PSC-K three airports are available: the Mandalay city International Airport, to the very north of the Block; the Shante city Airport located a few kilometres form the western boundary of the central part of the Block; the Helo city Airport at 50 km east of the eastern Block boundary. The airports can provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management.

During the Project, the potential impacts on local air quality are exclusively related to the temporary atmospheric emissions from the aircraft during the data acquisition phase. This survey will affect mainly NO_2 and C0x atmospheric concentration. The duration of the survey is expected to be from three to five weeks.

Mitigation Measures

No mitigation measures are foreseen.

Conclusion

The potential impact significance on air quality associated with the operation phase are summarized in Table 6.7.

Table 6.7 Ranking of Impacts on Air Quality – Grav-Mag Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Impacts on local air quality due to atmospheric emissions from the aircraft	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
Score	*1*	*1*		*1*	

The potential impact on air quality results as **Low** for the whole territory. The ranking should be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

6.2.1.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.8 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.

Mitigation Measures

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;
- limiting vehicle speed;
- 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 drainageand a well compacted surface.

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 abovementioned mitigation measures will considerably reduce the expected potential impacts related to dust emissions.

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, the potential impact significance on air quality associated with the seismic survey are summarized in Table 6.9.

Table 6.9 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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
Score	*1*	*1*		*1*	

The potential impact on air quality results as **Low** for the whole territory. The ranking should be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

6.2.1.5 GHG Emissions

Impacts Identification

During seismic survey, CO_2 emissions will be the result of fuel combustion from vehicles used for personnel transport, power generator for energy supply and airplane used for Grav-mag survey. 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:

The GHG emissions produced by the exhaust systems of road vehicles during the seismic survey 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. At this stage of the Project, detailed information concerning the involved staff and vehicles needed are not available, and it is not possible to provide a quantitative estimation of the foreseen GHG emissions during the seismic survey. Anyway, considering a typical diesel 4WD car, COPERT IV defines an emission factor of less than 210g of CO_2/km (or 3ton of CO_2/ton of fuel consumed). Considering that it is foreseen a limited number of vehicles only for personnel transport in operation during the seismic survey, negligible GHG emissions are expected from the Project; moreover those emissions will be limited to the duration of the activities.

The GHG emissions produced by power generators located at the camps sites in order to provide energy to the personnel during seismic survey can be assessed through the implementation of the GHG Protocol guidance. Calculation based on the GHG Protocol typically entails the collection of activity data, in the form of the quantity of fuel consumed for combustion purposes or other activity data (such as electricity consumption, fugitives volumes, etc.), and emission factor data, in the form of information on the characteristics of the fuel combusted and the efficiency of the oxidation process. Fuel data for power generators are not available at this stage of the Project, but considering the purpose of those generators (e.g., energy supply to the personnel at the camp site), it is not foreseen a significant fuel consumption, thus negligible GHG emissions will be released.

The GHG emissions released by the airplane during the Grav-Mag survey may be qualitatively assessed by means of typical emission factor based international Dataset (U.S. 2014 Climate Registry Default Emission Factors) [1]. In terms of aircraft CO_2 emission, considering that a small aircraft is expected to be used (e.g. Cessna 185 or 208) a similar emission factor of 3.2 ton of CO_2/ton of fuel consumed (e.g. JET A1) can be assumed. Considering that it is foreseen a limited number of flights for a limited time frame, negligible GHG emissions are expected.

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 technique for energy efficiency, as the use of efficient power generators that produce lower GHG emissions.
- Generators are to be well maintained (including the maintenance inspections recommended by the manufacturer) and with emission levels meeting WHO recommendations.

[1] Source: http://www.theclimateregistry.org/downloads/2014/04/2014-Climate-Registry-Default-Emissions-Factors.pdf

The following mitigation measures to manage temporary emissions of greenhouse 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).

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 6.10.

Table 6.10 Ranking of Impacts on Air Quality – GHG Emissions

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
GHG emissions from road vehicles and power generators in use during seismic survey	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, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
Score	*1*	*1*	*3*	*1*	
GHG emissions from aircraft in use during Grav-Mag survey	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, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **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 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 are likely to occur during the two activities of the Project (Grav-Mag and 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.

During the Grav-Mag survey the noise sources will be limited to the airplane engine.

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

- *Grav Mag Survey:* noise emissions will be generated by aircraft during the data acquisition phase (flights)
- *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 6.11 Key Impacts – Acoustic Climate

Grav-Mag Survey	*Seismic Survey*
• Temporary annoyance at residential buildings due to overflights; • Potential temporary disturbance and/or displacement of fauna (e.g. reduction of usable habitat).	• Temporary annoyance at residential buildings near the work sites; • Potential temporary disturbance and/or displacement 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

Noise emissions generated during onshore activity, both Grav-Mag and seismic survey, could affect human receptors present in the proximity of the work site, with consequence on behaviour and health (annoyance, sleep disturbance, stress). Noise could also affect local fauna.

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.

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation,* the sensitivity has been evaluated as **Low**.
- In *urban areas*, the sensitivity has been evaluated as **High**, because the potential noise effects on the human health, as consequences of elevated sound levels, are very likely.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Moderate**.
- In areas characterized by the presence of *dry forest and green forest,* the sensitivity has been evaluated as **Moderate**.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Moderate**.

It is to be highlighted that the value of the sensitivities reported above has been assessed throughout the analysis of the currently available data and should be confirmed/reviewed in the further stage of the project by means of field surveys.

6.2.2.3 Grav-Mag Survey

Regarding the Grav-Mag Survey, the following source of impact has been identified.

Table 6.12 Noise Quality Impacts

Source of Potential Impact	Potential Impact
Aircraft's overflights of the Project areas	Noise emissions at sensitive receptors from aircraft during the data acquisition phase (flights).

The impact assessment on the acoustic climate described in the following sections is based on the analysis of the sources of potential impacts reported above.

Impacts Identification

During the Grav-Mag survey, the aircraft is expected to overfly the Project area at a low height (80-200m), thus the noise emissions generated by the airplane's engine may generate a potential impact at sensitive receptors located in the overflight's area.

However, this disturbance will be temporary and limited to the transit of the aircraft.

During the survey no significant vibration emissions will be generated.

Mitigation Measures

The activity will be performed during the daylight hours.

Conclusion

Considering the evaluation criteria defined in Section 6.1.2, the potential impact significance on the acoustic climate associated with the Grav-Mag survey are summarized in **Table 6.13**.

Table 6.13 Ranking of Impacts on Noise Quality - Grav-Mag Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Impacts on local acoustic climate due to aircraft operations	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	

According to the criteria defined by eni Standard requirements *(Environmental, Social and Health Impact Assessment Standard - Doc n° 1.3.1.47)*, the potential impact on noise quality results as **Low** for the whole territory. The ranking will be confirmed after the performing of the Grav-Met survey, which will allow to carry on a ground truth of the currently available data.

6.2.2.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.14 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 displacement 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 sources of potential impacts 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 will 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/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 is reported in Table 6.15, below. In the table the typical sound power levels of the equipment are identified from international standards on noise emissions from equipment (i.e. European Directive 2006/42/CE Machinery Directive) or from noise vendor datasheets.

Table 6.15 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. The noise propagation from the source (the piece of equipment) to the receptor can be calculated using standard calculation methods, and the noise impact will be the result of 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 camp site.

Table 6.16 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. 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 micro-charges. The charges, placed in an in-line configuration, will be blasted with a remote control. The dimensions and the exact locations of charges will be defined in a more advanced stage of the project.

The vibroseis source option will be considered, especially during the dry season, in order to increase the average daily production and minimize the related environmental impact.

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, 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.

[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.

Sensitive receptors within 500 m from project areas (camp site, line survey, access road) will be monitored to quantify the vibration caused by blasting. Further details are reported in the Environmental Management Plan (Section 8).

Mitigation Measures

In addition to general mitigation measures, the noise impact on receptors during the seismic survey will be specifically reduced using the following measures:

- switch off equipment when not in use;
- whenever feasible, schedule different noisy activities to occur concurrently, since the combined noise levels produced may not be significantly greater than the level produced if the operations were performed separately;
- limit noisy construction activities to the least noise-sensitive times of day.

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 6.17.

Table 6.17 Ranking of Noise 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 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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	
Short Term Impact due to noise emission during blasting activities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	

The potential impact on noise quality results as **Low** for the whole territory. The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

Anyway, it has to be highlighted the needed of putting in force a noise monitoring plan with the aim to evaluate the real noise emissions due to project and the increase above the current background level. Only in this way a proper noise assessment of project can be performed, and the contingent necessity of further mitigation measures identified.

6.2.3 Water

6.2.3.1 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 freshwater resources.

This Section analyses only the impacts correlated to the seismic survey because the Grav-Mag activities (aircraft use) will have negligible impacts on freshwater resource.

Box 6-3 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- Grav-Mag survey: negligible impacts are expected during this activity.
- 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 main river that crosses Block PSC-K (in the Northern side of the Block) is the Mytinge River. Many secondary rivers are located within the Block PSC-K as well as some natural inland water bodies (perennial and non-perennial) and many artificial water bodies, used for energy production and irrigation purposes.
- The flood risk along all the secondary rivers, especially in the North-West part of the Block the flood risk is medium – 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 6.18 Key Impacts –Water Quality

Grav-Mag Survey	*Seismic Survey*
• Negligible impacts are expected during this activity	• 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 component is reported in the following Sections.

6.2.3.2 Water Sensitivity

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*).

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation,* the sensitivity has been evaluated as **Moderate**.
- In *urban areas*, the sensitivity has been evaluated as **High**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Moderate**.
- In areas characterized by the presence of *dry forest and green forest,* the sensitivity has been evaluated as **Moderate**.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Moderate**.

The value of the sensitivities reported above will be confirmed after the performing of the field surveys.

6.2.3.3 Seismic Survey

Regarding the Seismic Survey, the following source of impact has been identified.

Table 6.19 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).

Source of Potential Impact	Potential Impact
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 6.19.

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 and of the line survey.

Key potential impacts on water resources (surface water and groundwater) are the following:

- Potential contamination of water resources with solid and liquid wastes;
- Potential contamination from fuels, lubricant oils and chemicals;
- Potential effects arising from runoff;
- Effects of sediment plumes on surface water;
- Consumption of water resources.

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 waste that will be generated during the site preparation 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.
- 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.

The main liquid waste that will be generated during the seismic survey are the followings:

- sanitary waste water. This waste water comes from sanitary installations within the camp site. 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.

The appropriate disposal sites will be identified before the beginning of project activities in accordance with the local authorities.

The magnitude and the likelihood that this impact will occur is dependent on the results of the hydrogeology survey in area of influence and/or nearby surface water.

Potential Contamination from Fuels, Lubricant Oils and Chemicals

Potential contamination of freshwater may arise from the transport, storage and handling of fuels, lubricants and chemicals during site clearance and access roads construction.

The magnitude and the likelihood that this impact will occur is dependent on the results of the hydrogeology survey in area of influence and/or nearby surface water.

Potential Effects Arising from Runoff

During site clearance and access roads construction, excavation for topsoil removal in the camp site 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 and camp site) 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).

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.

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 and for civil uses.

Bottled drinkable water will be supplied to the camp sites.

Mitigation Measures

The following mitigation measures will be enforced from the management and mitigations measures envisaged in specific Management 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.

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.

3. Potential Effects Arising from Runoff

The following actions should be undertaken, where and when appropriate in order to minimize the effects arising from:

- A stormwater management strategy will be implemented in the Environmental Management 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.

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 reported in Environmental Management Plan;

5. Consumption of Water Resources

Bottled drinkable water will be supplied to the camp sites.

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 6.20.

Table 6.20 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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **medium (7)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **medium (7)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	

Considering the potentially 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**. 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.**

The ranking should be confirmed in a more advanced stage of the project, after the performing of the field surveys.

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. This Section analyses only the impacts correlated to the seismic survey because the Grav-Mag activities (aircraft use) will have negligible impacts on soil.

Box 6-4 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- Grav-Mag survey: no impacts are expected during this activity.
- 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.
- Groundwater.
- Flora and Fauna.
- Agricultural activity.
- Landform.
- Community health and welfare.

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 6.21 Key Impacts – Soil Quality

Grav-Mag Survey	Seismic Survey
• No impacts are expected during this activity	• 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

Block PSC-K 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.

Block PSC-K is mainly characterized by the Recent alluvium unit, that is made up by sediments, deposited side by side since the beginning of Holocene to form the present landscape of Myanmar. Other geological units in Block PSC-K are listed below:

- Metamorphics Rxs
- Mainly Granites
- Irrawaddy Group and equivalents;

- Lower Pegu Group and marine, brackish and terrestrial equivalents;
- Margui Series, Mawchi Series;
- Molasse-type sediments.

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation,* the sensitivity has been evaluated as **Moderate**.
- In *urban areas*, the sensitivity has been evaluated as **Low**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Low**.
- In areas characterized by the presence of *dry forest and green forest,* the sensitivity has been evaluated as **Moderate**.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Low**.

The value of the sensitivities reported above will be confirmed after the performing of the field surveys.

6.2.4.3 Seismic Survey

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 6.22 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 6.22.

Impacts Identification and Assessment

The aim of this Section is to identify the possible impacts on soil during the seismic survey. The potential impacts on soil is likely to be confined to the area of the line survey and associated access roads and to the camp site.

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.

Potential Disturbance and Degradation

During the works soil movements will result from the excavation and earthworks related to:

- the line survey preparation (localised flattening of soil) ;
- the temporary camp site preparation;
- the access road construction.

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;

Land take

During seismic survey, some portion of land will be used, and consequently cause soil loss, for:

- Access roads and site access;
- Camp site;
- Line survey and upholes.

Once that the activity will be completed the sites will be restored to their original condition.

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:

- Erosional landforms will be avoided or, if this is no possible, minimized in survey planning.
- Before starting any work, photographic records will be made of the existing condition of the camp site. 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.

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.

Land take

No machinery will be allowed to leave the access roadways or the working strip.

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 6.23 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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **medium (7)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **medium (5)** • Water bodies: **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 natural forest habitat. In this area the impacts has been evaluated as medium. The ranking should be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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 seismic survey activities. This Section analyses only the impacts correlated to the seismic survey because the Grav-Mag activities (aircraft use) will have negligible impacts on flora and fauna.

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

- *Grav-Mag:* Negligible impacts are expected during this activity.
- *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.
- Occurrence of protected areas and other areas important for biodiversity located within the Block.

Project Influencing Factors

- A policy of minimal clearance will be implemented by eni myanmar in accordance with eni E&P Standards.
- 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.

The following table presents the key impacts of the project on the flora and vegetation component during the key project phases.

Table 6.24 Key Impacts – Flora and Vegetation

Grav-Mag Survey	*Seismic Survey*
• Negligible impacts are expected during this activity	• Loss of natural vegetation (and secondary plant species) and deforestation • Damage to natural Protected Areas and Sensitive areas • 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

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation,* the sensitivity has been evaluated as **High**.
- In *urban areas*, the sensitivity has been evaluated as **Low**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Low**.
- In areas characterized by the presence of *dry forest and green forest,* the sensitivity has been evaluated as **High**.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Moderate**.
-

The value of the sensitivities reported above will be confirmed after the performing of the field surveys.

6.2.5.3 Seismic Survey

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 6.25 Flora and Vegetation Impacts

Source of Potential Impact	Potential Impact
Site Clearance and camp site preparation of temporary facilities (camp site; access roads)	Habitat fragmentation; introduction of aliens species
Movement of vehicles, equipment and personnel	Deposition of dust and exposure to atmospheric pollutants; Habitat fragmentation
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 6.25.

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.

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 and the camp site. A policy of minimal clearance will be implemented by *eni myanmar* in accordance with *eni E&P* Standards. Off-road driving and the creation of new, unplanned tracks will be avoided if not strictly necessary.

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 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 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 and in camp sites 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 are not available.

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 should be performed along the line survey and in correspondence of the camp sites. The floristic surveys should be planned during the flowering season.

Degradation of Abiotic Components of Ecosystems

In order to minimise environmental disturbances earthworks will be limited as much as possible. Any sensitive area located around the seismic campsite (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 should 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 revegetation (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 6.26 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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **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 natural forest and erosion landforms. In these areas the impacts have been evaluated as **medium**.

The ranking will be confirmed after the performing of the field surveys.

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, access roads, up-holes); 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
- Location of camp site; amount of machinery in use during the camp site preparation; 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 6.27 Key Impacts – Fauna

Grav-Mag Survey	*Seismic Survey*
• No impacts are expected during this activity	• Habitat reduction, decrease in features of ecological networks, habitat fragmentation, and isolation (camp site 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 PSC-k the following vulnerable species has been identified through the spatial distribution (range maps) data provided by the IUCN Red List of Threatened Species:

- N.6 Critically Endangered species;
- N.10 Endangered species;
- N.17 Vulnerable species.

At this stage, considering that the route of the seismic line survey will be established after the performing of the Grav-Mag survey, the sensitivity of the resource has been evaluated for each land cover area, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Moderate**, because the presence of species under protection is likely.
- In *urban areas*, the sensitivity has been evaluated as **Low**, because the presence of species under protection is very unlikely.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Low**, because the presence of species under protection is unlikely.

- In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **High**, because the presence of species under protection is very likely.
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **High**, because the presence of species under protection is very likely.

The value of the sensitivities reported above will be confirmed after the performing of the field surveys.

6.2.6.3 Seismic Survey

A summary of the impacts on fauna identified during seismic survey are listed in the following table.

Table 6.28 Fauna Impacts

Source of Potential Impact	Potential Impact
Set-up (including site preparation) of temporary facilities (camp site, 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, 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 2D-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, 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 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. The Seismic survey may also create physical migration pathways.

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

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 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) 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.
- A 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 should 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.
- Hunting to be prohibited.
- 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 should be fitted with mufflers or housing to restrict noise levels.
- All equipment should be properly maintained to minimise emissions.
- If signs of potential concentrations of wildlife are observed, such as burrow complexes or dense vegetation, these should be avoided so as not to harm animal populations.
- Application of the Waste Management Plan and Spill Prevention and Management Plan

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 6.29 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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **medium (7)**
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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (6)** • Water bodies: **low (6)**
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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (6)** • Water bodies: **low (6)**
Score	*1*	*1*		*1*	

The impact on fauna component due to Project activities is **Low** for the whole territory except the potential alteration of abiotic components in ecosystems of natural forest habitat. In this area the impacts has been evaluated as medium.

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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 analyzed and in Section 5 of the ESHIA, the Ecosystem Services are here in after described for each habitat 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 the presence of dry forest and green forest**. 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.
  Forest habitats are particularly vulnerable to both direct and indirect habitat conversion relating to Project activities, particularly related to the utilization of some resources during the construction phase (timber for infrastructures, foods) and to the consequent degradation of some regulating services, such as altered surface and subsurface hydrological patterns, erosion and increased pollution. These situation can potentially lead to deforestation, species loss and potential conflicts with local communities. In the Area of Influence, existing waste management services will not be accessible and disposal of waste will probably has to take place on site. In site closure and rehabilitation of forest habitats, an understanding of landscape level trends, native species, and potential future ecosystem services of the area will be crucial.

- **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 6.30 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) 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.		The reduction of the habitat could reduce the ability to gather wild foods (e.g. fruit, nuts), and to harvest timber and agricultural outputs.	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. Terrain modification. Noise, dust and vibrations. Visual disturbance.	Use of local natural materials (e.g. aggregates) for roads, etc.	Natural flood and erosion control of surrounding vegetation.		The reduction of the habitat could reduce the ability to gather wild foods (e.g. fruit, nuts), and to harvest timber and agricultural outputs.	Loss of carbon sequestration services from clearing trees and 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.
Workforce,	Disposal and pollution from wastes and wastewater, having visual,	Use of local natural materials for building camps.	Assimilation service of rivers, soils, etc. disposing of liquid and solid		Possible pollution of water supply. Potential changes to supply of wild foods through introduction of alien	Loss of carbon sequestration services from clearing trees and vegetation. Reduction in flood	

Sub-activity Issue	Potential Impact	Dependencies on Ecosystem Services			Impacts on Ecosystem Services		
		Provisioning	Regulating	Cultural	Provisioning	Regulating	Cultural
	physical, biological and chemical impacts. Potential introduction of alien-invasive species.		wastes. Water filtration service to provide clean water		species (typically negative impacts).	and erosion control and water purification by clearing vegetation.	
Site preparation: Vegetation clearance, excavation, dewatering, trenching	Modification, fragmentation and removal of habitats. Soil erosion. Water runoff and sedimentation.				The reduction of the habitat could reduce the ability to gather wild foods (e.g. fruit, nuts), and to harvest timber and agricultural outputs	Loss of carbon sequestration services from clearing trees and 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
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 natural resources for	Use of aggregates (sand, gravel, rocks, etc.). Timber from trees. Water, etc.	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
	buildings, e.g. cutting forests, excavating sand, etc.						
Landscape alteration: from presence of the camp site 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). Development of a respond Emergency Plan	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.

Here below a summary 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 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 water course will be implemented.
- Minimal cutting of vegetation (including well site 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 by small vertebrates.
- Works will be undertaken outside the bird breeding season.
- Hunting to be prohibited.
- Artificial lighting (e.g. in the camp site) will be limited in compliance with best practices.
- Noise sources should 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 with in 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

- *Grav-Mag Survey*: no impacts are expected during this the Grav-Mag survey.
- *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 and contractors.
- Accommodation strategy.
- Duration of employment contracts offered by eni 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 6.31 Key Impacts – Economy and Employment

Grav-Mag Survey	Seismic Survey
• No impacts are expected during the Grav-Mag 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 two main project phases (Grav-Mag surveys and Seismic survey) 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 PSC-K can be evaluated, for each land cover areas, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Low**.
- In *urban areas*, the sensitivity has been evaluated as **High**, due to the potential economic activities which could be exist here.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **High**, since the local economy is based on agriculture.
- In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Low.**
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **High**.

6.3.1.3 Grav-Mag Survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available to provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management: they are the Mandalay city International Airport, to the very north of the Block, the Shante city Airport, a few kilometres from the western boundary of Block, and the Helo city Airport, at 50 km from the Block.

No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

Therefore, no impacts on economy and employment are expected during the Grav-Mag survey.

6.3.1.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.32 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 6.32.

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.

Currently, the exact number of personnel/workers needed during the seismic survey phase is not available. 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.

At the time of writing this ESHIA no detailed information was available regarding the type of staff required during the seismic survey phase. However, it is expected that the majority of the workforce will consist of qualified or semi-qualified workers with skill sets not generally found amongst the local population, leaving the less technical tasks and jobs for local residents who will represent only a small percentage of the total personnel hired.

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.

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 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 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.

- Develop a Local Content Strategy/Plan aimed at enhancing the capacities of potential local partners (workforce, 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. This would require commitment to support capacity-building initiatives, train institutions and invest in local capacities.
- Develop a Social Investment Program to deliver sustainable benefits to the region where the Project is being developed. The program should define the governance structure, investment themes and key considerations, disbursement, monitoring and review mechanisms, as well community engagement. It should also be aligned with regional development priorities as set by the government.
- Sourcing local goods and services: 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. 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: engage early in the process with national and regional authorities to define and agree on a strategy to manage the influx of non-local job seekers to avoid exacerbating urban poverty and plan for provision of social infrastructure.

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 6.33.

Table 6.33 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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **medium (7)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **low (5)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **low (6)**

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Score	*1*	*1*		*1*	
Temporary economic impact – national level (positive)	Less than 1 year / Temporary	National scale: Entire country	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (8)** • Dry forest and green forest: **low (6)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **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 survey 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 Project related 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

- *Grav-Mag Survey*: no impacts are expected during this the Grav-Mag survey.
- *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 6.34 Key Impacts – Infrastructures and Public Services

Grav-Mag Survey	Seismic Survey
• No impacts are expected during the Grav-Mag 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 each of the two main project phases (Grav-Mag surveys and Seismic survey) 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 PSC-K can be evaluated, for each land cover areas, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Low**.
- In *urban areas*, the sensitivity has been evaluated as **Moderate**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Moderate**, due to the presence of channels and trenches connecting crops and an intricate network of trails connecting all crops.
- In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Low.**
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Low**.

6.3.2.3 Grav-Mag Survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available to provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management: they are the Mandalay city International Airport, to the very north of the Block, the Shante city Airport, a few kilometres from the western boundary of Block, and the Helo city Airport, at 50 km from the Block.

No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

Therefore, no impacts on infrastructures and public services are expected during the Grav-Mag survey.

6.3.2.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.35 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 6.35.

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.

Nevertheless, 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. The detailed information concerning the involved staff and vehicles will be provided once the contractor will be selected.

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.

Increased Pressure on Public Services and Utilities

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 should be employed during the seismic survey phase to reduce impacts on local infrastructures.

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 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 6.36.

Table 6.36 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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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.

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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

- *Grav-Mag Survey*: no impacts are expected during this the Grav-Mag survey.
- *Seismic Survey:* camp site; 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.

The following table presents the key impacts of the project on land and livelihood during the key project phases.

Table 6.37 Key Impacts – Land and Livelihood

Grav-Mag Survey	Seismic Survey
• No impacts are expected during the Grav-Mag survey	• Temporary land take corresponding to the camp site • 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 each of the two main project phases (Grav-Mag surveys and Seismic survey) 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 PSC-K can be evaluated, for each land cover areas, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Low**.
  - In *urban areas*, the sensitivity has been evaluated as **Moderate**.
  - In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **High**.
  - In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Low.**
  - In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Moderate**.
-

6.3.3.3 Grav-Mag Survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available to provide support for landing and take-off activities, aircraft recovery, fuel and spares

provision, possible waste management: they are the Mandalay city International Airport, to the very north of the Block, the Shante city Airport, a few kilometres from the western boundary of Block, and the Helo city Airport, at 50 km from the Block.

No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

Therefore, no impacts on land and livelihood are expected during the Grav-Mag survey.

6.3.3.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.38 Land and Livelihood Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Camp site	Temporary land take corresponding to the camp site
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 6.38.

Impacts Identification

During seismic survey, some portion of land will be used and consequently cause soil loss, for:

- Camp site;
- 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 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.

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 are 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 6.39.

Table 6.39 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	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **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.

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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

- *Grav-Mag Survey*: no impacts are expected during this the Grav-Mag survey.
- *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 6.40 Key Impacts –Cultural Heritage

Grav-Mag Survey	Seismic Survey
• No impacts are expected during the Grav-Mag 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 each of the two main project phases (Grav-Mag surveys and Seismic survey) 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 1,284 temples have been identified through the analysis of the currently available data within the Study Area of block PSC-K. 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 PSC-K has been evaluated for the following land cover areas:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Moderate**.
  - In *urban areas*, the sensitivity has been evaluated as **Moderate**.
  - In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Low**.
  - In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Moderate.**
  - In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Low**.

6.4.1.3 Grav-Mag Survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available to provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management: they are the Mandalay city International Airport, to the very north of the Block, the Shante city Airport, a few kilometres from the western boundary of Block, and the Helo city Airport, at 50 km from the Block.

No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

During the survey, furthermore, no vibrations will be produced.

Therefore, no impacts on cultural heritage are expected during the Grav-Mag survey.

6.4.1.4 Seismic Survey

Regarding the seismic survey, the following sources of potential impact have been identified.

Table 6.41 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 6.41.

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.

Mitigation Measures

The Seismic survey performed with micro-charges does not require main site 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.

If the seismic survey will be integrated with the use of vibroseis, it is likely that the survey lines will be partially cleared of vegetation and loose material.

The source lines will be cleared and smoothed using non-invasive techniques, where possible. The surface of the source line must be smooth enough to enable the vibroseis 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).

Given the topography and surface conditions reported in the environmental baseline, it is anticipated that no bulldozing or invasive line clearance operations are expected so far.

Avoidance is the preferred 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 rescue procedures should be conducted as outlined by international and national standards.

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 6.42.

Table 6.42 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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species *1*	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species *1*	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **low (4)**

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

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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

- *Grav-Mag Survey*: no impacts are expected during this the Grav-Mag survey.
- *Seismic Survey*: presence of camp sites 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 6.43 Key Impacts –Landscape

Grav-Mag Survey	Seismic Survey
• No impacts are expected during the Grav-Mag survey	• Temporary visual impacts for the presence of camp sites 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 sites

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

At this stage, the sensitivity of the landscape into the Block PSC-K can be evaluated, for the following land cover areas, as following:

- In areas characterized by presence of bare soil, bush/shrub and mixed vegetation, the sensitivity has been evaluated as High.
- In *urban areas*, the sensitivity has been evaluated as **Low**.
- In areas characterized by *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Moderate**.
- In areas characterized by the presence of *dry forest and green forest,* the sensitivity has been evaluated as **High.**
- In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Low**.

6.5.1.3 Grav-Mag Survey

The realization of a Grav-Mag survey does not essentially require significant logistics in terms of personnel, equipment, spares and back-up. Organizational efforts will be limited to the issues related to the arrival and recovery of the aircraft, the fuel provision, and the personnel accommodation. Adjacent to the Block PSC-K three airports are available to provide support for landing and take-off activities, aircraft recovery, fuel and spares provision, possible waste management: they are the Mandalay city International Airport, to the very north of the Block, the Shante city Airport, a few kilometres from the western boundary of Block, and the Helo city Airport, at 50 km from the Block.

No base camp is likely to be placed and the accommodations for the personnel are likely to be selected among the structures present in the cities close to the selected airports.

Therefore, no impacts on landscape are expected during the Grav-Mag survey.

6.5.1.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.44 Landscape Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Camp site preparation of temporary facilities (camp site; access roads)	Temporary visual impacts for the presence of camp sites 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

Source of Potential Impact	Potential Impact
Lighting equipment of the camp sites	Light pollution during the night period due to the presence of the camp sites

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 6.44.

Impacts Identification

During the seismic survey, the presence of temporary facilities as the camp sites 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 environmental 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 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.

Considering that:

- the camp site 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.

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 6.45.

Table 6.45 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 sites and seismic lines)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**
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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**
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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**
Score	*1*	*1*		*1*	

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

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

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 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

- *Grav-Mag Survey*: atmospheric emissions and noise emissions from aircraft during the data acquisition (flights).

- *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 6.46 Key Impacts –Community Health and Safety

Grav-Mag Survey	Seismic Survey
• Negligible impacts on local air quality due to atmospheric emissions from the aircraft during the data acquisition phase • Temporary annoyance at population	• 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 relate 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 PSC-K can be evaluated, for the following land cover areas, as following:

- In areas characterized by presence of *bare soil, bush/shrub and mixed vegetation*, the sensitivity has been evaluated as **Low**.
  - In *urban areas*, 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 *mixed agriculture and irrigated/flooded agriculture*, the sensitivity has been evaluated as **Moderate**, because they are the sites where the population work.

- In areas characterized by the presence of *dry forest and green forest*, the sensitivity has been evaluated as **Low.**

In area characterized by the presence of *water bodies*, the sensitivity has been evaluated as **Moderate**.

6.6.1.3 Grav-Mag Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.47 Community Health Impacts – Grav-Mag Survey

Source of Potential Impact	Potential Impact
Use of an aircraft to carry out the survey	Potential increased noise, decreased air quality

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 6.47.

Impacts Identification

The only project activity and stressor with the potential to negatively impact health and welfare during the Grav-Mag survey is the use of an aircraft. A Cessna Caravan type carrying the three instruments (gravimeter, magnetometer and LiDAR sensor) at one time represents the currently preferred solution, but there is the possibility to replace the airplane with a helicopter in case unexpected constraints or particular requirements are needed. The final decision will be taken as soon as the Grav-Mag contractor will be selected.

The following types of potential impacts on community health and welfare have been identified during this activity:

- temporary atmospheric emissions (NO_2 and $C0_x$) from the aircraft during the data acquisition phase;
- temporary noise emissions from the aircraft during the data acquisition phase.

Mitigation Measures

In order to minimize the annoyance to population, the activity will be performed during the daylight hours.

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 Grav-Mag survey are summarized in Table 6.48.

Table 6.48 Ranking of Impacts on Community Health – Grav-Mag Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Impacts on local air quality due to atmospheric emissions from the aircraft	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	
Impacts on local noise quality due to the aircraft use	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**
Score	*1*	*1*		*1*	

According to the criteria defined by eni Standard requirements *(Environmental, Social and Health Impact Assessment Standard - Doc n° 1.3.1.47)*, the potential impact on community health, due to the Grav-Mag survey, results as **Low** for the whole territory.

The ranking will be confirmed after the performing of the field surveys, which will allow to carry on a ground truth of the available data.

6.6.1.4 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.49 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 6.49.

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.

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 isn’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.

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.

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 well sites.

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.

Mitigation Measures

The following mitigation measures should 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 corporate requirements for occupational health and safety management including driving and traffic safety.

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.

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 should include a process for the identification of accident hotspots and if required the use of bypasses around these areas.

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 6.50.

Table 6.50 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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **low (6)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **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**.

The ranking will be confirmed after the field surveys' completion, that will make possible to ground truth the available data.

7.0 CUMULATIVE IMPACT ASSESSMENT

eni Myanmar holds the hydrocarbon exploitation licence in the entire PSC-K Block and no other O&G activity operates in the same Block; furthermore, from an analysis of the 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. However, a more detailed investigation will be conducted in next steps of the Project, through onsite surveys and interviews with public and local stakeholders.

8.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

8.1 INTRODUCTION

This preliminary 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's approach to the management and monitoring of environmental issues related to the Project's phases as requested by the Myanmar EIA *Draft Law 24/12/13.*

This preliminary EMMP has been developed on the basis of the available information and should be reviewed and finalized in a more advanced phase of the project, once site surveys will be performed.

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´s 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 – doc. N. 1.3.1.47);
- 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 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 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	--	--
Flora & Fauna, Habitats and Protected Areas		
Trends in occurrence/abundance of all identified plant species	--	--
Trends in occurrence/abundance of protected /vulnerable /endangered plant species	--	--
Trends in occurrence/abundance of all identified terrestrial animal species	--	--
Trends in occurrence/abundance of protected/ vulnerable/ endangered animal species	--	--
Diversity Indices (Shannon, Simpson) for biological groups	--	--
Trends in invasive alien species	--	--

KPIs	Value	Note
Total area of land disturbed against total area rehabilitated.	--	--
Trends in health/condition of monitored flora sites	--	Through changes in vegetation coverage (%)
Waste		
Monthly non-hazardous waste production	ton	--
Monthly hazardous waste production	ton	--
Percentage of recycled or recovered waste per month	%	--
Percentage of disposed waste per month (%)	%	--
Water		
Quality status of surface water	--	--
Quality status of groundwater	--	--
Soil		
Quality status of surface soil	--	--
Quantity of impacted surface soils	--	--

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
	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	N/A
	Industrial waste	N/A

DOMAIN	Component	VECs
WATER	Groundwater and Surface water	The main river that crosses Block PSC-K (in the Northern side of the Block) is the Mytinge River. Many secondary rivers are located within the Block PSC-K as well as some natural inland water bodies (perennial and non perennial) and many artificial water bodies, used for energy production and irrigation purposes
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-surveyand 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

DOMAIN	Component	Specific Objectives
	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

In the absence of relevant national laws, 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[3].

[3] WHO Air Quality Guidelines are available at http://www.who.int/en

Table 8.5 IFC/WHO Air Quality Standards

Parameter	Averaging Time	Concentration (µg/m^3)	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/m^3)	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/m^3)	
Benzene	Annual	5	European directive 2008/50/EC

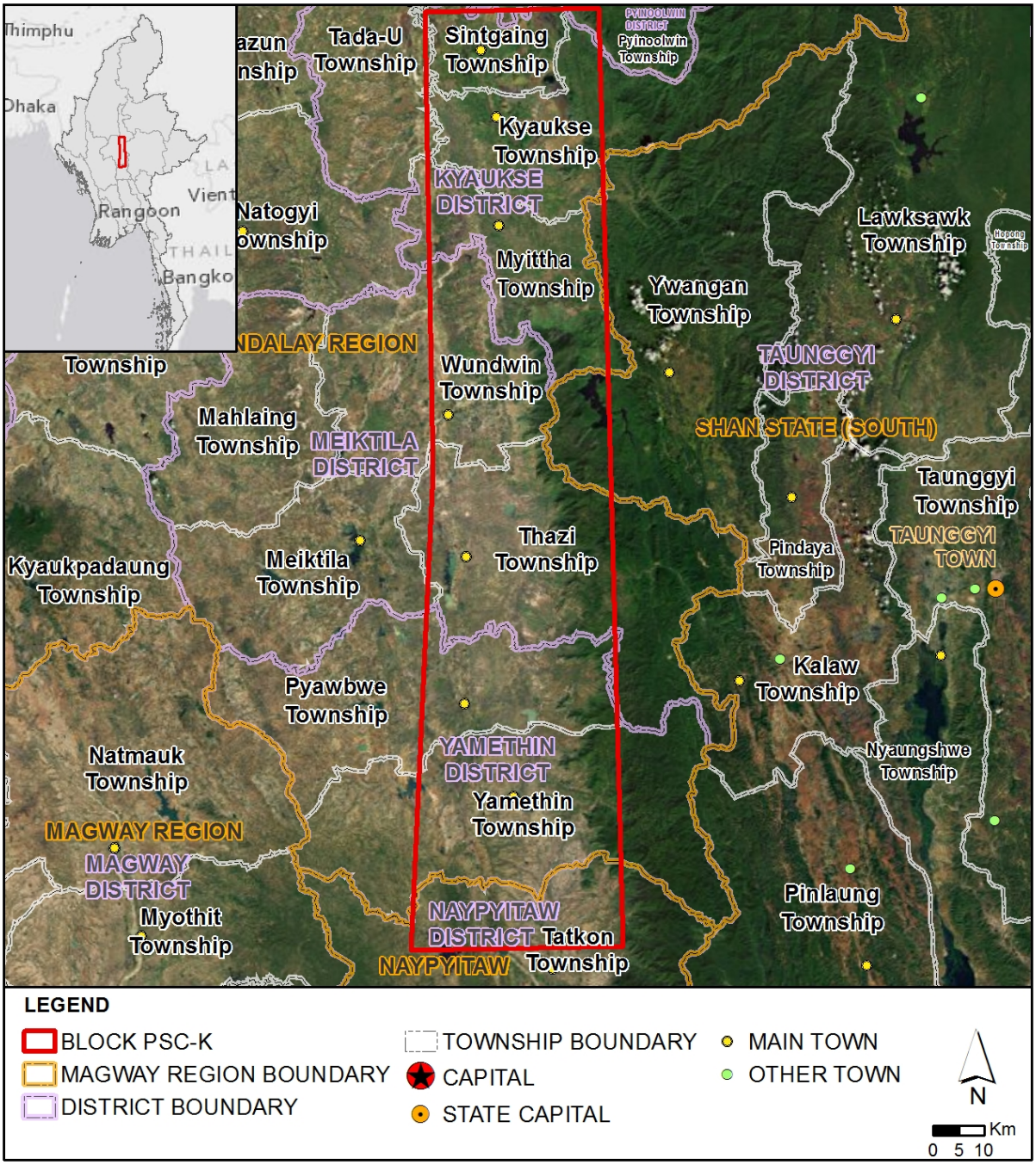
The WHO has established the following air quality criteria to be considered when selecting substances (or pollutant indicators) to be included in an air quality monitoring network:

- The selection of the substances should be based on the current air pollution issues potentially affecting the area, and on those expected for the future.
- The substances should be measured fairly extensively, or the extent of monitoring should 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 should be included.

8.8.1.2 Study Area

Figure below presents the Study Area of the Project that is equivalent to the whole PSC-K Block.

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:

- Identify the current levels of air pollution over the Project area.
- Monitor the impact on local air quality from the Project during seismic survey and Grav-Mag 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 detailed monitoring locations will be defined in a later phase of the project, after a site visit and, in relation to the drilling phase, after the final location of the drilling wells.

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); identification of 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 format.

Table 8.6 Environmental monitoring

Receptor	Monitoring Task	Monitoring locations	Monitoring Parameter	Timing
Sensitive areas (i.e. communities, residential area, ecological areas) and camp site	Airborne pollutant concentrations during the seismic survey	At sensitive receptors located downwind the Project sites (e.g. within 20km from emissions sources)	NOx, SO2, 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	Wind speed and direction; air temperature; relative humidity; precipitation.	Continuous, during activities.

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	$\mu g/m^3$	40 (Annual) 200 (1-hour)	IFC/WHO
Ozone (O_3) concentration	$\mu g/m^3$	100 (8-hour daily maximum)	IFC/WHO
Particulate Matter (PM_{10}) concentration	$\mu g/m^3$	20 (Annual) 50 (1-hour)	IFC/WHO
Particulate Matter ($PM_{2.5}$) concentration	$\mu g/m^3$	20 (Annual) 25 (1-hour)	IFC/WHO
Sulphur Dioxide (SO_2) concentration	$\mu g/m^3$	20 (24-hours) 500 (10 minute)	IFC/WHO
Carbon Monoxide (CO) concentration	mg/m^3	30 (1 hour) 10 (8 hours)	WHO/EU
Benzene	$\mu g/m^3$	5 (Annual)	EU

8.8.1.5 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.1.6 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 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 [4]:

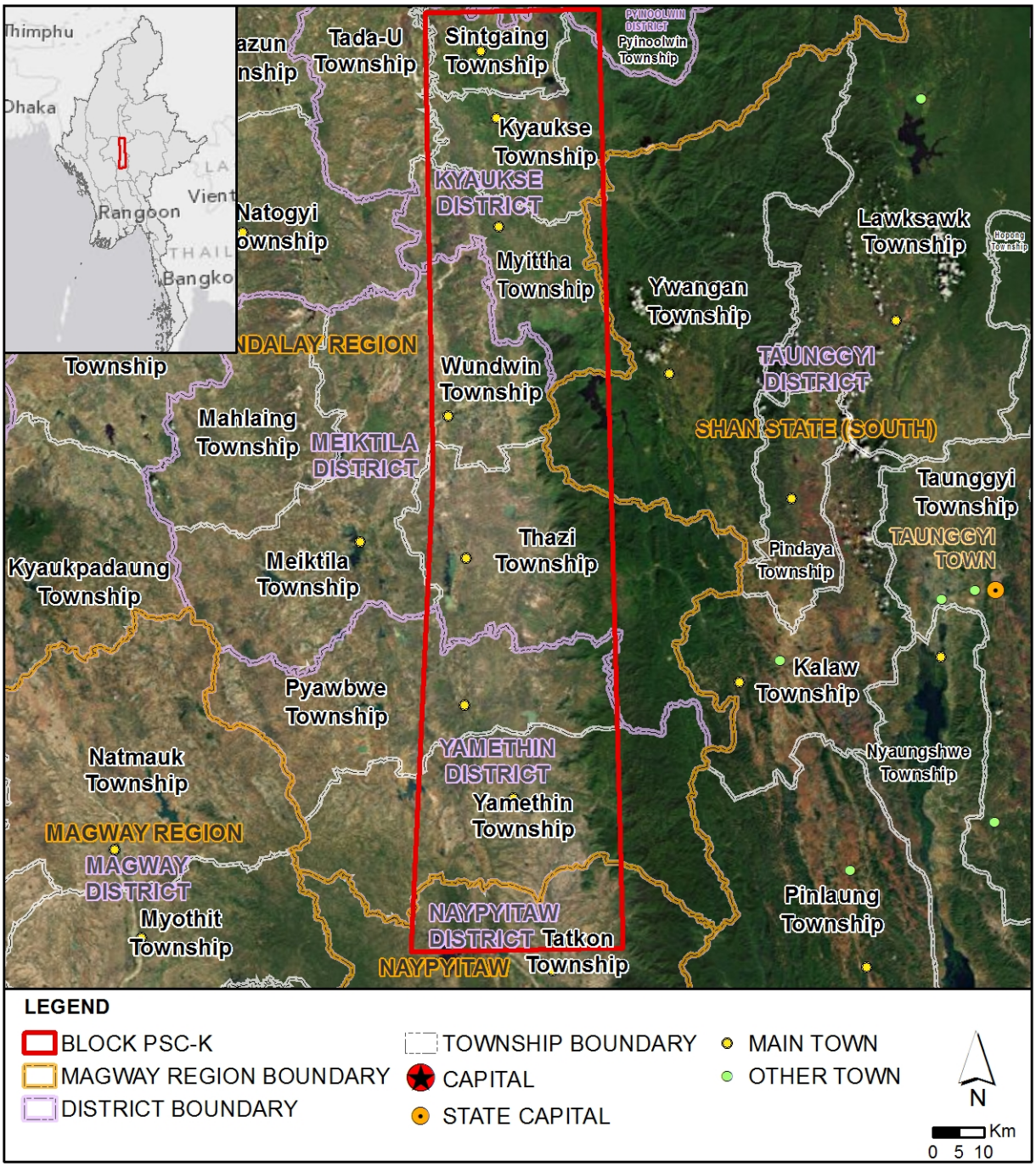
- **55 dBA during daytime** (daytime hours 07:00 to 22:00).
- **45 dBA during night-time** (night-time hours 22:00 to 07:00).

8.8.2.2 Study Area

Figure below presents the Study Area of the Project that is equivalent to the whole PSC-K Block.

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



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. The detailed monitoring locations will be defined in a later phase of the project, after a site visit and, in relation to the drilling phase, after the final location of the drilling wells.

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, 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.

Representative measurement locations shall be chosen on the outskirts of each sensitive area to quantify the vibration caused by charges blast. The table below provides the locations proposed for the vibration monitoring. The detailed monitoring locations will be defined in a later phase of the project, after a site visit and, in relation to the drilling phase, after the final location of the drilling wells.

8.8.2.4 Monitoring Plans

The monitoring methodology shall be applied in compliance with IFC EHS guidelines, that states the following:

- Typical monitoring periods should be sufficient for statistical analysis and may last 48 hours or hourly, or more frequently, as appropriate;
- Noise monitoring should 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 should 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 format.

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 each 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 $L_{eq}A$ 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 each sensitive receptors within 500 m from noise 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

Indicators
The environmental indicators are reported in the table below.

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)[5]
		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)

8.8.2.5 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.2.6 Responsibilities

The table 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.

[5] 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.

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 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.

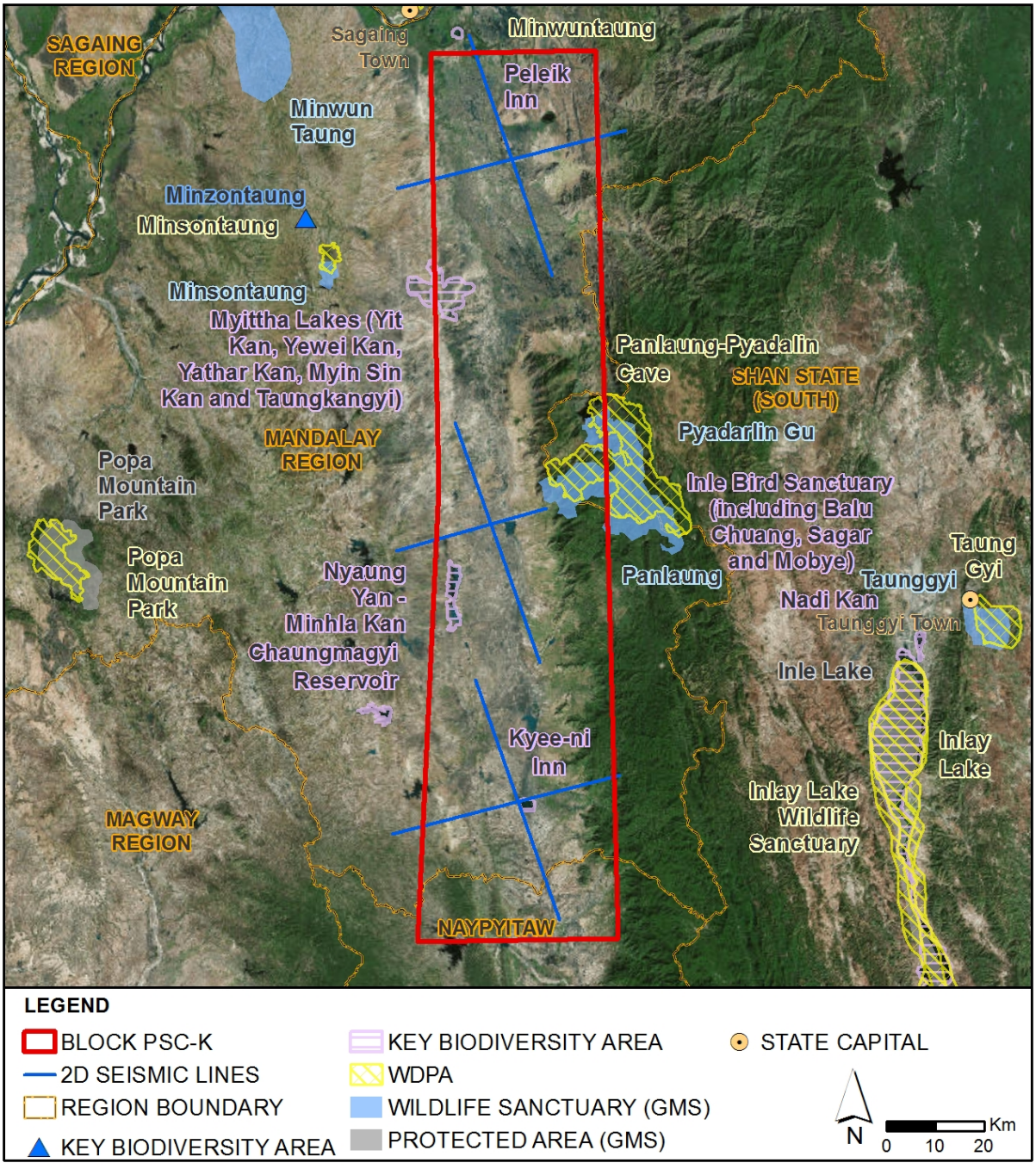
Furthermore, the International Finance Corporation (IFC) has developed a series of Performance Standards that aim at protecting the environment. Performance Standard 6 "recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources 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-within the Block PSC-K



Source: eni, 2014

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, an habitat mapping shall be performed.

Eni's actions for conservation of biodiversity in the PSC-K 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:

- To perform site survey and habitat mapping for the identification of sensitive areas (critical/natural habitats) for detailed baseline data collection. Proper actions (i.e. sampling strategy and design) will be needed in case of critical habitats overlapping with the seismic survey layout. and/or the drilling wells location
- To avoid the loss of vegetation especially for species of priority importance, as endemic species, a monitoring plan should be performed along the line survey and in correspondence of the camp sites. The floristic surveys should be planned during the flowering season. If any, vegetation losses should be quantified;
- Any sensitive area identified (natural or critical habitat) and located around the seismic campsite (e.g. sensitive vegetation, water well) 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 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) 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.

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 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/operations phase 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 PSC-K 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

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, access road or line survey. Area of direct interference (line survey, camp site, 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, access road or line survey. Area of direct interference (line survey, camp site, 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.

Indicators
The environmental indicators are reported in the table below.

Table 8.14 Biodiversity indicators

Flora & Fauna, Habitats and Protected Areas			
Occurrence of Plant Species	numeric	N/A	N/A
Vegetation Coverage	%	N/A	N/A
Occurrence of Plant species of Conservation Concern	numeric	N/A	N/A
Occurrence and Abundance of Bird Species	numeric	N/A	N/A
Occurrence and Abundance of Mammal Species	numeric	N/A	N/A
Occurrence and Abundance of Reptile/Amphibian Species	numeric	N/A	N/A
Occurrence and Abundance of Animal species of Conservation Concern	numeric	N/A	N/A
Occurrence and Abundance of Invasive Alien Species	numeric	N/A	N/A
Total Area of identified natural habitat of conservation concern	m^2	N/A	N/A
Plant cover in identified natural habitat of conservation concern	%	N/A	N/A

8.8.3.5 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.3.6 Responsibilities

The table below summarizes the responsibilities of different organizations.

Table 8.15 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.

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) relate to the management of the Project's waste are reported in the following table.

Table 8.16 Applicable IFC EHS Guidelines

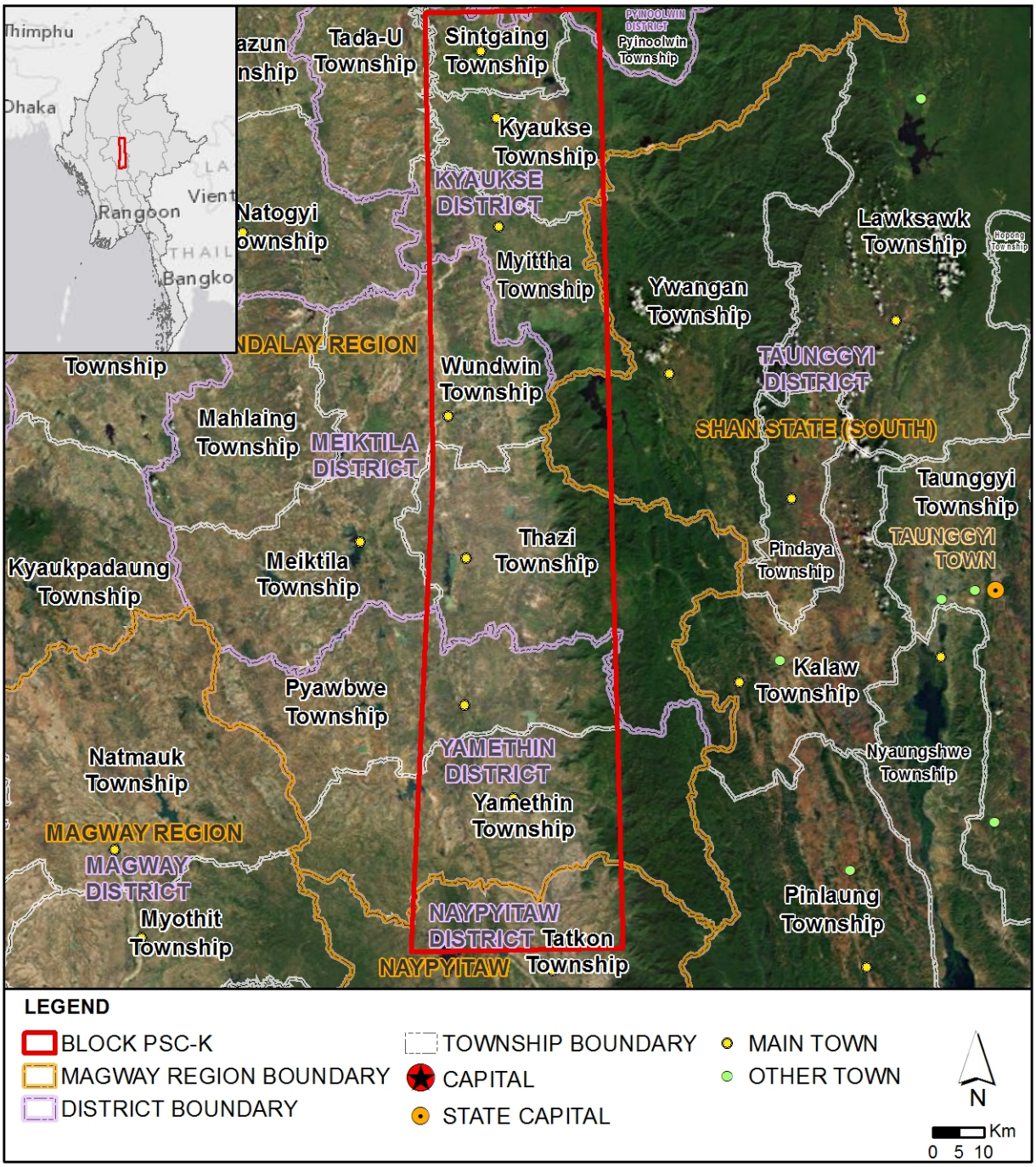
Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches 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 5.1 below presents the Study Area of the Project that is equivalent to the whole PSC-K Block.

Figure 8.4 Environmental Study Area



8.8.4.3 Waste Origins/Sources

The Project will have different sources of waste. Below they are analyzed based on their origin. The main wastewater are summarized in Table below.

Table 8.17 Wastewaters

Waste Source	Generated waste
Camp Site	Sewage
Parking, refuelling and waste storage areas. Areas for equipment and vehicles washing	Used oil, oily waters

The main activities that will generate solid waste are summarized in **Table 8.18**.

Table 8.18 Solid waste sources in the near-shore and onshore sections of the Project

Waste Source	Generated waste
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; Waste oil; 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.

- 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 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 campsite staff, and staff dealing with wastes 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. At the end of the working day, waste in skips will be transported to the campsite, and stored. Storage will be located in the camp site, 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 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 wastes will be disposed by specialist contractors at sites that are equipped and approved for such wastes.
- 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 wastes, as for example, all the civil wastes (paper, wood, kitchen waste, etc.) produced at camp site, 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'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 subse-

quent 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 (for more details, refer to EMP).

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in table format

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	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

Indicators
The environmental indicators are reported in the table below.

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

8.8.4.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.4.7 Responsibilities

Table 8.21 summarizes the responsibilities of different organizations with respect to the management of wastes 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 in of the final WMP • Development and custodianship of this WMP including: o collection, compilation and analysis of waste management performance statistics to ensure compliance; o driving continual improvements; o reporting for documenting the environmental monitoring campaigns; o communication of changes in the WMP to Staff, contractors and Myanmar authorities, as required; and o 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 o 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 ESIA (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.

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

In the absence of relevant national laws, the Project will comply with 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
- Offshore Oil and Gas Development.

Applicable EHS Guidelines has been summarized in the following table.

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 and exploration and production drilling. 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

The following table reports the Myanmar applicable legislation and regulation regarding the water resources.

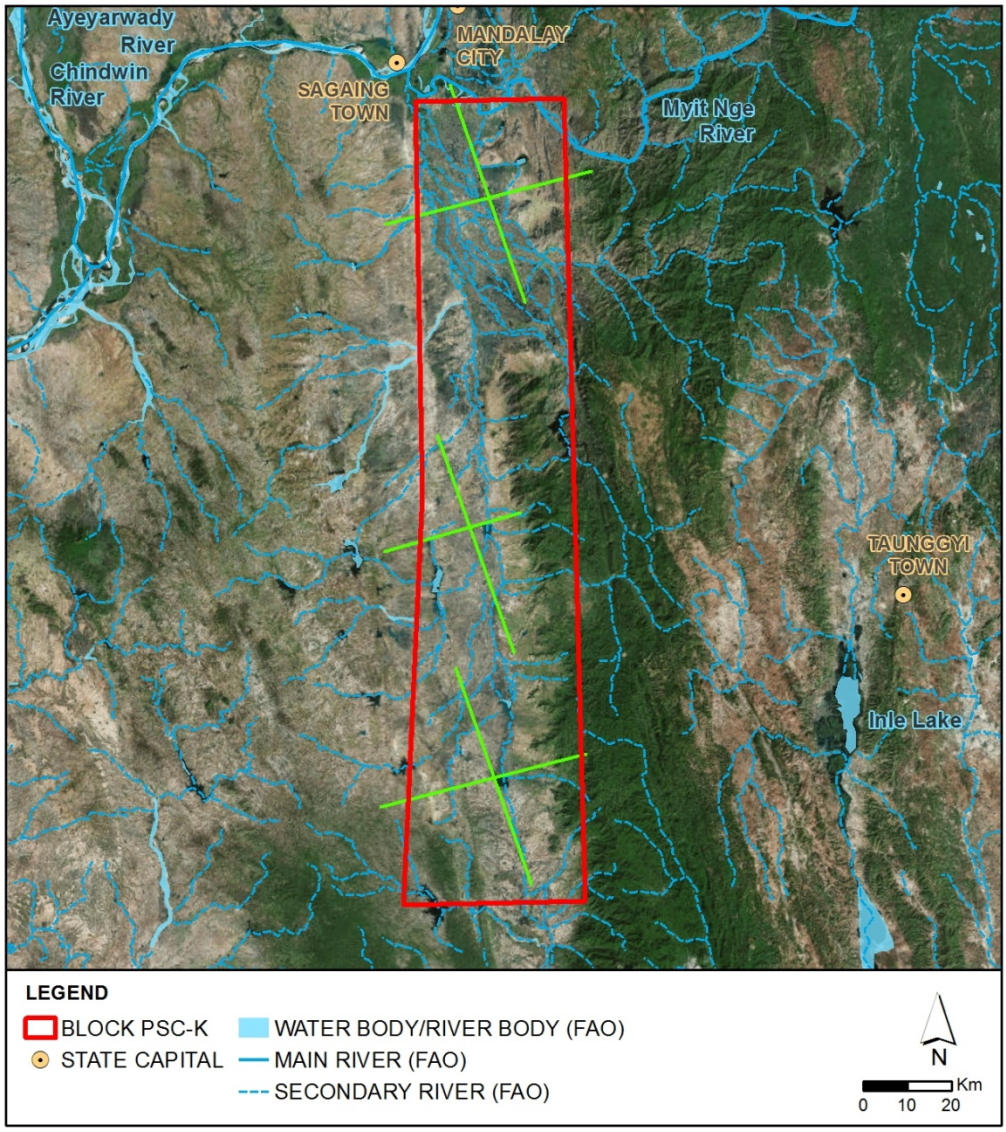
Table 8.23 Myanmar Applicable Legislation & Regulation

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

As shown in *Figure 5.8* many secondary rivers are located within the Block PSC-K as well as some natural inland water bodies (perennial and non perennial) and many artificial water bodies, used for energy production and irrigation purposes.

Figure 8.5 River network Block PSC-K



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;

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 should not be established on land subject to seasonal flooding. An adequate separation distance should 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. 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 tank 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	-
Total Suspended Solids (TSS)	50 mg/l
Metals	-
Total nitrogen	10 mg/l
Total Kjeldahl nitrogen	-
Ammonia nitrogen	-

Parameters	IFC Indicative Values
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.

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 should be constructed outside environmentally sensitive locations.

The following actions should 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.

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.

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, waste 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 format.

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)	Colour, odour, 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	Number of erosive events caused by the project Percentage of project related erosive events detected and corrected	Continuous

Groundwater

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 format.

Table 8.26 Outline of Monitoring Programme

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
Groundwater	Sampling	Boreholes located inside the Block and already sampled for the base-line.	TPH, Metals, BTEX, MTBE	Quarterly and after the closure of the activities

Indicators
Dutch and WHO Drinking water standards have been used as environmental indicators for water resources.

The environmental indicators are reported in the table below.

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

8.8.5.5 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws. .

8.8.5.6 Responsibilities

The table 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.

8.8.6 Cultural Heritage Management 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. The Plan has been developed following eni's standards and will consider all the relevant IFC EHS guidelines.

The following table 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	• Section 2 of the law defines the protected and preserved cultural monuments as follows: o 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 o 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. o 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 has no sites on the World Heritage List (*Source: UNESCO, 2014*). However properties submitted on the Tentative List are as follows:

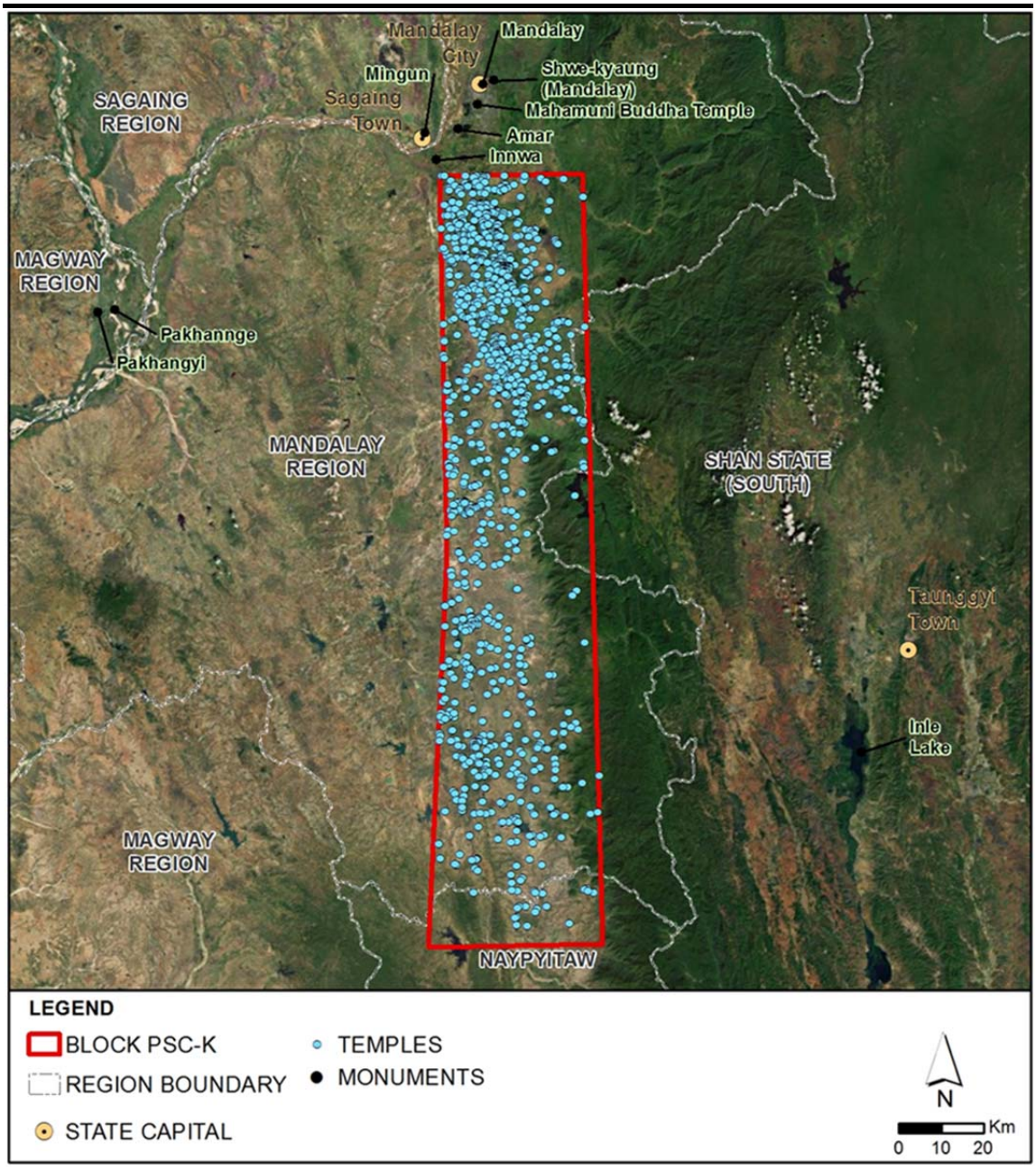
- *Ancient cities of Upper Myanmar*: Innwa, Amarapura, Sagaing, Mingun, Mandalay (04/10/1996);
- Badah-lin and associated caves (04/10/1996);
- Bagan Archaeological Area and Monuments (04/10/1996);
- Inle Lake (04/10/1996);
- Mon cities: Bago, Hanthawaddy (04/10/1996);
- Myauk-U Archaeological Area and Monuments (04/10/1996);
- Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra) (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*. Only the site nr. 2 (Badah-lin and associated caves) is located on block PSC-K boundary; other cultural heritage sites, in a buffer of 30 km around block PSC-K, are nr. 1 and from 3 to 6 (Ancient cities of Innwa, Amarapura, Mingun, Mandalay) and nr. 20 (Wooden Monasteries of Shwe-Kyaung). They are described in the following sections.

Figure 8.6 Location of Site on World Heritage Tentative List

Within the block PSC-K, finally, there are 1,284 temples, as shown in *Figure 8.7*. An exact mapping of the location of these temples has been carried out only within the block PSC-K's boundary.

Figure 8.7 Location of Cultural Heritage Sites and Temples in the block PSC-K (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 ar-

eas 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. 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.

8.8.6.4 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, 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 should be monitored daily during the blasting activities.

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in table format.

Table 8.30 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, 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, 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

8.8.6.5 Implementation Schedule

The monitoring activities will be performed as mentioned in the table above.

The Plan should be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.6.6 Responsibilities

The table below summarizes the responsibilities of different organizations.

Table 8.31 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.

8.9 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's Emergency and Medical Response Plan.

8.10 PUBLIC CONSULTATION AND DISCLOSURE

The objective of this phase of engagement is to present stakeholders with the ESHIA report. This includes providing information on the project impacts and mitigation measures designed to avoid, minimize or, in case of positive impacts, to enhance them.

The ESHIA Disclosure is aimed at reaching the highest possible number of stakeholders. This includes all stakeholders identified during the main ESIA phase and additional ones, as necessary. Media will also be involved in the disclosure program to ensure the highest possible outreach of the information campaign.

ESHIA Disclosure activities will be conducted after the delivery of the ESHIA to the Burmese Ministry of Environment at national, regional and local level.

Engagement is mainly being performed through face-to-face meetings with institutions, and individual stakeholders. Other engagement activities (i.e. participation in municipal markets, letters to the citizens, socio economic surveys, people's perception survey, supplemented interviews and focus groups.

In line with stakeholder engagement international best practices, once the ESHIA has been finalized the disclosure program will be further extended including a presentation to public meetings and media. Feedback collected during the engagement activities of the disclosure phase will be taken into consideration in the implementation of the Project.

Refer to Section 9 for details on Public Consultation and Disclosure.

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 includes 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 in 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 risks, impacts and opportunities of the project.

9.2 METHODOLOGY AND APPROACH

This section describe the methodology and approach adopted for each of the above mentioned step.

9.2.1 **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 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 for relevant baseline data collection? (E.g. Who can provide local information on agricultural activity? Who can best advice on approach to be undertaken with local communities? Who best 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?

9.2.2 Stakeholder *Engagement Plan*

A Stakeholder Engagement Plan will be implemented. It 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 will be arranged with the aim of 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 will be 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 preliminary list of focus groups to be held during the field visit to target areas. The preliminary list is based on standard issues and vulnerable groups identified by ERM. The survey activities will allow to fine tuning the list and identifying additional groups that might be relevant to the assessment and therefore may be subject to change. Focus groups will be held settlements representative within each target area identified within Block PSC-K, however, the number of meetings will vary depending on the specific issues facing each locality.

Table 9.1 Preliminary 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 groups will open by informing the group about the Project and purpose of the ESIA study. Participants will then be asked a series of open ended questions on topics specifically related to the group of individuals. All information will be recorded in note form then written up into the focus group records. Participants will be 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 will be conducted in every target area and in Mandalay capital city where the regional and main township administration is located. However, the specific issues facing seismic activities will dictate the exact location and number of interviews.

Table 9.2 below presents a preliminary list of key informants the reason they have been selected. At this stage in the planning process, 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 Preliminary 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 will be conducted 'in the field', that will involve driving around the local area and asking the key informant to provide a demonstration of discussion topics.

Information collected during interviews will be recorded into KII interview forms. In addition, interviews at the settlement level will feed into the Community Fact Sheets. All information will be recorded in the relevant data collection tool on a daily basis.

9.2.3 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 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.

These information will be 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 ongoing 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

This ESHIA is based on a review of currently available data, therefore no activity of stakeholder engagement and consultation has been conducted so far, but only a stakeholder mapping has been carried out.

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, Settlements) • 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 representatives	• 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)

Relevant stakeholders have been identified through a data collection and expert knowledge. The Stakeholder List, however, will be completed during the next field activity and will be basis of engagement strategy and plan. After this survey, also stakeholders interest and attitude towards the project could be mapped.

9.4 FURTHER CONSULTATIONS AND ACTIVITIES

Consultations with affected parties/communities already identified will be conducted during the next phase of the Project, along with the information disclosure of the Project.

Myanmar
ESHIA STUDY FOR THE EXPLORATION
BLOCK PSC-K

Environmental, Social and Health Impact Assessment

Annex 1

TABLE OF CONTENTS:

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1. LEGALLY PROTECTED AND IMPORTANT AREAS OF BIODIVERSITY

This analysis of the protected areas, areas of biodiversity importance, key biodiversity areas and sensitive areas was developed using secondary information and data from the following sources:

- **World Database of Protected Areas** (WDPA, 2013), whose online interface is www.protectedplanet.net. It is a joint project of IUCN (International Union for Conservation of Nature) and UNEP (United Nations Environment Programme), and the most comprehensive global database on terrestrial and marine protected areas.

- **IUCN Management Categories**. IUCN has provided the international guidelines on the categorisation of protected areas. These categories are internationally recognised and facilitate a global system for defining, recording and classifying protected areas and the wide variety of specific aims they might embody. A brief description of the IUCN Protected Areas Categories (http://www.unep-wcmc.org/iucn-protected-area-management-categories_591.html) is reported below:

  - Category Ia Strict Nature Reserve: they are protected from all but light human use in order to preserve all geological and geomorphic features of the region and their biodiversity, which is often dense and restricted exclusively to scientific monitoring, study or education.
  - Category Ib Wilderness Area**:** they are generally larger than category Ia, the main objectives of these areas is to provide an environment in which biodiversity and ecosystem processes (including evolution) are allowed to flourish or experience restoration if previously disturbed by human activity. Human use is limited, often allowing only those who are willing to travel of their own accord rather than via established touristic activities.
  - Category II National Park: they provide protection for functioning ecosystems, but tend to be more lenient with human visitation and the supporting infrastructure. National Parks are managed in a way that may contribute to local economies through promoting educational and recreational tourism on a scale that will not reduce the effectiveness of conservation efforts.
  - Category III Natural Monument or Feature**:** these are comparatively smaller areas that are specifically allocated to protect a natural monument and its surrounding habitats. They can be natural in the wholes sense, or include elements that have been influenced or introduced by humans. The latter should hold biodiversity associations or could otherwise be classified as a historical or spiritual site, though this distinction can be quite difficult to ascertain.
  - Category IV Habitat/Species Management Area**:** they focus on more specific areas of conservation in correlation to an identifiable species or habitat that requires continuous protection. These protected areas will be sufficiently controlled to ensure the maintenance, conservation and restoration of particular species and habitats and public education of such areas is widely encouraged as part of the management objectives.
  - Category V Protected Landscape/ Seascape: they cover entire bodies of land or ocean which engages a range of for-profit activities within the management plan. The main objective is to safeguard regions that have built up a 'distinct character' in regards to their ecological, biological, cultural or scenic value. Protected Landscapes and Seascapes allow a higher level of sustainable interaction with surrounding communities (such as traditional agricultural and forestry systems)and should represent an integral balance between people and nature.
  - Category VI Protected area with sustainable use of natural resources**:** it is a more encompassing classification that is based on a mutually beneficial relationship be-

tween nature conservation and the sustainable management of natural resources in correspondence the livelihoods of surrounding communities. A wide range of socio-economic factors are taken into consideration in creating local, regional and national approaches to the use of natural resources. Though human involvement is a large factor in the management of these protected areas, developments are not intended to allow for wide scale industrial production.

- **Important Bird Areas (IBAs)** are key sites for the conservation of bird species, identified through the BirdLife International IBA programme. The identification of IBAs is based on a set of internationally agreed, standardised criteria and is an ongoing process. Inventories of IBAs have now been produced for most of the terrestrial and freshwater regions of the world, while work is underway to expand the programme into the marine environment. A site may qualify as an IBA if it meets one or more of the following criteria (http://www.biodiversitya-z.org/areas/17):

  - A1 - Globally threatened species: the site is known or thought regularly to hold significant numbers of a globally threatened species, or other species of global conservation concern
  - A2 - Restricted-range species: the site is known or thought to hold a significant component of a group of restricted-range bird species (global distribution of less than 50,000 km^2) whose breeding distributions define an Endemic Bird Area (i.e. where two or more restricted-range species occur together) or a Secondary Area (one that supports one or more non-overlapping restricted-range species).
  - A3 - Biome-restricted species: the site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome
  - A4 - Congregations: a site may qualify on any one or more of the four sub-criteria listed below:
    i) Site known or thought to hold, on a regular basis, 1% of a biogeographic population of a congregatory waterbird species.
    ii) Site known or thought to hold, on a regular basis, 1% of the global population of a congregatory seabird or terrestrial species.
    iii) Site known or thought to hold, on a regular basis, 20,000 waterbirds or 10,000 pairs of seabirds of one or more species.
    iv) Site known or thought to exceed thresholds set for migratory species at bottleneck sites.

- **Endemic Bird Areas (EBAs)** are regions of the world that represent natural areas of bird endemism where the distributions of two or more restricted-range bird species overlap. A restricted-range species is defined as one having a historical breeding range of no more than 50,000 km. Nearly all of the world's restricted-range species occur within identified EBAs; the remainder occur in 'Secondary Areas', defined by the presence of single restricted-range species whose distributions do not overlap with any others. These areas of high bird endemism are also important for other endemic taxa, and are thus priorities for broad-scale ecosystem conservation.
  EBAs have been ranked for overall priority based on their biological importance (the number of restricted-range species, taxonomic uniqueness of those species and the size of the EBA) and the current threat level (the percentage of restricted-range species in each EBA which are threatened, and the categories of threat of these species) (*http://www.biodiversitya-z.org/areas/13*).

- **A-Z areas of biodiversity importance** (*www.biodiversity a-z.org*) is a glossary of various important systems to assign and protect areas for biodiversity conservation. The guide contains detailed information for a number of recognised systems to prioritise and protect areas of biodiversity importance that fall into two main categories: areas under protected area frameworks that are supported by national or sub-national institutions as well as international conventions and programmes, and global prioritisation schemes that are developed by academic and conservation organisations. The guide includes internationally recognised protected areas such as World Heritage Sites and Ramsar Sites, as well as the many approaches used to prioritise areas for conservation effort and protection including Biodiversity hotspots and Key Biodiversity Areas.

- **Conservation International (CI)** (*www.conservation.org*) is a non-profit environmental organization, whose mission is to protect nature and its biodiversity for the benefit of humanity. In its website a world biodiversity hotspots map is available. Biodiversity hotspots are regions of the world where attention is needed to address biodiversity loss and to guide investments in conservation. These regions are identified based on quantitative thresholds and mostly correspond to tropical forests, characterized both by exceptional levels of plant endemism and by serious levels of habitat loss.

- **Global 200 Ecoregions (WWF - World Wildlife Fund)** (http://wwf.panda.org/about_our_earth/ecoregions/about/) is a science-based global ranking of the Earth's most biologically outstanding terrestrial, freshwater and marine habitats. It provides a critical blueprint for biodiversity conservation at a global scale. It is the first comparative analysis of biodiversity to cover every major habitat type, spanning 5 continents and all the world's oceans. The aim of the Global Ecoregions analysis is to ensure that the full range of ecosystems is represented within regional conservation and development strategies, so that conservation efforts around the world contribute to a global biodiversity strategy.

- **Last of the wild areas** (Wildlife Conservation Society WCS and the Centre for International Earth Science Information Network CIESIN at Columbia University, 2005) are areas with the least amount of human influence with large, intact tracts of relatively undisturbed ecosystems that are considered important for biological diversity.

1.1 MYANMAR ENVIRONMENTAL POLICIES

After a period of intense exploitation of natural resources during the colonial and post-colonial period, Myanmar leaders showed their commitment to conserving the environment and promoting sustainable development with the creation in 1990 of ad hoc institutions in charge of preparing new environmental policies and legislation, of strengthening international cooperation on environmental issues and of improving the management of natural resources. However, the current environmental protection framework shows critical legal and institutional constraints, for instance very sector-specific laws that often exceed the technical and financial capability of the relevant government agencies. The future success of environmental protection in Myanmar depends on the formulation of policies reflecting a more integrated approach to planning and management of resources, as well as on the improved coordination between stakeholders and the allocation of the necessary resources for policy implementation.

Development of Myanmar environmental governance and legislation

In the first thirty years following independence (1948-1978), little attention was paid to environmental protection because the Country was facing economic and political struggles. In the 1980s the Forest Department initiated, in collaboration with UNDP and FAO, the "Nature Conservation and National Parks project (1981-1984)" for the expansion of the protected area system and the establishment of a new institution with specific competence on conservation and PA management. In the 1990s the legal and institutional framework of environmental governance was completely reviewed and updated resulting in the creation of new institutions and the formulation of new policies for forest and protected areas management.

The Forest Policy (1995) recognises different categories of forest:

a) reserve (reserved) forests which are fully protected for commercial and local supply, watershed protection and biodiversity conservation;
b) public protected forests protecting trees but allowing other activities;
c) unclass (unclassified) forests where access is open to local people.

The protected area system falls under the "Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law" (1994), which replaced the old "Wildlife Protection Act" (1936). This law regulates the establishment of six categories of PAs (scientific nature reserve, national park, marine national park, nature reserve, wildlife sanctuary, geophysically significant reserve) and of other nature reserves determined by the Minister of Forestry. In 2001 a 30-year Forest Master Plan was approved mandating the increase of the Permanent Forest Estate PFE to 30% and of PAs to 10% of the total country area.

Recent developments and future trends

In 2009 NCEA (National Commission for Environmental Affairs) published the National Sustainable Development Strategy (NSDS) for Myanmar which has been formulated in collaboration with UNEP through the combination of consultative forums and multi-stakeholders mechanisms. This represents an important step towards the improved coordination between relevant stakeholders and the integration of environmental considerations into development. Nevertheless, as of 2010 the members of the National Council for Sustainable Development, who shall be in charge of the implementation of NSDS, still have not been selected, thus deferring the promulgation and enforcement of detailed regulations.

1.2 ENVIRONMENTAL INTERNATIONAL CONVENTIONS

Myanmar is signatory of:

- Convention on Biological Diversity;
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora;
- Convention on the Conservation of Migratory Species of Wild Animals;
- UN Convention to Combat Climate Change.

1.3 INDO-BURMA BIODIVERSITY HOT SPOT

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 and extends from eastern India and southern China across Southeast Asia. In terms of species diversity and endemism, the Indo-Burma Hotspot is one of the most biologically important regions of the planet. Due to high human population pressure, rapid economic development, and changing consumption patterns, the natural ecosystems of the hotspot are being placed under increasing pressure.

Reflecting its high diversity of landforms and climatic zones, Indo-Burma supports a wide variety of habitats and thus high overall biodiversity. This diversity is enriched by the development of areas of endemism as a result of the hotspot's geological and evolutionary history.

Forests are among the most species-rich ecosystems in the hotspot, in Myanmar Lowland evergreen forests formerly covered large areas. However, due to the (former) abundance of commercially valuable timber species in these forests and their suitability for agriculture (including tree plantations), they have been among the most heavily exploited of all habitats. Large areas have been cleared and much of the remaining forest is threatened with conversion to cash crops and subsistence agriculture. Also the freshwater swamp forest, which is distributed in Myanmar, hosts 171 threatened Species among mammals, birds, reptiles, amphibians, fish, invertebrates and plants which are specific of the Indo-Burma biodiversity hot spot (*Ecosystem Profile Indo-Burma Biodiversity Hotspot, 2011 Update – Critical Ecosystem Partnership Fund, 2012*)

This biodiversity hot spot is not legally protected at national level.

1.4 MYANMAR CONSERVATION CORRIDORS

The following table shows the 14 conservation corridors identified in Myanmar, organized as follows: 8 terrestrial conservation corridors, 4 river conservation corridors and 2 marine conservation corridors.

Table 1.1 List of Conservation Corridors

N.	Name	Corridor Type	Area Km^2
1	Chin Hills Complex Corridor	Terrestrial	36,272
2	Bago Yoma Range corridor	Terrestrial	16,143
3	Western Shan Yoma Range Corridor	Terrestrial	27,742
4	Upper Chindwin Catchment Corridor	Terrestrial	50,156
5	Lower Chindwin Forest Corridor	Terrestrial	40,087
6	Taninthayi Range Corridor	Terrestrial	42,880
7	Rakhine Yoma Range Corridor	Terrestrial	47,914
8	Upper Ayeyawady Catchment Corridor	Terrestrial	101,394
9	Thanlwin River Corridor	River	7,692
10	Chindwin River Corridor	River	5,299
11	Ayeyawady River Corridor	River	19,798

N.	Name	Corridor Type	Area Km^2
12	Sittaung River Corridor	River	3,048
13	Taninthayi Marine Corridor	Marine	58,606
14	Rakhine Marine Corridor	Marine	40,698
Total			**497,729**

1.5 PROTECTED AREAS AT NATIONAL LEVEL

The following table shows the 43 protected areas established in Myanmar

Table 1.2 Myanmar Protected Areas

Name	National Designation	Year Established	Location and Coordinates	Area (km^2)	Key Species Protected
Alaungdaw Kathapa N.P	National Park	1989	Sagaing Region, 23°36'N, 95°32'E	1,606	Elephant, Tiger, Leopard, Gaur, Sambar, Serow, Bear
Bawditataung	Nature Reserve	2008 (Proposed)		73	-
Bumhpabum W.S *	Wildlife Sanctuary	2004	Kachin State 26° 29' N & 97° 31' E	1,854	Elephant, Gaur; Serow; Deep Spp; Clouded Leopard; Golden Cat; Jackal; Goral; Mancaques; Civets; Bear; Leopard; Pheasant; Hornbills
Chatthin	Wildlife Sanctuary	1941	Sagaing Region, 23°36'N, 95°32'E	269	Eld's Deer, Sambar, Barking Deer
Hlawga Wildlife Park	Wildlife Park	1982	Yangon Region, 17°0'N, 960°10'E	6	Enclosed Wildlife park. Sambar, Barking Deer, Hog Deer, Eld's Deer, Mythun, Migratory birds
Hponkanrazi W.S *	Wildlife Sanctuary	2003	Kachin State 27° 30' & 97° 43'	2,704	Barking Deer, Avifauna, Red Goral, Gibbon, Wild Dogs, Mongooses
Htamanthi	Wildlife Sanctuary	1974	Sagaing Region, 25°26'N, 95°37'E	2,151	Rhinoceros, Elephant, Gaur, Tiger
Hukaung Valley W.S	Wildlife Sanctuary	2004	Kachin State 26°11'N, 96°10'E	6,371	Elephant, Leopard, Tiger, Gaur, Sambar, Bear, Wild Boar, Serow
Hukaung Valley W.S (Extension)	Wildlife Sanctuary	2004	Kachin State	15,431	Elephant, Leopard, Tiger, Gaur, Sambar, Bear, Wild Boar, Serow
Indawgyi W.S	Wildlife Sanctuary	2004	Kachin State 25°10'N, 96°15'E	815	Elephant, Tiger, Sambar, Leopard, Bear, Serow, Gaur

Name	National Designation	Year Established	Location and Coordinates	Area (km^2)	Key Species Protected
Inlay Lake Bird Sanctuary (Wetland)	Wildlife Sanctuary	1985	Shan State, 20°10'N, 97°02'E	642	Wetland and Migratory Birds
Kahilu W.S	Wildlife Sanctuary	1928	Karen State 17°13'N, 97°06'E	161	Rhinoceros, Serow, Mouse Deer, Hog Deer
Kelatha W.S	Wildlife Sanctuary	1942	Mon State 17°13'N, 97°06'E	24	Serow, Avifauna
Khakaborazi Protected Area	National Park	1996	Kachin State 28°12'N, 97°45'E	3,812	Takin, Musked Deer, Red Goral, Black Barking Deer
Kyaikhtiyoe W.S	Wildlife Sanctuary	2001	Mon State 17°25'N, 97°06'E	156	Tiger, Goral, Gaur, Sambar, Monkey
Kyauk Pan Taung W.S	Wildlife Sanctuary	2001 (Proposed)	Chin State 21°20'N, 92°55'E	133	Serow, Goral, Leopard, Clouded Leopard, Clouded Leopard, Wild Cats, Barking Deer, Wild Boar
Lampi Islands Marine N.P	Marine National Park	1996	Taninthayi Region 10°45'N, 98°15'E	205	Coral Reefs, Mouse Deer and Salon ethnic culture
Lawkananda W.S	Wildlife Sanctuary	1997	Mandalay Region 21°10'N, 94°48'E	0.47	Avifauna, Cultural Diversity
Lenya N.P *	National Park	2002 (Proposed)	Tanintharyi Region between 10° 48' & 99° 20' N, between 98° 49' & 99° 20' E	1,761	Tapir, Elephant, Monkeys, Barking Deer, Sambar, Wild Boar, Bear, Mouse Deer, Wild Cats, Pangolin, Lizards, Birds, Tiger
Lenya National Park * (extension)	National Park	2004 (Proposed)	Tanintharyi Region	1,399	Tiger, Elephant, Tapir, Gaur, Banteng, Sambar, Gurney's Pitta
Loimwe Protected Area	Protected Area	1996	Shan State 21°0'N, 99°55'E	43	Tiger, Bear, Pangolin, Pheasant
Mahamyaing W.S. *	Wildlife Sanctuary	2002 (Proposed)	Sagaing Region between 22° 50' & 23° 45' N, between 94° 15' & 95° 00' E	1,180	Sambar, Wild Boar, Banteng, Feline, Gibbon, Wild Dogs, Mongooses
Meinmahla Kyun W.S	Wildlife Sanctuary	1994	Ayeyarwady Region,15°55'N, 95°20'E	137	Mangrove Crocodiles, Birds
Minsontaung W.S	Wildlife Sanctuary	1999	Mandalay Region 21°30'N, 95°45'E	23	Barking Deer, Rabbit, Dhole, Reptiles, Land Tortoise, Wild Cat, Snakes
Minwun-Taung W.S	Wildlife Sanctuary	1972	Sagaing Region 22°02'N, 95°58'E	206	Barking Deer, avifauna

Name	National Designation	Year Established	Location and Coordinates	Area (km^2)	Key Species Protected
Moscos Island W.S	Wildlife Sanctuary	1927	Taninthayi Region 14°05'N, 97°05'E	49	Barking Deer, Sambar, Swiftlet
Moyungyi Bird Sanctuary (Wetland)	Bird Sanctuary	1988	Bago Region, 17°30'N, 96°30'E	104	Migratory Birds
Mulayit	Wildlife Sanctuary	1936	Kayin State 16°07'N, 98°30'E	139	Barking Deer, tiger, Leopard
Natma Taung N.P	National Park	1994 (Proposed)	Chin State 21°10'N, 93°55'E	723	Gaur, Serow, Goral and Avifauna
Panlaung-Pyadalin Cave W.S	Wildlife Sanctuary	1999	Shan State 21°10'N, 96°30'E	334	Elephant, Tiger, Leopard, Gaur, Banteng, Golden Cat, Clouded Leopard, Serow, Gibbon
Parsar Protected Area	Protected Area	1996	Shan State 20°25'N, 99°45'E	77	Jungle Fowl, Chinese Pangolin
Pidaung W.S	Wildlife Sanctuary	1918	Kachin State, 25°25'N, 97°12'E	122	Elephant, Gaur, Banteng, Sambar, Tiger, Leopard, Bear
Popa Mountain Park	Mountain Park	1989	Mandalay Region, 20°53'N, 95°15'E	129	Barking Deer, Leopard, Geomorphologic features
Pyin Oo Lwin Bird Sanctuary	Bird Sanctuary	1918	Mandalay Region 22°0'N, 96°30'E	127	Not available from source
Rakhine Yoma Elephant Range	Wildlife Reserve	1997	Rakhine State 18°0'N, 94°40'E	1,756	Elephant, Gaur, Leopard, Jackal, Bear
Shinpin Kyatthaut W.S *	Wildlife Sanctuary	2006 (Proposed)	Bago Region between 15° 50' & 15° 58', between 96° 9' & 96° 16'	72	Barking Deer, Hog Deer, Wild Boar, Pangolin, Wild Dog, Civet, Reptiles
Shwesettaw W.S	Wildlife Sanctuary	1940	Magway Region, 20°12'N, 94°35'E	553	Eld's Deer, Sambar, Barking Deer, gaur
Shwe-U-Daung W.S	Wildlife Sanctuary	1918	Mandalay Region, 23°00'N, 96°30'E	326	Rhinoceros, Elephant, Gaur, Banteng, Sambar, Serow, Tiger, Bear
Tanintharyi N.P *	National Park	2002 (Proposed)	Tanintharyi Region 12° 02' N & 97° 00' E	2,072	Sambar, Barking Deer, serow, Goral, Leopard, Wild Elephant, Birds, Tiger
Tanintharyi Nature Reserve *	Nature Reserve	2005	Tanintharyi Region	1,700	Gurney's Pitta, Tiger, Elephant, Tapir
Taunggyi Bird Sanctuary	Bird Sanctuary	1930	Shan State 20°45'N, 97°04'E	16	Avifauna
Thamihla Kyun W.S	Wildlife Sanctuary	1970	Ayeyarwady Region 15°05'N, 94°17'E	0.88	Marine Turtle

Name	National Designation	Year Established	Location and Coordinates	Area (km²)	Key Species Protected
Wethtikan Bird Sanctuary	Bird Sanctuary	1939	Magway Region 20°0'N, 95°30'E	4	Wetland Birds

Source: BANCA, 2011 and FAO, 2004

The only legally Protected Areas which partially overlaps the Block PSC-K is the Panlaung-Pyadalin Cave.

Table 1.3 Characteristics of Panlaung-Pyadalin Cave

Site ID	30
Locality	Shan State, Ywa Ngan Township
Coordinates	N 21° 01', E 96° 21'
Size (km²)	334
Altitude (m. asl)	150 – 1,555
Myanmar category	Wildlife Sanctuary
IUCN category	IV
Site Governance	Nature and Wildlife Conservation Division
Boundaries	Demarcated
Year gazetted	2002
Protection level	Total
Main purposes	Conservation, Cultural heritage, Research/ Education, Recreation/ Ecotourism
Habitat	Mixed Deciduous Forest (Moist Upper), Mixed Deciduous Forest (Dry Upper), Indaing Forest
Key resources	Asian Elephant, Banteng, Gaur, Clouded Leopard, Serow

Site description

Panlaung-Pyadalin Cave Wildlife Sanctuary is situated in Ywa Ngan Township of Shan State. It was established with the purpose of preserving the archaeological site of the Pyadalin limestone caves, to conserve the surrounding environment and habitat for mammals like Wild Elephants, Gaur, Leopard, Banteng, Sambar, many species of monkeys and many species of birds. The sanctuary is an important watershed area for the Kingda dam. The climate is hot and dry in lower elevation and moderate in higher elevation, with average rainfall recorded between 1,250 – 2,000 mm per year.

Natural resources

Moist upper and dry upper mixed deciduous forests and deciduous dipterocarp (Indaing) forest are the forest types of the site. A new species of lizard, *Cyrtodactylus chrysopylos*, was discovered in 2003 by the California Academy of Science.

Management

Annual operation plan Management actions in place:

- Environmental education

Management problems:

- Budget

Man power Required actions:

- To build a field office and guard posts
- Settlement for the encroaching people
- Provision of communication and field equipment

Tourism

The site is easily accessible all season to local tourists who can reach it by car 37 km east from Kume on Yangon Mandalay Highway.

The main attractions are the two limestone Pyadalin caves located in the Panlaung forest reserve. The smaller contains paintings that are over 11,000 years old, dated between the Mesolithic and Neolithic periods. Both caves contain over 1,600 stone relics and many animal and human bones and red ochre.

Myanmar
ESHIA STUDY FOR THE EXPLORATION
BLOCK PSC-K

Environmental, Social and Health Impact Assessment

Annex 2

NORTH

SOUTH

820000.00 840000.00

2400000.00 2380000.00 2360000.00 2340000.00

2320000.00 2300000.00 2280000.00 2260000.00 2240000.00

N

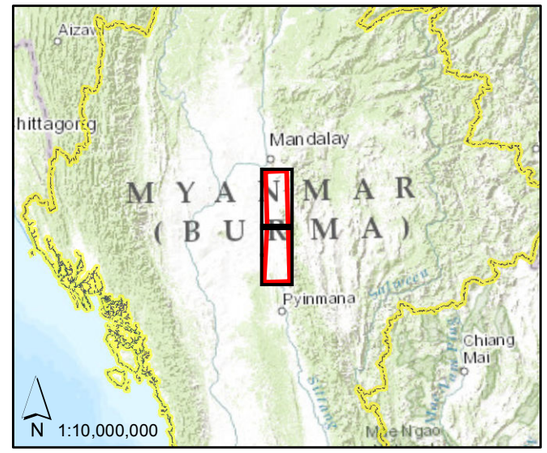
0 10 20 km

LEGEND

- 2D SEISMIC LINES (DRAFT)
- BLOCK PSC-K

LAND COVER PSCK

- WATER BODIES
- IRRIGATED / FLOODED AGRICULTURE
- DRY FOREST
- LOW LYING MIXED VEGETATION
- GREEN FOREST
- OPEN
- BUSH / SCRUB
- MIXED AGRICULTURE
- URBAN



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Project

ESHIA Study for the Exploration Block PSC-K

Drawing

01 - Land Cover Map

Prepared by		
File Name	Annex nr	Document nr
04_LandCover_Proj	2	TBP
Date	Scale	Delivery Purpose
29 - 01 - 2015	1:350,000	-

NORTH

SOUTH

820000.00 840000.00

2400000.00 2380000.00 2360000.00 2340000.00

2320000.00 2300000.00 2280000.00 2260000.00 2240000.00

N

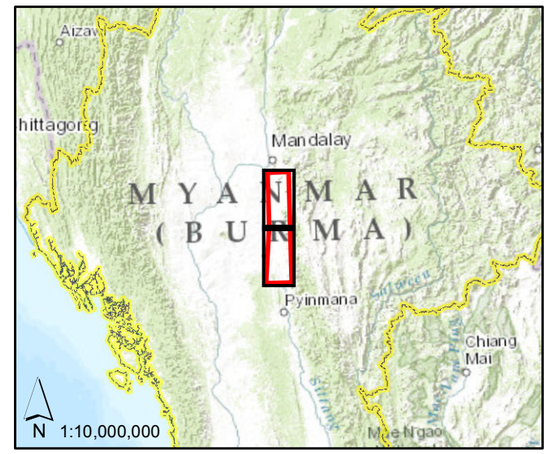
0 10 20 km

LEGEND

2D SEISMIC LINES (DRAFT)

LAND COVER CHANGE DETECTION 2011 - 2014 PSC-K

- UNKNOWN
- DRY AREAS BOTH SEASON
- WET SEASON WATER EXTENT
- GREEN VEGETATION INCREASE WET SEASON
- DRY SEASON GREEN VEGETATION
- DRY SEASON WATER EXTENT
- DRY SEASON IRRIGATED/FLOODED AGRICULTURE
- WET SEASON IRRIGATED/FLOODED AGRICULTURE
- GREEN VEGETATION DECREASE DRY-WET SEASON
- WATER EXTENT DECREASE DRY-WET SEASON



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ESHIA Study for the Exploration Block PSC-K

Drawing

02 - Land Use Change Detection Map (2011 - 2014)

Prepared by		
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Date	Scale	Delivery Purpose
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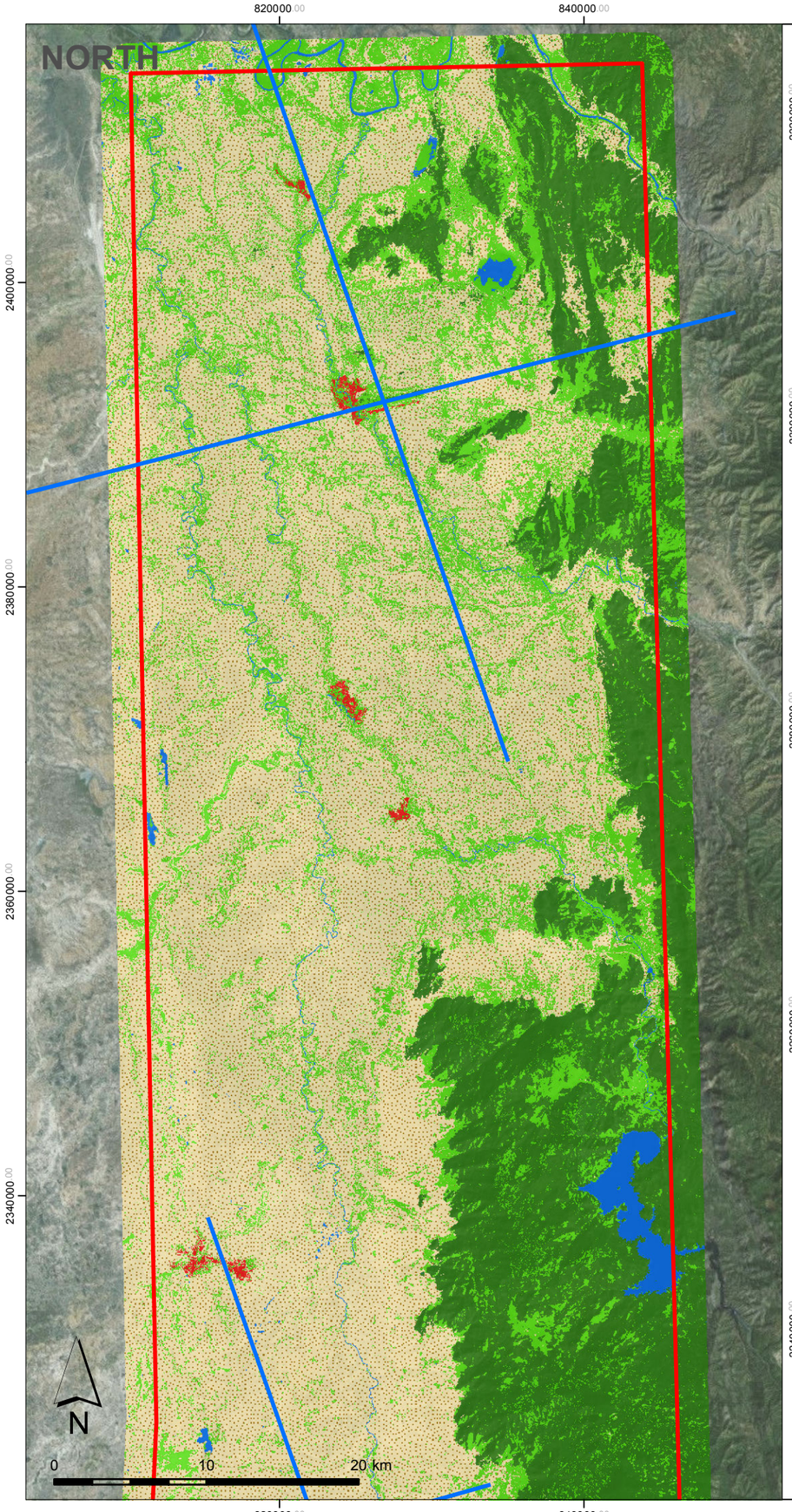
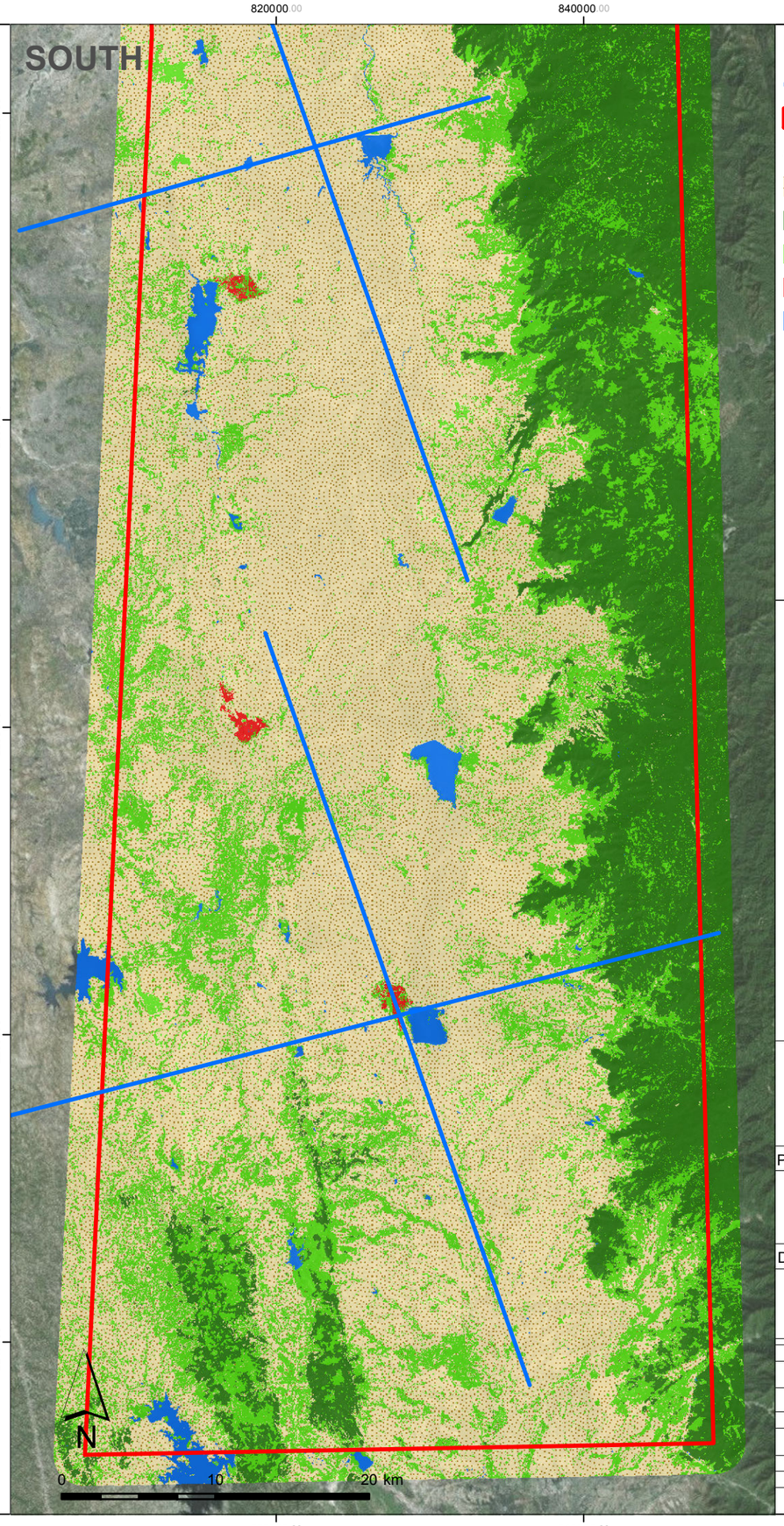


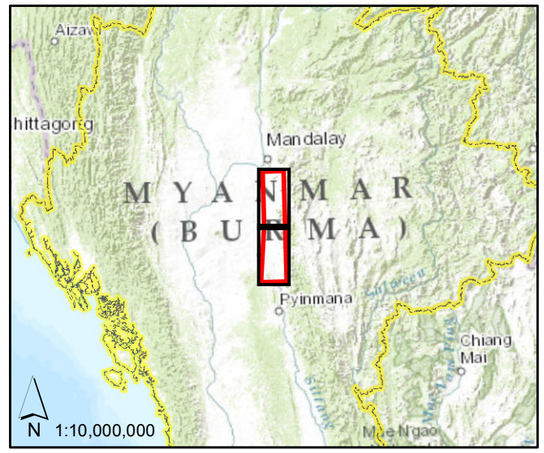


LEGEND

- 2D SEISMIC LINES (DRAFT)
- BLOCK PSC - K

HABITAT MAP (IPIECA Standards)

- CULTIVATED HABITAT
- FOREST AREA
- GRASSLAND HABITAT
- SETTLEMENT (NOT IPIECA)
- WETLAND RIVER AND LAKE HABITAT



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Project
ESHIA Study for the Exploration Block PSC K
Drawing
03 - Habitat Map (IPIECA)
Prepared by

File Name	Annex nr	Document nr
seca.mxd	2	TBP

Date	Scale	Delivery Purpose
29 - 01 - 2015	1:350,000	-

Myanmar
ESHIA STUDY FOR THE EXPLORATION
BLOCK PSC-K

Environmental, Social and Health Impact Assessment

Annex 3

Table 1 Environmental Impacts – Grav Mag Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Air Quality	Impacts on local air quality due to atmospheric emissions from the aircraft	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
	GHG emissions from aircraft in use during Grav-Mag survey	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, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**

Notes: [(1)] GHG emissions have an impact on a world scale, thus human receptors and ecosystems have been considered as a unique resource.

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Noise and vibration	Impacts on local acoustic climate due to aircraft operations	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Water quality	No impacts					
Soil and subsoil	No impacts					
Flora and Vegetation	No impacts					
Fauna and habitats	No impacts					

Table 2 Social Impacts – Grav Mag Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Economy and Employment	No impacts					
Infrastructures and Public Services	No impacts					
Land and Livelihood	No impacts					

Table 3 Cultural Impacts – Grav Mag Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Cultural Heritage	No impacts					

Table 4 Visual Impacts – Grav Mag Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Landscape	No impacts					

Table 5 Health Impacts – Grav Mag Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Community health	Impacts on local air quality due to atmospheric emissions from the aircraft	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**
	Impacts on local noise quality due to the aircraft use	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**

Table 6 Environmental Impacts – Seismic Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Air Quality	Dust emissions	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
	Vehicles Exhausts	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Noise and vibration	Short Term Impact due to noise 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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
	Short Term Impact due to noise emission during blasting activities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Water quality	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **medium (7)** • Water bodies: **medium (7)**
	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **medium (7)** • Water bodies: **medium (7)**

Component	Impact	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
	Effects of Sediment Plumes on Water Resources	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**

Component	Impact	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: moderate (2) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (5)** • Water bodies: **low (5)**
Soil and subsoil	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **medium (7)** • Water bodies: **low (6)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
	Potential Disturbance and Degradation	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **low (4)**
	Land Take	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **medium (5)** • Water bodies: **low (4)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Flora and Vegetation	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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **low (6)**
	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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **low (6)**

Component	Impact	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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **medium (7)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **low (6)**
Fauna and habitats	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, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **medium (7)** • Water bodies: **medium (7)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
	Modification of the Ecological Network	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (6)** • Water bodies: **low (6)**
	Increasing collision rate from traffic	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: high (3) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (6)** • Water bodies: **low (6)**

Table 7 Social Impacts – Seismic Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Economy and Employment	Temporary employment opportunities – regional level (positive)	Less than 1 year / Temporary	Regional scale: as determined by country's administrative boundaries	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **medium (7)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **low (5)** • Water bodies: **medium (7)**
	Temporary employment opportunities– local level (positive)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **low (6)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Infrastructures and Public Services	Degradation and temporary disruption of road infrastructures	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
	Increased Pressure on Public Services and Utilities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**

Component	Impact	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, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (4)**
Land and Livelihood	Temporary land take corresponding to the camp site	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
	Temporary loss of livelihoods and household income.	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**
	Disturbance to/interruption of crop production	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: high (3) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (6)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**

Table 8 Cultural Impacts – Seismic Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Cultural Heritage	Physical disturbance or damage to cultural heritage sites	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **low (4)**
	Degradation or collapse due to vibration	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: moderate (2) • Urban areas: moderate (2) • Mixed agriculture and irrigated/flooded agriculture: low (1) • Dry forest and green forest: moderate (2) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (5)** • Urban areas: **low (5)** • Mixed agriculture and irrigated/flooded agriculture: **low (4)** • Dry forest and green forest: **low (5)** • Water bodies: **low (4)**

Table 9 Visual Impacts – Seismic Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Landscape	Physical changes to landscape elements (camp sites and seismic lines)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**
	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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**

Component	Impact	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, bush/shrub and mixed vegetation: high (3) • Urban areas: low (1) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: high (3) • Water bodies: low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **low (4)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (6)** • Water bodies: **low (4)**

Table 10 Health Impacts – Seismic Survey

Component	Impact	Duration	Extent	Importance / Resilience of Receptor / Resource	No. of Elements Involved	Impact Rank
Community health	Increased transmission of communicable diseases	Between 1 and 5 years	Regional scale: as determined by country's administrative boundaries	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (6)** • Urban areas: **medium (8)** • Mixed agriculture and irrigated/flooded agriculture: **medium (7)** • Dry forest and green forest: **low (6)** • Water bodies: **medium (7)**
	Pressure on health care	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**

Component	Impact	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, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**
	Community safety	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil, bush/shrub and mixed vegetation: low (1) • Urban areas: high (3) • Mixed agriculture and irrigated/flooded agriculture: moderate (2) • Dry forest and green forest: low (1) • Water bodies: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil, bush/shrub and mixed vegetation: **low (4)** • Urban areas: **low (6)** • Mixed agriculture and irrigated/flooded agriculture: **low (5)** • Dry forest and green forest: **low (4)** • Water bodies: **low (5)**