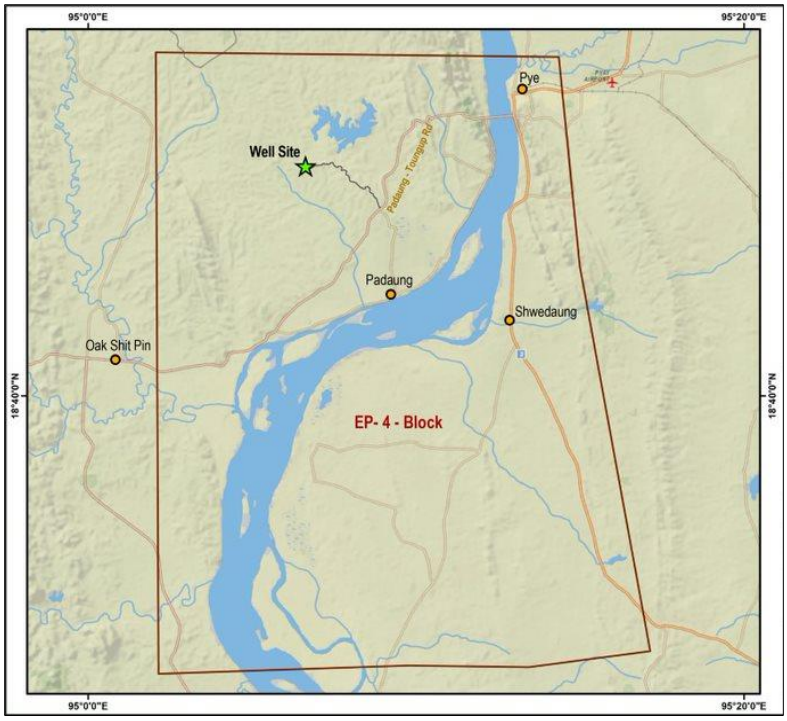
BASHNEFT INTERNATIONAL B.V.

EIA Study of the 1st Prospecting and Appraisal Well Drilling in Block EP- 4, Republic of the Union of Myanmar Republic of the Union of Myanmar.

DRAFT EIA REPORT



Asian Consulting Enterprises Pte. Ltd., Singapore

In Joint Venture with

Asian Consulting Engineers Pvt. Ltd., India

QUALITY CONTROL PLAN

Project Title	EIA for the 1st Prospecting and Appraisal Well Drilling in Block EP-4, Pyay District, Bogo Region, Republic of Union of Myanmar Project.
Client	Bashneft International B. V.
Contact Person	Mr. Grigory Stepanov Project Manager Bashneft International B. V.

Document Prepared By	Asian Consulting Enterprises Pte. Ltd., Singapore Asian Consulting Engineers Pvt Ltd., India
Original Prepared	26.12.2019

Approved By:

Suparmar Malik

(Team Leader)

26/12/2019

(Date)

By signing, I certify, that the document/report has been prepared and reviewed as per the quality assurance measures established in Asian Consulting Engineers Pvt Ltd, (ACE) "Quality Management System".

TABLE OF CONTENTS

CHAPTER-5: DESCRIPTION OF THE SURROUNDING ENVIRONMENT

CHAPTER-6: IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

PHOTO PLATES

PHOTO PLATES

ANNEXURES

Annexure I- HSE Policy

APPENDIX

Appendix 1: Design justification

LIST OF ABBREVIATIONS

%	Percentage
µg/m^3	Microgram per meter cube
µS/cm	Micro siemens per centimeter
^{0}C	Celsius- (temperature measurement unit)
2D	Two dimensional
ACE	M/s Asian Consulting Enterprises Pte. Ltd., Singapore
AIDS	Acquired Immune deficiency syndrome
AMSL	Above Mean Sea Level
APHA	America Public Health Association
API	American Petroleum Institute standards
AQ	Air Quality
As	Arsenic
ASEAN	Association of South east Asian Nations
BATs	Best Available Technologies
BHA	Bottom hole Assembly
BOC	Burma Oil Company
BOD	Biological Oxygen Demand
BOD	Biological Oxygen Demand
BOP	Blow out preventor
$CaCO_3$	Calcium Carbonate
CBD	Convention of Biological Diversity
CC	Communication Coordinator
Cd	Cadmium
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeter
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
Cr	Chromium
CSR	Corporate Social Responsibility
CT	Casing and tubing
dB	Decibel
DG	Diesel Generator
DL	Danger Level
DMH	Department of Meteorology and Hydrology
DO	Dissolved oxygen
ECC	Emergency Coordination Centre
ECC	Environmental Compliance Certificate
ECD	Equivalent circulating density
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
EMP	Environment Management Plan
EN	Endangered
ERG	Emergency Response Group
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESIA	Environment and Social Impact Assessment
EURO	Currency of European Union
F	Fluoride
Fe	Iron
FSU	Flocculation and Coagulation Unit
ft	feet
g/cm^3	Gram per Centimeter cube
GCU	Government Computer University

LIST OF ABBREVIATIONS

GEF	Global Environmental Facility
GES	Global Experience Specialist
GIS	Geographic Information System
GOST	Gosstandart
GW	Ground water
ha	Hectare
HCs	Hydrocarbon
HDPE	High Density Polyethylene
Hg	Mercury
HIV	Human Immunodeficiency Virus
HSE	Health, Safety and Environment
IFC	Intranational Finance Corporation
INC	Initial National Communication
IR	Incident Controller
IRT	Incident Response Team
ISO	International Organization for Standardization
kgf/cm^2	Kilogram force per centimeter square
km	Kilometer
km^2	Kilometer square
LANDSAT	Land Satellite
LCM	Lost Circulation Material
LPG	Liquified Petroleum Gas
LULC	Land Use Land Change
M	Magnitude
m	Meter
m/min	Meter per minute
m/s	Meter per second
MARPOL	Maritime Pollution
MBT	Methylene Blue Test
mg/kg	Milligram per kilogram
mg/l	Milligram per liter
MIC	Myanmar Investment Commission
MIMU	Myanmar Information Management Unit
ml	Milliliter
mm	millimeter
Mn	Manganese
MOE	Myanmar Ministry of Energy
MoECAF	Ministry of Environmental, Conservation and Forestry
MM	Modified Mercalli
MOGE	Myanma oil and Gas Enterprise
MONREC	Myanmar's Ministry of Natural Resources and Environmental Conservation
MPa	Megapascal Pressure Unit
MPE	Myanmar Petrochemical Enterprise
MPPE	Myanmar Petroleum Products Enterprise
MPT	Myanmar Post and Telecommunication
MS	Mild steel storage
mS/cm	Milli Siemen per centimeter
Na	Sodium
NAPA	National Action Plan for adaptation
NGOs	Non-Governmental Organizations
NH_3	Ammonia Nitrogen
NO_2	Nitrite
NO_2	Nitrogen Dioxide
NO_3	Nitrate
NQ	Noise Quality
NTU	Nephelometric Turbidity Unit
OC	Operations Coordinator
OHS	Occupational Health and Safety
OHSAS	Occupational Health and Safety Assessment Series
Pb	Lead
pH	Potential of hydrogen

LIST OF ABBREVIATIONS

PM	Particulate Matter
PPEs	Personal Protective Equipment's
PSC	Production Sharing Contract
PTU	Pyay Technological university
PU	Pyay University
RPM	Respirable Particulate Matter
RS	Richter Scale
SAR	Sodium Absorption Ratio
SO_2	Sulphur Dioxide
SO_4	Sulphate
SPL	Sound Pressure Levels
SPM	Suspended Particulate Matter
SS	Soil Sampling
SW	Surface water
TDS	Total Dissolved Solids
TR	Technical Reports
TSS	Total Suspended solids
UNDP	United Nations Development Programme
UNFCC	United Nations Framework Convention on Climate Change
USD	United States Doller
USEPA	United States Environment Protection Agency
VECs	Valued environmental and social components
VOCs	Volatile Organic Carbon
VU	Vulnerable
WBM	Water Based Mud
WHO	World Health Organization
WL	Water Level
WOC	Water Oil Contact

1

EXECUTIVE SUMMARY

1 EXECUTIVE SUMMARY

(စီမံကိန်းဆိုင်ရာ အဓိကအချက်အလက်များ)

ဤပတ်ဝန်းကျင်ထိခိုက်မှုအကဲဖြတ်ခြင်း (EIA) အစီရင်ခံစာသည် ၂၀၁၅ ခုနှစ် ဒီဇင်ဘာ ၁၅ရက်နေ့တွင်ထုတ်ပြန်ထားသော ကြော်ငြာစာအမှတ် ၆၁၆/၂၀၁၅ အရ ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနှင့် သစ်တောရေးရာ ဝန်ကြီးဌာန၏ နောက်ဆုံးလုပ်ထုံး လုပ်နည်းများနှင့်အညီ ရေးသားထားပြီး အပြည်ပြည်ဆိုင်ရာ လမ်းညွှန်ချက်များအားလည်း မှီငြမ်းအသုံးပြုထားပါသည်။

1.1 INTRODUCTION (နိဒါန်း)

လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန (MOEE) လက်အောက်ရှိ မြန်မာ့ရေနံနှင့် သဘာဝဓာတ်ငွေ့လုပ်ငန်း (MOGE) သည် EP-4 လုပ်ကွက်အား ၂၀၁၄ ခုနှစ် ဩဂုတ်လ (၁၀)ရက်နေ့တွင် Bashneft International B.V (နောင်တွင် Bashneft ဟုခေါ်) အား ထုတ်လုပ်မှုခွဲဝေမှုစာချုပ် (PSC) ဖြင့် လုပ်ကွက်စူးစမ်းလေ့လာရေးနှင့် ဖွံ့ဖြိုးတိုးတက်မှုတို့အား လုပ်ကိုင်ဆောင်ရွက်ခွင့် ပြုခဲ့ပါသည်။ အဆိုပါ ဇရိယာသည် ပဲခူးတိုင်းဒေသကြီး အနောက်ဖက်ခြမ်း၏ အစိတ်အပိုင်းတစ်ခုဖြစ်ပြီး မြန်မာနိုင်ငံအလယ်ပိုင်းချိုင့်ဝှမ်းဒေသအတွင်း ကျရောက်နေကာ ဘူမိသဘောအရ ပြည်ချိုင့်ဝှမ်းဒေသဟု ခေါ်ဆိုနိုင်ပါသည်။

Project Overview (လုပ်ငန်းစီမံချက်အား ခြုံငုံလေ့လာခြင်း)

EP-4 လုပ်ကွက်သည် ဇရိယာစုစုပေါင်း ၈၄၁ စတုရန်းကီလိုမီတာရှိပြီး ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော် ပြည်ချိုင့်ဝှမ်းဒေသအတွင်း တည်ရှိပါသည်။ အဆိုပါလုပ်ကွက်သည် ရန်ကုန်မြို့ (မြန်မာနိုင်ငံ၏ အကြီးဆုံးမြို့)၏ အနောက်မြောက်ဘက် ၂၈၀ ကီလိုမီတာနှင့် နေပြည်တော် (မြန်မာနိုင်ငံ၏ မြို့တော်)၏ အနောက်တောင်ဘက် ၁၄၀ ကီလိုမီတာ တွင်တည်ရှိပါသည်။ EP-4 လုပ်ကွက်ရှိ wellsite ၏ ပထဝီဝင်ဆိုင်ရာ ကိုဩဒိနိတ် (geographical coordinate) အားTable (1.1) တွင်ဖော်ပြထားပါသည်။

Table (1.1) Wellsite ၏ geographical coordinate

Point No.	Latatude (N)			Longitude (E)		
	Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	18	46	58.19	95	06	37.57

Project Proponent/Block Operator (စီမံကိန်းအား လုပ်ပိုင်ခွင့်ရှိသူ)

Bashneft သည် စီမံကိန်းအားလုပ်ပိုင်ခွင့်ရှိသူအနေဖြင့် ရှယ်ယား ၉၀% အားပိုင်ဆိုင်ပြီး လက်ကျန် ရှယ်ယာအား Sun Apex Holding Ltd., Myanmar မှ ပိုင်ဆိုင်ပါသည်။ အဆိုပါဒေသ၏ sub-surface ဆိုင်ရာ အချက်အလက်များအားအခြေပြုပြီး EP-4 လုပ်ကွက်တွင် Bashneft သည်၎င်း၏ ပထမဆုံး စမ်းသပ်လွန်တွင်းတူးဖော်မှုအား ခွဲခြားသတ်မှတ်ခဲ့ပြီး hydrocarbon reserve အားတွက် ချက်ရန်အ တွက် လွန်တူးခြင်းလုပ်ငန်းစဉ်များကို ဆောင်ရွက်ရပါမည်။

MOGE နှင့် ထုတ်လုပ်မှုခွဲဝေမှုစာချုပ် (PSC) အရ အဆိုပြု လွန်တူးခြင်းဆိုင်ရာ လုပ်ဆောင်မှုများအ တွက် Bashneft အနေဖြင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လုပ်ငန်းစဉ်များကို ဆောင်ရွက် ရပါမည်။ Bashneft သည် သဘာဝပတ်ဝန်းကျင် ကာကွယ်ထိန်းသိမ်းရေးဆိုင်ရာ အစီအမံများနှင့် သ ဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုစီမံချက်များအား ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ၏ ဥပဒေများ၊ စည်းမျဉ်းများ၊ စည်းကမ်းချက်များ၊ ညွှန်ကြားချက်များနှင့် သတိပေးချက်များနှင့်အညီ၊ အပြည်ပြည် ဆိုင်ရာ ရေနံလုပ်ငန်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်းများနှင့် ကိုက်ညီမှုရှိစေရန် တာဝန်ယူဆောင်ရွက်ရပါ သည်။

စီမံကိန်းအား လုပ်ကိုင်ဆောင်ရွက်ခွင့်ရှိသူ၏ ဆက်သွယ်ရန်လိပ်စာနှင့် အချက်အလက်များ

ဆက်သွယ်ရန်။
Mr. Grigory Stepanov
Tel: +95 (9) 43-168-142
Tel/Fax: +95 (1) 230-44-05
Email: StepanovGV@bashneft.ru

ရုံးလိပ်စာ။

Arcc Office. Lvl. 6,611 လှည်းတန်းစင်တာ
ပြည်လမ်းနှင့်လှည်းတန်းလမ်းထောင့် ကမာရွတ်မြို့နယ်၊ ရန်ကုန်မြို့၊ ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ။

1.2 ACTIVITIES UNDERTAKEN DURING EIA STUDY (EIA ဆိုင်ရာလေ့လာမှုလုပ်ဆောင်နေစဉ်ကာလအတွင်း လုပ်ဆောင်မှုများ)

Project Proposal (စီမံကိန်းဆိုင်ရာ အဆိုပြုချက်)

Bashneft အနေဖြင့် EIA Study မစတင်မီအလျင် စီမံကိန်းအဆိုပြုမှု အစီရင်ခံစာအား သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန (MONREC) လက်အောက်ရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန (ECD) သို့ ပေးပို့ရပါမည်။ စီမံကိန်းအဆိုပြုမှုအစီရင်ခံစားအား Bashneft မှပေးပို့ခဲ့ပြီး ၂၀၁၉ခုနှစ် ဇူလိုင်လတွင် အတည်ပြုချက်ရရှိခဲ့ပါသည်။ EIA လုပ်ငန်းစဉ်ဆိုင်ရာ Annex I အရ အဆိုပါလုပ်ငန်းစဉ်သည် EIA အားလိုအပ်ပါသည်။ ဆိုလိုသည်မှာ Item 13 "ရေတိမ်ဒေသရေနံနှင့် သဘာဝဓာတ်ငွေ့ စမ်းသပ်တိုင်းတာတူးဖော်ခြင်း" စသည်ဖြင့် အမျိုးအစားခွဲခြားပြထားပါသည်။

Scoping Report (နယ်ပတ်သတ်မှတ်ခြင်း အစီရင်ခံစာ)

စီမံကိန်းအတွက် နယ်ပတ်သတ်မှတ်ခြင်းအပိုင်းအား ဆန်းစစ်ခြင်းနှင့် ၎င်းအားပေးပို့ခြင်းအပြီးတွင် လုပ်ဆောင်ရပါမည်။ စီမံကိန်း၏ အခြားဖြစ်ပေါ်လာနိုင်ချေရှိသော အကျိုးသက်ရောက်မှုများနှင့် ၎င်းတို့အား လျော့ချနိုင်မည့်နည်းလမ်းများ စသည်တို့အားလည်း ခွဲခြားဖော်ထုတ်ခြင်းများအား ဆောင်ရွက်ရပါမည်။ စီမံကိန်းနှင့် သက်ဆိုင်သူများအားလုံးနှင့် စေ့စပ်ညှိနှိုင်းဆွေးနွေးခြင်းများအား အခြေခံအချက်အလက်များကောက်ယူစဉ်ကာလအတွင်း ပြုလုပ်ရမည်ဖြစ်ပြီး ၎င်းတို့၏အမြင်နှင့် စိုးရိမ်ပူပန်မှုများအား ထုတ်ဖော်ခွင့်ပြုရမည်ဖြစ်ပြီး အဆိုပါအချက်များအား EIA အဆင့်တွင် ထည့်သွင်းစဉ်းစားရပါမည်။

EIA အစီရင်ခံစာအတွက် နယ်ပယ်သတ်မှတ်ခြင်းအစီရင်ခံစာအား EIA လုပ်ငန်းစဉ်လိုအပ်ချက်ကိုလိုက်၍ ပြင်ဆင်ရမည်ဖြစ်ပြီး EIA ၏ အစိတ်အပိုင်းတစ်ခုအဖြစ်လိုအပ်သော နယ်ပယ်သတ်မှတ်ခြင်းနှင့် လေ့လာခြင်းတို့အား အကြမ်းဖျင်းဖော်ပြသည့် သတ်မှတ်တာဝန်နှင့်လုပ်ပိုင်ခွင့်များ (TOR) ပါဝင်ရပါမည်။ နယ်ပယ်သတ်မှတ်ခြင်းအစီရင်ခံစာအား ၂၀၁၉ ခုနှစ် စက်တင်ဘာလတွင် ပေးပို့ခဲ့ပြီး ၂၀၁၉ခုနှစ် နိုဝင်ဘာ (၁၈) တွင် အတည်ပြုချက်ရရှိခဲ့ပါသည်။ (ECD နှင့် MOGE တို့ထံမှရရှိခဲ့သော နယ်ပယ်သတ်မှတ်ခြင်းအစီရင်ခံစာ၏ သဘောတူညီမှုစာအား နောက်ဆက်တွဲ (က) တွင် ဖော်ပြထားပါသည်။

Data Collection to Establish the Environmental Settings (ပတ်ဝန်းကျင်အနေအထား ပေါ်ထွက်လာစေရန်အတွက် အချက်အလက်များ စုဆောင်းခြင်း)

ဒုတိယ (secondary) နှင့် မူလရင်းမြစ် (primary source) များအပေါ်တွင်အခြေပြုပြီး အချက်အလက် (data) များအား ကောက်ယူရပါသည်။ စီမံကိန်းလုပ်ကွက် (နောက်တွင် study area ဟုခေါ်ဝေါ်သုံးနှုန်း) အမှန်တကယ်တည်ရှိ နေသောသဘာဝပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ အနေအထားများအား ပိုမိုသိရှိနားလည်စေရန်အတွက် ကွင်းဆင်းလေ့လာခြင်းများကို ပြုလုပ်ရပါမည်။ primary data ကောက်ယူခြင်းတွင် ကွင်းဆင်းကြည့်ရှုစစ်ဆေးခြင်း၊ အခြေခံနမူနာကောက်ယူခြင်းနှင့် ရူပဆိုင်ရာ၊ ဇီဝဆိုင်ရာ၊ လူမှုရေးဆိုင်ရာနှင့် ကျန်းမာရေးဆိုင်ရာ အရင်းအမြစ်များ စသည်တို့ပါဝင်ပါ

သည်။ အခြေခံလေ့လာမှုများနှင့် တွေ့ဆုံဆွေးနွေးမှုများဆိုင်ရာ အသေးစိတ်အချက်အလက်များအား ဤ executive summary ၏ အပိုင်း ၁.၆ နှင့် ၁.၁၀ နှင့် EIA Report ၏ အခန်း ၅ နှင့် ၉ တို့တွင် အသီးသီးဖော်ပြထားပါသည်။

1.3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK (မူဝါဒ၊ ဥပဒေနှင့် အဖွဲ့အစည်းဆိုင်ရာ မူဘောင်)

စီမံကိန်းတွင်အသုံးပြုနိုင်သော ဥပဒေ/စံနှုန်းနှင့် အခြားစည်မျဉ်းစည်ကမ်းနှင့် မူဝါဒများအား အောက်ပါအတိုင်း Table 1.2 နှင့် 1.3 တို့တွင် အသီးသီးဖော်ပြထားပါသည်။

Table 1.2 သက်ဆိုင်ရာ ဥပဒေပြဌာန်းချက်များ

စဉ်	ဥပဒေ/စံနှုန်း
မြန်မာနိုင်ငံ၏ ပတ်ဝန်းကျင်ဆိုင်ရာဥပဒေများ၊ မူဝါဒများနှင့် ဖွဲ့စည်းမှု မူဘောင်	
၁။	ပတ်ဝန်းကျင်ထိခိုက်မှုအကဲဖြတ်ခြင်းလုပ်ငန်းစဉ် (MONREC) (သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန) (ယခင် MoECAF) (၂၀၁၅ ခုနှစ် ဒီဇင်ဘာလ ၂၉ ရက်)
၂။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှု ကောက်မရှင် အမိန့်ကြော်ငြာစာအမှတ် ၁/၂၀၁၃ (၂၀၁၃ ခုနှစ် ဇန်နဝါရီ ၃၁ ရက်)
၃။	ရေအရင်းအမြစ်နှင့် မြစ်ကြောင်းများထိန်းသိမ်းရေးဥပဒေ (၂၀၀၆ ခုနှစ် အောက်တိုဘာ ၂ ရက်)
၄။	ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ၊ (၁၉၉၈ ခုနှစ်)
၅။	ရှေးဟောင်အဆောက်အအုံများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ၊ (၂၀၁၅ ခုနှစ်)
၆။	ရှေးဟောင်ဝတ္ထုပစ္စည်းများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ၊ (၂၀၁၅ ခုနှစ် ဇူလိုင်လ ၂၂ ရက်)
၇။	အမျိုးသား သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန် (၂၀၁၅ ခုနှစ်)
၈။	မြန်မာ့ရင်းနှီးမြှုပ်နှံမှု ဥပဒေ၊ (၂၀၁၈ ခုနှစ်)
၉။	လယ်ယာမြေဥပဒေ၊ (၂၀၁၂ ခုနှစ်)
၁၀။	သစ်တောဥပဒေ၊ (၂၀၁၈ ခုနှစ်)
၁၁။	ငါးလုပ်ငန်းအက်ဥပဒေ (၃ - ၁၉၀၅ခုနှစ်)
၁၂။	ရေချိုငါးလုပ်ငန်းဥပဒေ (၁၉၉၁ ခုနှစ် မတ်လ ၄ ရက်)
၁၃။	ဗမာနိုင်ငံတော်အစိုးရ လယ်ယာ(သစ်တောဌာန) ကြော်ငြာစာ အမှတ် ၁ (၁၉၂၄ ခုနှစ်)
၁၄။	ငါးလုပ်ငန်းဦးစီးဌာန အမိန့်ကြော်ငြာစာအမှတ် ၂/၉၃ (၁၉၉၃ ခုနှစ်)
၁၅။	ဇီဝမျိုးစုံမျိုးကွဲများ အကာကွယ်ထိန်းသိမ်းခြင်းနှင့် ထိန်းသိမ်းမှု ဇရိယာ ဥပဒေ (၂၀၁၈ ခုနှစ်)
၁၆။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး စည်းမျဉ်းစည်းကမ်းများ (၂၀၁၄ ခုနှစ်)

Table 1.3: အခြားဆက်ဆပ်နေသော ပတ်ဝန်းကျင်ဆိုင်ရာ ဥပဒေ၊ စည်းမျဉ်းစည်းကမ်းနှင့် မူဝါဒများ

စဉ်	အခြားဆက်ဆပ်နေသော ပတ်ဝန်းကျင်ဆိုင်ရာ ဥပဒေ၊ စည်းမျဉ်းစည်းကမ်းနှင့် မူဝါဒများ
၁။	ရေနံနှင့် သဘာဝဓာတ်ငွေ့ ဥပဒေ၊ ရေနံတွင်းအက်ဥပဒေ (၁၉၁၈ ခုနှစ်)
၂။	ရေနံအက်ဥပဒေ (၁၉၃၄ ခုနှစ်)၊ ရေနံတွင်းဆိုင်ရာစည်းမျဉ်းစည်းကမ်းများ (၁၉၃၆ ခုနှစ်)
၃။	ရေနံဆိုင်ရာ စည်းမျဉ်းစည်းကမ်းများ (၁၉၃၇ ခုနှစ်)
၄။	ရေနံနှင့် ရေနံထွက်ပစ္စည်းဆိုင်ရာ ဥပဒေ (၂၀၁၇ ခုနှစ်)
၅။	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာမူဝါဒ (၁၉၉၄ ခုနှစ်)
၆။	မီးသတ်ဥပဒေ (၂၀၁၅ ခုနှစ်)
၇။	အလုပ်သမားအဖွဲ့အစည်းဥပဒေ (မာတုပစ္စည်းနှင့် ဆက်ဆပ်ပစ္စည်းများ အန္တရာယ်မှ တားဆီးကာကွယ်ရေး ဥပဒေ (၂၀၁၃ခုနှစ် သြဂုတ် ၂၆ ရက်)
၈။	အလုပ်သမား အဖွဲ့အစည်းဥပဒေ (၂၀၁၁ ခုနှစ် အောက်တိုဘာ ၁၁ရက်)
၉။	အလုပ်သမားရေးရာ အငြင်းပွားမှု ဖြေရှင်းရေး ဥပဒေ (၂၀၁၂ ခုနှစ်)
၁၀။	အနိမ့်ဆုံးလုပ်ခလစာဥပဒေ (၂၀၁၃ ခုနှစ်)
၁၁။	အခကြေးငွေပေးချေရေးဥပဒေ (၂၀၁၆ ခုနှစ်)
၁၂။	ခွင့်ရက်နှင့် အလုပ်ပိတ်ရက် အက်ဥပဒေ (၁၉၅၁ ခုနှစ်)
၁၃။	ပို့ကုန်သွင်းကုန် ဥပဒေ (၂၀၁၂ ခုနှစ်)
၁၄။	ပြည်သူ့ကျန်းမာရေး ဥပဒေ (၁၉၇၂ ခုနှစ်)
၁၅။	ကူးစက်ရောဂါများ ကာကွယ်နှိမ်နင်းရေး ဥပဒေ (၁၉၉၅ ခုနှစ်)
၁၆။	ဆေးလိပ်နှင့် ဆေးရွက်ကြီးထွက်ပစ္စည်းများသုံးစွဲမှု ထိန်းချုပ်ရေး ဥပဒေ (၂၀၀၆ ခုနှစ်)
၁၇။	မော်တော်ယာဉ်ဥပဒေ (၂၀၁၅ ခုနှစ်)
၁၈။	မြန်မာ့အာမခံဥပဒေ (၁၉၉၃ ခုနှစ်)
၁၉။	အလုပ်အကိုင်နှင့် ကျွမ်းကျင်မှု ဖွံ့ဖြိုးတိုးတက်ရေး ဥပဒေ (၂၀၁၃ ခုနှစ်)

အသုံးချနိုင်သော အဆိုပါစည်းမျဉ်းစည်းကမ်းအပိုဒ်ငယ်လေးများအား အဆိုပြု စီမံကိန်းနှင့် ၎င်းတို့၏ ပတ်သက်ဆက်နွယ်မှုများနှင့်အတူ EIA အစီရင်ခံစာ၏ အခန်း ၃ တွင် အသေးစိတ်ဖော်ပြထားပါသည်။

Institutional Framework (အဖွဲ့အစည်းဆိုင်ရာ မူဘောင်)

EIA အား မြန်မာနိုင်ငံ၏ ဥပဒေပြုမူဘောင်နှင့် အညီဆောင်ရွက်ပြီး ၎င်း၏ နောက်ဆုံးအစီရင်ခံစာအား ပြန်လည်ကြည့်ရှုသုံးသပ်နိုင်ရန်နှင့် အတည်ပြုမှုရရှိနိုင်ရန် သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာန [MoNREC (ယခင် MoCAF)] သို့ ပေးပို့ရပါမည်။ ဝန်ကြီးဌာနမှ ထုတ်ပေးသော ပတ်ဝန်းကျင်ဆိုင်ရာလိုက်နာမှုလက်မှတ် [Environmental Compliance Certificate, (ECC)] ရရှိပြီးပါက Bashneft International B.V သည် ရင်းနှီးမြှုပ်နှံမှုဆိုင်ရာ လိုင်စင်/သဘောတူညီ

မူဆိုင်ရာလျှောက်ထားချက် ECC နှင့် အတည်ပြု EIA အစီရင်ခံစာတို့နှင့်အတူ မြန်မာ့ရင်းနှီးမြှုပ်နှံမှု ကော်မရှင် (MIC) ထံသို့ ပေးပို့ပါမည်။

Company Health, Safety & Environment (HSE) Policy (ကုမ္ပဏီ၏ ကျန်းမာရေး၊ ဘေးအန္တရာယ်ကင်းရှင်းရေးနှင့် ပတ်ဝန်းကျင်ဆိုင်ရာ မူဝါဒ)

ကျန်းမာရေး၊ ဘေးအန္တရာယ်ကင်းရှင်းရေးနှင့် ပတ်ဝန်းကျင် (HSE) သည် Bashneft ၏ ဦးစားပေးလုပ်ဆောင်ရမည့်ကိစ္စရပ်များထဲမှတစ်ခုဖြစ်ပါသည်။ HSE မူဝါဒအား ၂၀၁၁ ခုနှစ်တွင် Bashneft လိုက်နာကျင့်သုံးခဲ့ပြီး (နောက်ဆက်တွဲ-ခ တွင်ဖော်ပြထား) ၎င်း၏ အသုံးဝင်သော HSE ဆိုင်ရာ မဟာဗျူဟာ ပါဝင်ပါသည်။ အဆိုပါဗျူဟာသည် စဉ်ဆက်မပြတ်ဖွံ့ဖြိုးတိုးတက်စေရန်အတွက် လိုအပ်သော ပေါင်းစည်းမှုဗျူဟာဆိုင်ရာ အောက်ပါစည်းမျဉ်းစည်းကမ်းများကို ဖော်ပြထားပါသည်။

Corporate Social Responsibility (CSR) (အလုံးစုံသော လူမှုရေးဆိုင်ရာ တာဝန်ယူမှုများ)

Bashneft ၏ အလုံးစုံသော လူမှုရေးဆိုင်ရာ တာဝန်ယူမှုများ (CSR) အား ၎င်းမှ လိုက်နာကျင့်သုံးနေသော အောက်ဖော်ပြပါ CSR ဆိုင်ရာ စည်းမျဉ်းစည်းကမ်း အထောက်အထားများကိုကြည့်၍ ထင်ရှားစွာ တွေ့မြင်နိုင်ပါသည်။

(၁) ကမ္ဘာလုံးဆိုင်ရာ ကိုယ်ကျင့်တရားနှင့် ကျင့်ဝတ်များဆိုင်ရာ စံနှုန်းများအားထိန်းသိမ်းထားရှိခြင်း၊ လူအခွင့်အရေးဆိုင်ရာ ကိစ္စရပ်များအား လေးစားလိုက်နာမှုရှိခြင်းနှင့် ၎င်းတို့အား ချွင်းချက်မရှိ စောင့်ကြည့်လေ့လာခြင်း။

(၂) သဘာဝပတ်ဝန်းကျင်အား ထိန်းသိမ်းကာကွယ်ခြင်းနှင့် အနာဂတ်မျိုးဆက်များ၏ အကျိုးစီးပွားအား ကာကွယ်စောင့်ရှောက်ခြင်း။

(၃) လုပ်ငန်းခွင်ဘေးအန္တရာယ်ကင်းရှင်းရေးအား မြှင့်တင်ဆောင်ရွက်ခြင်းနှင့် ပင်ကိုစွမ်းရည်တိုးမြှင့်နိုင်စေရန် ဆောင်ရွက်ခြင်း။

(၄) အကျိုးအမြတ်ဆိုင်ရာများအား တစ်ဖက်တွင် Customers များ၊ ဒေသဆိုင်ရာ လူအဖွဲ့အစည်းများ၊ regulatory bodies များနှင့် အကျိုးအမြတ်မယူသော အဖွဲ့အစည်းများနှင့် အခြားတစ်ဖက်တွင် ကုမ္ပဏီရှယ်ယာရှင်များ၊ မိတ်ဖက်များနှင့် အလုပ်သမားများ စသည်တို့အကြား ညီညွတ်မှုတစေခြင်း။

(၅) ကုမ္ပဏီဝန်ထမ်းများ၏ ဘဝအရည်အသွေး တိုးတက်မြင့်မားစေခြင်းနှင့် လုပ်ငန်းဆောင်ရွက်မှုဒေသအတွင်း လူဦးရေတိုးတက်လာစေခြင်း။

(၆) ကုမ္ပဏီ၏ လုပ်ငန်းလည်ပတ်မှု နယ်ပယ်အတွင်း ဒေသခံလူ့အဖွဲ့အစည်းများ၏ ဖွံ့ဖြိုးတိုက်တက်မှု အတွက်ဆောင်ရွက်ခြင်း ဆိုလိုသည်မှာ ကုသိုလ်ဖြစ် အစီအစဉ်များဆောင်ရွက်သောအဖွဲ့များဖွဲ့ စည်းခြင်းမှတဆင့် ထိရောက်သောလူမှုရေးမိတ်ဖက်များအား တိုးမြင့်အောင်ဆောင်ရွက်ခြင်း။

(၇) အလုံးစုံသော လူမှုရေးဆိုင်ရာ တာဝန်ယူမှုများ (CSR) အား ကုမ္ပဏီ၏ နေ့စဉ်နေ့တိုင်း လုပ်ငန်း လုပ်ဆောင်မှုအအတွင်းတွင် သတမတ်တည်း ပေါင်းစပ်ထည့်သွင်းပြီး စီမံကိန်းနှင့် ပါတ်သက် ဆက်နွယ်နေသူ (stakeholders) များအားလုံးနှင့် ကျယ်ကျယ်ပြန့်ပြန့် တွေ့ဆုံဆွေးနွေးခြင်းများ အား တိုးတက်လုပ်ဆောင်ခြင်း။

(၈) ကုမ္ပဏီ၏ သတင်းအချက်အလက်များ ရရှိနိုင်ခြင်းနှင့် ပွင့်လင်းမြင်သာမှုတို့အား သေချာကျနစွာ ဆောင်ရွက်ခြင်းဖြင့် stakeholders များ၏ သိမြင်နိုင်မှုများအား မြှင့်တင်ဆောင်ရွက်ခြင်း။

Social Responsibility Standards (လူမှုရေးဆိုင်ရာ တာဝန်ယူမှု စံနှုန်း)

Bashneft ၏ လူမှုရေးဆိုင်ရာ တာဝန်ယူမှုစံနှုန်းမှာ လုပ်ငန်းစဉ်လုံခြုံရေးနှင့် ပတ်ဝန်းကျင်ကာကွယ် ထိန်းသိမ်းရေး စက်ဝန်းအတွင်းတွင်ရှိပါသည်။

1.4 PROJECT DESCRIPTION စီမံကိန်းဆိုင်ရာ အကြောင်းအရာဖော်ပြချက်

အဆိုပြု လွန်တွင်းတူးဖော်ခြင်းအား EP-4 လုပ်ကွက်တွင် ဆောင်ရွက်ရပါမည်။ wellsite ၏ geographical coordinates များအား Table 1.4 တွင်ဖော်ပြထားပါသည်။ လုပ်ကွက်တည်နေရာမြေပုံ အား Figure 1.1 တွင်ဖော်ပြထားပါသည်။

Table (1.4) Wellsite ၏ geographical coordinate

Point No.	Latatude (n)			Longitude (e)		
	Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	18	46	58.19	95	06	37.57

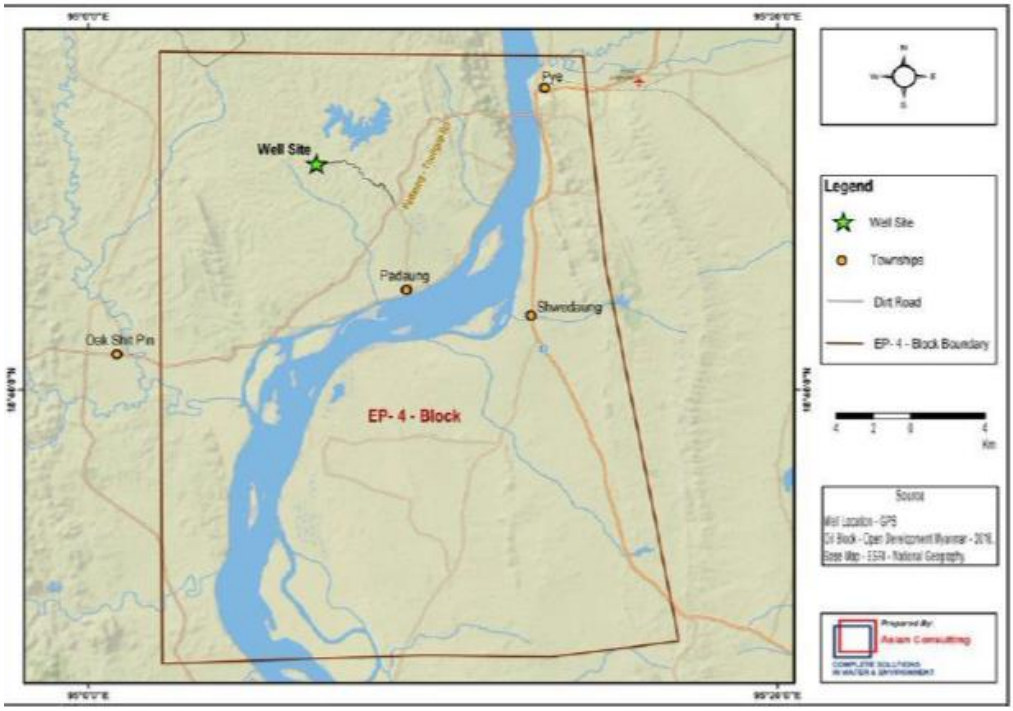


Figure 1.1 Well Site ၏ တည်နေရာပြမြေပုံ

အဆိုပါဒေသ၏ Sub-surface ဆိုင်ရာအချက်အလက်များအား ခွဲခြမ်းစိတ်ဖြာမှုအပေါ်တွင်အခြေပြုကာ Bashneft အနေဖြင့် hydrocarbon တွေ့ရှိရမှုကို အကဲဖြတ်ရန်နှင့် စီးပွားဖြစ်နိုင်မှုအလားအလာအား အကဲဖြတ်ရန် စသည်တို့အား ဆောင်ရွက်နိုင်ရန်အတွက် အဆိုပြုသောနေရာတွင် ၎င်း၏ ပထမဦးဆုံးသော အကဲဖြတ်တွင်း (appraisal well) တည်နေရာအား ခွဲခြားသတ်မှတ်ရပါသည်။

Appraisal Drilling Operation (အကဲဖြတ်လွန်တွင်းတူးဖော်ခြင်း)

အဆိုပါလုပ်ငန်းစဉ်တွင် လုပ်ကွက်ပြင်ဆင်ခြင်း၊ တွင်း foundation ချခြင်း၊ နေနံတူးစင်တည်ဆောက်ခြင်း၊ လွန်တွင်းတူးခြင်းနှင့် site အားမူလအတိုင်းပြန်လည်မွမ်းမံရာတွင် တွင်းတူးခြင်း စသည်တို့ပါဝင်ပါသည်။ ပုံမှန်အနေအထားတွင် အဆိုပါလုပ်ငန်းစဉ်များကိုဆောင်ရွက်ရန် အချိန် ၃ - ၄ လခန့်ကြာမြင့်နိုင်ပါသည်။ လွန်တူးစင်အား လွန်တွင်းတူးဖော်ရန်အတွက် အသုံးပြုပါသည်။ တွင်းတူးရှဲ့အား drill string နှင့် drill bit အတွင်းသို့ဖြတ်သန်းရောက်ရှိစေပြီး drill string နှင့် bore အကြားရှိ annulus ဆီသို့ပြန်တက်လာစေပါသည်။

Activities Involved in Appraisal Drilling (အကဲဖြတ်လွန်တွင်းတူးဖော်ရာတွင်ပါဝင်သော လုပ်ဆောင်မှုများ)

Seismic surveys မှတဆင့် အလားအလာကောင်းသော ဘူမိဗေဒဖွဲ့စည်းပုံများအား အတန်းအစားခွဲခြားပြီးနောက် reserve အားအကဲဖြတ်ရန်နှင့် စီးပွားဖြစ်နိုင်မှုအလားအလာတို့အားဆုံးဖြတ်ရန်အတွက် အကဲဖြတ်လွန်တွင်းတူးဖော်ခြင်းအား အစီအစဉ်ချရပါမည်။ ဓာတုဗေဒဆိုင်ရာ ခွဲခြမ်းစိတ်ဖြာမှုအတွက် အမှန်တကယ်ဖြစ်ပေါ်နေသော အပူချိန်အတိုင်းအတာ၊ ကျောက်နမူနာများ၊ ပြန်ထုတ်လာသော အရည်နမူနာများ စသည်တို့ကိုရရှိရန်အတွက် အကဲဖြတ်လွန်တွင်းတူးဖော်ခြင်းသည် မလုပ်မဖြစ် လုပ်ဆောင်ရန်လိုအပ်ပါသည်။ အကဲဖြတ်လွန်တွင်းတူးဖော်မှုတွင်ပါဝင်သော လုပ်ဆောင်မှုများမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- ***Site Selection & Preparation (လုပ်ကွက်ရွေးချယ်ခြင်းနှင့် ပြင်ဆင်ခြင်း)***

  ဤဒေသ၏ Sub-surface ဆိုင်ရာ အချက်အလက်များအား ခွဲခြမ်းစိတ်ဖြာလေ့လာမှုကို အခြေပြုပြီး ရေနံနှင့်သဘာဝဓာတ်ငွေ့ တည်ရှိနေမှုအလားအလာကို ထုတ်ဖော်နိုင်ပါသည်။ 2D seismic survey လုပ်ငန်းစဉ်မှတဆင့် ကနဦးကြည့်ရှုစစ်ဆေးမှုများအား ဇရိယာအတွင်းတွင် စတင်ခဲ့ပြီးဖြစ်ကာ seismic survey မှရရှိသော အချက်အလက်များအား အဓိပ္ပါယ်ကောက်ခြင်းဖြင့် လွန်တွင်းများ၏ တိကျသောတည်နေရာအား ရရှိနိုင်ပါသည်။

- ***Drilling Operation (လွန်တွင်းတူးခြင်း လုပ်ဆောင်မှု)***

  Hydrocarbon အား အကျိုးရှိစွာ အသုံးချနိုင်စေရန်အတွက် မျက်နှာပြင်နှင့် ရေစုကန်အကြားတွင် ရေသွယ်မြောင်းလိုအပ်ပါသည်။ ၎င်းအား လွန်တူးခြင်းလုပ်ငန်းစဉ်မှ ရရှိနိုင်ပါသည်။ လွန်တူးခြင်းလုပ်ဆောင်မှုအား နေ့ရောညပါ ဆောင်ရွက်ရပါမည်။ တွင်းတူးမှုကြာချိန်မှာ ဘူမိဗေဒဆိုင်ရာ setting များနှင့် hydrocarbon ဖွဲ့စည်းမှု တည်နေရာအပေါ်တွင်မူတည်ပြီး ၂ - ၃ လအတွင်းပြီးစီးနိုင်ပါသည်။

- ***Well Abandonment (တွင်းအားစွန့်ပယ်ခြင်း)***

  Subsoil user အနေဖြင့် တွင်းစွန့်ပယ်ခြင်းအား အချိန်မှီနှင့် အရည်အသွေးပြည့်ဝစွာ လုပ်ဆောင်ရမည်ဖြစ်ပါသည်။ တွင်းစွန့်ပယ်ခြင်း နည်းစဉ်များအတွက် လိုအပ်ချက်များမှာ

  - Pay beds များအတွက် သီးသန့်အရည်အသွေးအားမခံချက်
  - တွင်းထွက်ရေနှင့် ရေချိုများပါဝင်သော water bearing beds များ
  - Subsoil အနေအထားကိုပြည့်မှီသော casing strings များ၏ အလုံပိတ်စွမ်းရည်နှင့်
  - ဘူမိရူပဆိုင်ရာလေ့လာမှုများနှင့် အလုပ်အကိုင်အသိအမှတ်ပြုလက်မှတ်ဆိုင်ရာ ရုပ်ပိုင်းဆိုင်ရာလုပ်ဆောင်မှုများမှ အသိအမှတ်ပြုသည့် ပတ်ဝန်းကျင်အနေအထား စသည်တို့ဖြစ်ပါသည်။

ကာကွယ်တားဆီးခြင်းနှင့် စွန့်ပယ်ခြင်းလုပ်ငန်းများပြုလုပ်နေစဉ်တွင် ရှုပ်ထွေးမှုများနှင့် အရေးပေါ်ကိစ္စရပ်များအား ဖယ်ရှားရန်အတွက် ကောင်းမွန်စွာစွန့်ပယ်ခြင်း (well abandonment) စီမံချက်အားပြင်ဆင်ပြီး လိုက်နာဆောင်ရွက်ရပါမည်။ well abandonment လုပ်ငန်းစဉ်အတွက် Cement Plug တပ်ဆင်ခြင်းအား လိုက်နာရပါမည်။ ဘူမိဗေဒဆိုင်ရာ နှင့်/သို့ နည်းပညာဆိုင်ရာ အကြောင်းပြချက်များအရ well abandonment အား လုပ်ဆောင်နိုင်ပါသည်။

- ***Well Suspension (တွင်းအားခေတ္တရပ်ဆိုင်းခြင်း)***

  Sub-soil user အနေဖြင့် တွင်းအားခေတ္တရပ်ဆိုင်းခြင်း (well suspension) အား drilling ပြုလုပ်နေစဉ်ကာလအတွင်းတွင်လည်းကောင်း၊ drilling ပြီးမြောက်ချိန်တွင်လည်းကောင်း၊ drilling operation ပြုလုပ်နေစဉ်အတွင်း စတင်နိုင်ပါသည်။ well suspension အား drilling ပြုလုပ်နေစဉ်နှင့် drilling လုပ်ငန်းစဉ်ပြီးစီးသည့်အချိန်များတွင် ပြုလုပ်နိုင်ပါသည်။

Resources, Utilities and Infrasturcture Requirements (အရင်းအမြစ်များ၊ အသုံးချမှုများနှင့်အခြေခံအဆောက်အအုံ လိုအပ်ချက်များ)

ငင်းတွင် ဘိလပ်မြေ၊ လွန်သွား၊ casing နှင့် လွန်တူးရွံအတွက် chemicals များနှင့် rig package အတွက် အပိုပစ္စည်းများ စသည်တို့ပါဝင်ပါသည်။

Power Supply (စွမ်းအင်အထောက်အပံ့)

လွန်တူးစင်အတွက်လိုအပ်သော စွမ်းအင်ကိုဖြည့်ဆည်းရန် လိုအပ်ချက်ပမာဏအပေါ်မူတည်ပြီး ဒီဇယ် အင်ဂျင် (DG sets) များအား ရွေးချယ်အသုံးပြုနိုင်ပါသည်။ သို့သော် စွမ်းအင်အပြည့်အဝလိုအပ်သောအချိန် များတွင် DG set သုံးလုံးအား အသုံးပြုနိုင်ပြီး ကျန်တစ်လုံးအား အရန်အဖြစ်ထားရှိရပါမည်။

Water Consumption (ရေသုံးစွဲမှု)

လုပ်ငန်းသုံးနှင့် ဆေးကြောမှုအတွက် ရေပမာဏအနည်းငယ်သာအသုံးပြုပါသည်။ ထိုမှတပါး အဆိုပြုလုပ်ဆောင်မှုများသည် အချိန်တိုကာလအတွင်း ယာယီလုပ်ဆောင်မှုမျှသာဖြစ်ပါသည်။

Chemical and Fuel Storage (ဓာတုပစ္စည်းနှင့် လောင်စာဆီ သိုလှောင်ခြင်း)

စီမံကိန်းလုပ်ကွက်အတွင်း အမျိုးမျိုးသော ဓာတုပစ္စည်းများအားသိုလှောင်ထားရှိပြီး drilling အဆင့်အတွင်း ငင်းတို့အားအသုံးပြုပါသည်။ စီမံချက်ချမှတ်သောအဆင့်တွင် သုံးစွဲရန်အလားအလာရှိသော chemicals အားလုံးကို တွက်ချက်လုပ်ဆောင်ရပါမည်။

Major Source of Potential Impacts (ဖြစ်နိုင်ချေရှိသော အကျိုးသက်ရောက်မှု အဓိကရင်းမြစ်)

Appraisal drilling programme များနှင့် ဆက်စပ်ဖြစ်ပေါ်လာသောဆူညံသံများ၊ စွန့်ပစ်အညစ်အကြေးအရည်များ၊ အစိုင်အခဲစွန့်ပစ်ပစ္စည်းများ၊ လေထုထုတ်လွှတ်မှုနှင့် လျှံထွက်ခြင်း၊ ယိုစိမ့်ခြင်းနှင့် အရာဝတ္ထုများပြုတ်ကျခြင်း စသည်တို့အား အောက်တွင်ရှင်းလင်းဖော်ပြထားပါသည်။

Noise (ဆူညံသံ)

လုပ်ကွက်ပြင်ဆင်သည့်အချိန်တွင် ထွက်ပေါ်လာသော ဆူညံသံများသည် ဆောက်လုပ်ရေးလုပ်ငန်းသုံး စက်ပစ္စည်းကိရိယာများ လည်ပတ်နေမှုနှင့် ပစ္စည်းများအား သယ်ယူပို့ဆောင်နေသော ယာဉ်ယန္တရားများ၏ သွားလာနေမှုကြောင့်ဖြစ်ပါသည်။

Air Emissions (လေထု ထုတ်လွှတ်မှု)

လေထုထုတ်လွှတ်မှုများသည် drilling လုပ်ဆောင်မှုများပြုလုပ်သောအချိန်တွင် ထွက်ပေါ်လေ့ရှိပြီး ၎င်းတို့တွင် ယာဉ်ယန္တရားများ၊ လုပ်ကွက်ပြင်ဆင်မှုများ (ရှင်းလင်းခြင်း၊ တူးဖော်ခြင်း၊ မြေကျင်းတူးခြင်း) နှင့် လွန်တူးစင်အတွက်လိုအပ်သော စွမ်းအင်လိုအပ်ချက်ပြည့်မှီစေရန် ဒီဇယ်အင်ဂျင်နှင့် ပါဝါမီးစက်များအတွင်းရှိ ဒီဇယ်ဆီလောင်ကျွမ်းမှုမှ ထွက်ပေါ်လာသောအငွေ့များ စသည်တို့အားလုံးမှ ထွက်ပေါ်လာသော ထုတ်လွှတ်မှုများပါဝင်ပါသည်။

Effluences and Solid Waste (အရည်စွန့်ပစ်ပစ္စည်းနှင့် အစိုင်အခဲစွန့်ပစ်ပစ္စည်း)

အောက်ဖော်ပြပါ **Table 1.5** သည် drilling လုပ်ငန်းများဆောင်ရွက်နေစဉ်ကာလအတွင်း စွန့်ပစ်ပစ္စည်းအမျိုးအစားများကို ဖော်ပြထားပါသည်။

Table 1.5: drilling လုပ်ငန်းဆောင်ရွက်နေစဉ်ထွက်ပေါ်လာသော စွန့်ပစ်ပစ္စည်းများ

စဉ်	ထုတ်လွှတ်သည့် စွန့်ပစ်ပစ္စည်းများ	ဖော်ပြချက်များ
၁။	Drilling လုပ်ရာမှ ထွက်ပေါ်လာသောအစများ	၎င်းတွင်လွန်တူးစများပါဝင်ပြီး အဓိကအားဖြင့် ယေလှကျောက်၊ သဲနှင့် ရွှံစေးတို့မှဖြစ်ပါသည်။
၂။	အစိုင်အခဲဖယ်ထုတ်သော စက်များမှထွက်ကျလာခြင်း	အစိုင်အခဲများအား ထိန်းညှိ/ဖယ်ထုတ်သော စက်များမှ ထွက်ပေါ်လာခြင်း
၃။	လွန်တူးစာများအားကျင်းထုတ်လိုက်သောရေများ	၎င်းသည် ပြွတ်သိပ်နေသော ရွှံ့မြေစာများကို shale shaker (သို့) vibration screen မှဖယ်ထုတ်ရန်အတွက် ရေနှင့်ဆေးကြောသန့်စင်ရာမှ ထွက်ပေါ်လာခြင်းဖြစ်ပါသည်။
၄။	မြောင်းစွန့်ပစ်ရေများ	မြောင်းစွန့်ပစ်ရေများကို အရင်းအမြစ်အမျိုးမျိုးမှ လာသည်ကို တွေ့ရှိရပါသည်။ ၎င်းတို့တွင် အောက်ပါတို့ပါဝင်ပါသည်။

		• ရေနုံတွင်းတူးစက်ထိန်းစင် ကြမ်းခင်းဇရိယာအား သန့်စင်ခြင်း • စက်ဇရိယာကြမ်းခင်း ရေထွက်ပေါက် • shale shaker စကာအား ဆေးကြောခြင်း
၅။	မိလ္လာရေဆိုး	ရုံးအိမ်သာများနှင့် အလုပ်သမား/ဝန်ထမ်းများ၏ အိမ်ခန်းများမှ ထွက်လာသော ရေဆိုးများ
၆။	ဓာတုပစ္စည်းပါဝင်သော ရွံ့များ	ဓာတုပစ္စည်းပါဝင်သော ရွံ့များအားထုတ်လွှတ်မှုကြောင့် ရေဆိုးသန့်စင်ခြင်းလုပ်ငန်းစဉ်အား လုပ်ဆောင်ရပါသည်
၇။	Hydrocarbon စွန့်ပစ်ပစ္စည်းများ	စက်ပစ္စည်များအား ဆီအသစ် လဲလှယ်သည့်အခါ ထွက်ပေါ်လာသောဆီဟောင်းများ။
၈။	အန္တရာယ်မရှိသော အစိုင်အခဲစွန့်ပစ်ပစ္စည်း	အန္တရာယ်မရှိသော အစိုင်အခဲစွန့်ပစ်ပစ္စည်းများတွင် စက္ကူ၊ အဝတ်စုတ်၊ လျှော်မှုင်၊ သစ်သား၊ ပလပ်စတစ်၊ ကွန်တိန်နာ စသည်တို့ ပါဝင်ပါသည်။
၉။	ဆေးဘက်ဆိုင်ရာ စွန့်ပစ်ပစ္စည်း	ပမာဏအနည်းငယ်မျှသာဖြစ်သော စွန့်ပစ်ပစ္စည်းများ၊ ပတ်တီးလိပ်များ၊ ဆေထိုးပြွန်များ၊ ဆေးပုလင်းခွံများ စသည်တို့ ပါဝင်ပါသည်။
၁၀။	ဇီဝဆိုင်ရာပျက်စီးမှုရှိသည့် စွန့်ပစ်ပစ္စည်းများ	drilling ပြုလုပ်ခြင်းနှင့် အလုပ်သမား/ဝန်ထမ်းများ၏ အိမ်ခန်းများမှထွက်လာသော အစားအသောက်များမှ ထွက်ပေါ်လာသောစွန့်ပစ်ပစ္စည်းများ (သို့) သစ်ရွက်ခြောက်ကြွေများ စသည်တို့ပေါင်းစပ်ကာ ဇီဝဆိုင်ရာပျက်စီးနိုင်သည့် စွန့်ပစ်ပစ္စည်းများဖြစ်ပေါ်လာပါ သည်။

Selection of Alternative Technology (အခြားရွေးချယ်စရာ နည်းပညာများအားရွေးချယ်ခြင်း)

Bashneft မှ လုပ်ဆောင်ခဲ့သော seismic survey ဆိုင် ရာလေ့လာမှုများအရ အဆိုပါ EIA ဆိုင်ရာလေ့လာမှုအား ရွေးချယ်ပေးထားသော တွင်းတည်နေရာများအတွက် ပြုလုပ်ရပါမည်။ ထို့ကြောင့် ဤလေ့လာမှုတွင် အခြားရွေးချယ်စရာလုပ်ကွက်များ မပါဝင်ပါ။ သို့သော် drilling နှင့် operation နှင့်ဆိုင်သော အမျိုးမျိုးသောရွေးချယ်စရာနည်းလမ်းများကို EIA study ၏ အခန်း (၄) (စီမံကိန်းဆိုင်ရာ ရှင်းလင်းဖော်ပြချက်) တွင်ဆွေးနွေးထားသည့်အတိုင်း ထည့်သွင်းစဉ်းစားရပါမည်။

1.5 DESCRIPTION OF THE SURROUNDING ENVIRONMENT (အနီးအနားပတ်လည်ရှိ ရှိသဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ရှင်းလင်းဖော်ပြချက်)

အဆိုပြု wellsite ပတ်လည်ရှိ တည်ရှိနေသည့် ပတ်ဝန်းကျင်အခြေအနေများအား မြေပြင် (မြေမျက်နှာသွင်ပြင်၊ ဘူမိဗေဒ၊ ငလျင်)၊ လေထု၊ ဆူညံမှု၊ ရေ၊ ဇီဝဗေဒဆိုင်ရာနှင့် အထွေထွေ လူမှုစီးပွားရေးအခြေအနေများနှင့်လျော်ညီစွာ အောက်ဖော်ပြပါ အပိုင်းခွဲ (sub section) များတွင် အသေးစိတ်ဖော်ပြထားပါသည်။ လေ့လာနေသောဇရိယာ၏ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အခြေအနေများအား ၂၀၁၇ခုနှစ် နိုဝင်ဘာလ (မုတ်သုံရာသီအပြီး) အတွင်းတွင် လေ့လာခဲ့ပါသည်။

Wellsite ပတ်ဝန်းကျင်ရှိ သဘာဝပတ်ဝန်းကျင်အခြေအနေများအား ကွင်းဆင်းကြည့်ရှုစစ်ဆေးမှုများအတွင်း ကောက်ယူရရှိခဲ့ပြီး မြေမျက်နှာသွင်ပြင်မြေပုံများနှင့် ဂြိုဟ်တုမြေပုံများများ၏ အကူအညီဖြင့် အကဲဖြတ်မှုများ ပြုလုပ်ခဲ့ပါသည်။ ပတ်ဝန်းကျင်ဆိုင်ရာ သွင်ပြင်လက္ခဏာရပ်များကို အောက်ပါအတိုင်း ဆွေးနွေးထားပါသည်။

Topography (မြေမျက်နှာသွင်ပြင်)

လုပ်ကွက်ဇရိယာသည် မြေပြင်အနေအထားအားဖြင့် ညီညာပြန့်ပြူးနေပြီး အချို့နေရာများတွင် အနိမ့်အမြင့် အနည်းငယ်ရှိပါသည်။ မြေမျက်နှာသွင်ပြင်အရ ၎င်းသည် မြေပြင်ညီအနေအထားမှ ကုန်းပြင်မြင့်များ ပါဝင်နေပြီး ပင်လယ်ရေမျက်နှာပြင်အထက် ၂၆မီတာ မှ ၂၂၆ မီတာအထိ မြင့်မားပါသည်။ လုပ်ကွက်ဇရိယာ၏ အလယ်ပိုင်းသည် ပြန့်ပြူးနေပြီး မြောက်ဘက်နှင့် တောင်ဘက်ပိုင်းတို့တွင် ကုန်းပြင်မြင့်အနည်းငယ်ရှိကာ နွေရာသီတွင် အပူပိုင်းစိုစွတ်ရာသီဥတုမျိုး ရှိပါသည်။

Geology (ဘူမိဗေဒ)

ပြည်ချိုင့်ဝှမ်းဒေသသည် ရေနံကြွယ်ဝသော အနည်ကျကျောက် (ရေတိမ်ဒေသ) ဖြစ်ပြီး ကုန်းမကြီးနှင့် marine plate တို့ဆုံတွေ့ရာ နယ်နိမိတ်နှင့်အပြိုင် တည်ရှိနေပါသည်။ ကျောက်များအနေဖြင့် Eocene Laungshe ယေလ့ကျောက်, ထီးလင်း နှင့် ပုံတောင်သဲကျောက်နှင့် Oligocene-Miocene Pegu Group စသည် တို့ ဖြစ်ကြပါသည်။ အဆိုပါအုပ်စုတွင် သဲကျောက်ကြားခံလွှာ၊ ယေလ့ကျောက်နှင့် ကျောက်မီးသွေး (deltaic to fluvial facies) နှင့် ရေတိမ်ဒေသယေလ့ကျောက်များ၊ ထုံးကျောက်နှင့် သဲကျောက်စသည်တို့ ပါဝင်ပါသည်။

Seismicity (ငလျင်)

အဆိုပြု စီမံကိန်းသည် ၂၀၀၅ ခုနှစ် မြန်မာနိုင်ငံ ငလျင်ဇုံပြမြေပုံအရ ငလျင်ဇုံ-၂ အတွင်းတွင် ကျရောက်နေပြီး လုပ်ကွက်ဇရိယာသည် ငလျင်ဒဏ်အသင့်အတင့် ရှိသော ဇုံအတွင်းတွင်ရှိပြီး အင်အားပြင်းငလျင်များ ဖြစ်နိုင်ချေနည်းပါးပါသည်။

Climate and Micro-meteorology (ရာသီဥတုနှင့် မိုးလေဝသအခြေအနေ)

မြန်မာနိုင်ငံ၏ ရာသီဥတုသည် မိုးရွာသွန်းမှုများသော အပူပိုင်းမုတ်သုံရာသီဥတုမျိုးဖြစ်ပြီး စို ထိုင်းစမြင့်မားကာ သင့်တင့်မျှတသော နေရောင်ခြည်ရရှိပါသည်။

လုပ်ကွက်ဧရိယာသည် ဆောင်းရာသီ (နိုဝင်ဘာလမှ ဖေဖော်ဝါရီလထိ)၊ နွေရာသီ (မတ်လမှ မေလထိ)၊ မုတ်သုံ (မိုး) ရာသီ (ဇွန်လမှ အောက်တိုဘာလထိ) စသည်ဖြင့် ရာသီဥတုသုံးမျိုးခံစားရပါသည်။ မုတ်သုံရာသီသည် ပုံမှန်အားဖြင့် မေလကုန်မှ နိုဝင်ဘာလဆန်ပိုင်းထိ ကြာမြင့်တတ်ပါသည်။ ၂၀၁၄ ခုနှစ်မှတ်တမ်းအရ တစ်နှစ်ပတ်လုံးရွာသွန်းသော မိုးရေချိန်မှာ ၁၂၂၆ မီလီမီတာ ရှိပါသည်။ ပြည်ခရိုင်သည် မိုးနည်းဒေသဖြစ်ပြီး အမြင့်ဆုံးအပူချိန် ၄၀ ဒီဂရီစင်တီဂရိတ်မှ အနိမ့်ဆုံးအပူချိန် ၁၅ ဒီဂရီစင်တီဂရိတ်ထိ ရှိပါသည်။ လုပ်ကွက်ဧရိယာ၏ သိသာထင်ရှားသော လေတိုက်ရာအရပ်မှာ နောက်မြောက်ဘက်မှ (၂၁ %) ဖြစ်ပြီး လေတိုက်နှုန်းအပြင်းထန်ဆုံးအဖြစ် မြောက်-အနောက်မြောက် ဘက်မှ တိုက်ခတ်သည်ကိုတွေ့ရှိရပြီး လေတိုက်နှုန်းမှာ တစ်နာရီလျှင် ၈မိုင်နှင့်အထက် တိုက်ခတ်ပါသည်။ အချိန်အားလုံး၏ ၂၅.၉၆% တွင် လေပြည်လေညင်းများ ပျံ့နှံ့တိုက်ခတ်နေပါသည်။

Existing Land Setting (တည်ရှိနေသော မြေပြင် အနေအထား)

အဆိုပြု EP-4 လုပ်ကွက်သည် ပဲခူးတိုင်းဒေသကြီး၊ ပြည်ခရိုင်အတွင်းတည်ရှိပါသည်။ နဝဒေး တံတားသည် ဧရာဝတီမြစ်အပေါ်တွင်ဖြတ်သန်းဆောက်လုပ်ထားပြီး မြို့နယ်နှစ်ခုဖြစ်သော ပြည်နှင့် ပန်းတောင်းမြို့နယ်တို့အား ဆက်သွယ်ပေးထားပါသည်။

Land Use Land Cover (LULC) (မြေအသုံးချမှု မြေဖုံး)

ယေဘူယျအားဖြင့် ပဲခူးတိုင်းဒေသကြီးတွင် စိုက်ပျိုးမြေ၊ သီးနှံစိုက်ပျိုးမြေ၊ စိုက်ခင်းမြေ၊ စား ကျက်မြေနှင့် အခြေချနေထိုင်မှုတိုးတက်လာသောဧရိယာ (buildup area) စသည်တို့ ပါဝင်ပါသည်။

ရေနံရှာဖွေရေးလုပ်ဆောင်မည့်နေရာ (block area) ၏ မြေအသုံးချမှုနှင့် အပေါ်ယံမြေလွှာ ဆိုင်ရာမြေပုံကို ၂၀၁၉တွင် ထိဧရိယာအတွင်း GIS နှင့် အဝေးထိန်းကိရိယာများအား အသုံးပြုပြီး LANDSAT imageries နည်းစဉ်ကို အသုံးပြုကာ ဆောင်ရွက်ခဲ့ပြီး site visit ကာလအတွင်း မြေပြင် တိုက်ရိုက်လေ့လာမှုများဖြင့် မှန်ကန်ကြောင်း သက်သေပြနိုင်ခဲ့ပါသည်။ မြေပုံဖော်ပြချက်အရ block area ၏ ၅၅% သည် သစ်ပင်နှင့် ခြုံပင်များဖြစ်ပြီး၊ ပလပ်မြေနှင့် ရိတ်သိမ်းပြီးမြေ ၁၆%၊ စိုက်ပျိုးမြေ ၁၆%၊ ကျက်တီးမြေ ၈% နှင့် ရေပြင် ၄% နှင့် buildup area ၁% စသည်တို့ကို တွေ့ရှိရပါသည်။

2013 နှင့် 2019 LULC ဆိုင်ရာ Landsat imageries နှိုင်းယှဉ်ချက်များအရ အောက်ပါအတိုင်း နိဂုံးချုပ် နိုင်ပါသည်။

- မြေပြင်ပေါ်တွင် သစ်ပင်နှင့် ခြုံပင်အမြောက်အများတိုးပွားလာမှုသည် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာရှုထောင့်အရ ကောင်းမွန်သော ပြောင်းလဲမှုဖြစ်ကြောင်း တွေ့ရှိနိုင်ပါသည်။
- စိုက်ပျိုးမြေများ၏အစိတ်အပိုင်းအချို့တို့သည် ကျတ်တီးမြေ၊ ပလပ်မြေနှင့် ရိတ်သိမ်းမြေများအဖြစ် ပြောင်းလဲသွားပါသည်။

ပုံရိပ်များအရ LULC နှင့်ပတ်သက်ပြီး ၂၀၁၅ နှင့် ၂၀၁၉ အကြားပြောင်းလဲမှုသည် ၂၀၁၃ နှင့် ၂၀၁၅ အကြားပြောင်းလဲမှုနှင့် နှိုင်းယှဉ်လျှင် နည်းပါးသည်ကိုတွေ့ရှိနိုင်ပါသည်။

Soil Quality (မြေဆီလွှာအရည်အသွေး)

Study area အတွင်းရှိ ကျေးရွာ (၅) ရွာတွင်ကောက်ယူထားသော နမူနာများအား ခွဲခြမ်းစိတ်ဖြာပြီး မြေဆီလွှာ၏ အရည်အသွေးအား အကဲဖြတ်ပါသည်။ Study area အတွင်းရှိ မြေဆီလွှာ၏ PH တန်ဖိုးမှာ ၇.၂၈ မှ ၈.၃ အတွင်းနှင့် SS2 (သီးကုန်းကျေးရွာ) တွင်အမြင့်မားဆုံးဖြစ်ပြီး စမ်းသပ်တိုင်းတာသော တည်နေရာများအားလုံးသည် အနည်းငယ် alkaline ဆန်သောမြေသဘောရှိပါသည်။ ကျန်ရှိနေသော မြေဆီလွှာအရည်အသွေး အကဲဖြတ်မှုနှင့်သက်ဆိုင်သည့် ရလဒ်များကို အောက်တွင်ဖော်ပြထားပါသည်။

- မြေဆီလွှာအတွင်းရှိ Organic ပစ္စည်းပါဝင်မှုမှာ ၁.၁၅ မှ ၃.၄၇ % အတွင်း ဖြစ်ပါသည်။ ၎င်းသည် မြေကြီးအတွက် အသင့်တော်ဆုံးဖြစ်ပါသည်။
- မြေဆီလွှာတွင်ပါဝင်သော Nitrogen နှင့် Phosphorous ပါဝင်မှုမှာ ၀.၀၆ မှ ၀.၀၇ % ဖြစ်ပြီး ၉.၁၇ မှ ၁၆၄.၈၄ mg/kg အသီးသီးရှိကြပါသည်။ Nitrogen နှင့် Phosphorous ပါဝင်မှုပမာဏမှာ ကောင်မွန်ပြီး ၎င်းသည် အပင်များကြီးထွားမှုနှင့် သီးနှံထွက်ရှိမှုတို့အတွက် မရှိမဖြစ်လိုအပ်ပါသည်။
- Potassium, calcium နှင့် magnesium တို့ကဲ့သို့သော macro nutrients ပါဝင်မှုများသည် ၁၀၅၄ မှ ၁၈၇၅ mg/kg၊ ၁၃၇၅ မှ ၅၀၄၅ mg/kg နှင့် ၁၁၇၀ မှ ၂၃၅၁ mg/kg အသီးသီးရှိကြကာ ၎င်းတို့သည်ပမာဏအားဖြင့် ပိုလျှံနေပြီး မြေဆီလွှာစိမ့်ဝင်နိုင်မှုနှင့် ဖွဲ့စည်းတည်ဆောက်မှုတို့မှာ စိုက်ပျိုးရေးလုပ်ဆောင်မှုအတွက် သင့်လျော်ကြောင်း ရည်ညွှန်းနေပါသည်။

Sodium စုစည်းမှုအချိုး (SAR) သည် ရေသွင်းစိုက်ပျိုးမှုပြုလုပ်ရန်သင့်တော်မှု ရှိ/မရှိ ရေအားတိုင်းတာ ခြင်းဖြစ်ပါသည်။ SAR တန်ဖိုးမြင့်လေ ရေသွင်းစိုက်ပျိုးမှုပြုလုပ်ရန် သင့်တော်မှုမရှိလေ ဖြစ်ပါသည်။ SAR တန်ဖိုးသည် ၀.၂၆ မှ ၀.၉၃ အတွင်းဖြစ်ပြီး မြေဆီလွှာအတွင်းရေစိမ့်ဝင်နိုင်မှုအား မထိခိုက်နိုင်ပါ။

Study area ၏ မြေဆီလွှာအတွင်းရှိ သဲ၊ နုန်းနှင့် ရွှံပါဝင်မှု ရာခိုင်နှုန်းများမှာ ၇.၉ မှ ၄၁.၀၆%၊ ၃.၁၉ မှ ၁၂.၄၂% နှင့် ၅၅.၀၁ မှ ၈၆.၂၇% အသီးသီးရှိကြပါသည်။ ၎င်းအားအခြေပြုကာ တည်နေရာအားလုံးရှိ ခွဲခြမ်းစိတ်ဖြာထားသည့် နမူနာများအားလုံးသည် ရွှံ့ဆန်သောနုန်းမြေများဖြစ်ကြောင်း သိရှိနိုင်ပြီး ၎င်းတို့သည် ခြောက်သွေ့ချိန်တွင် ချောမွတ်နေပြီး စိုစွတ်ချိန်တွင် ပျော့ပြောင်းနေပါသည်။ မှုန့်ညက်နေသော ရွှံစေးမြေသည် ကြမ်းသောသဲမြေထက် ရေကိုပိုမိုထိန်းသိမ်းနိုင်ပါသည်။

Air Environment (ပတ်ဝန်းကျင်လေထု)

လေ့လာနေသောဇရိယာ၏ ပတ်ဝန်းကျင်ရှိလေထုအရည်အသွေးအား PM_{10}, $PM_{2.5}$, SO_2, NO_2 စသည်တို့နှင့် ပတ်သက်ပြီး တည်နေရာ (၄) ခုတွင် စမ်းသပ်တိုင်းတာခဲ့ပါသည်။ ပတ်ဝန်းကျင်ရှိ ညစ်ညမ်းစေသောအရာများနှင့် ပတ်သက်၍ ထွက်ပေါ်လာသည့်အချက်အလက်များသည် လေ့လာနေသောနေရာ၏ လက်ရှိလေထုအရည်အသွေးအဆင့်အတန်းအား ဆုံးဖြတ်နိုင်ရန် ကူညီပေးပါသည်။ အဆိုပါစမ်းသပ်တိုင်းတာမှုတည်နေရာ ၄ ခုအနက် နေရာ ၃ခု၌ စမ်းသပ်တိုင်းတာခြင်းအား ဒီဇယ် အင်ဂျင်မီးစက် (DG set) အားအသုံးပြုကာ လုပ်ဆောင်ခဲ့ပါသည်။ ၎င်း DG set အား PM_{10} နှင့် $PM_{2.5}$ နှစ်ခုပေါင်း၏ အဝေးနေရာ (မီတာ ၃၀ ကျော်) တွင်ထားရပါမည်။ DG set မှထုတ်လွှတ်မှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော အနှောက်အယှက်များအား ရှောင်ရှားနိုင်ရန် Air sampler အား လေဆန်ပိုင်းတွင်ထားရှိရပါမည်။ ၂၄နာရီအတွင်း PM_{10} level သည် ၃၉.၅ $\mu g/m^3$ နှင့် ၅၃.၁ $\mu g/m^3$ အတွင်း $PM_{2.5}$ သည် ၂၂.၄ $\mu g/m^3$ နှင့် ၃၂.၅ $\mu g/m^3$ အတွင်း ခြားနားမှုရှိပါသည်။ တည်နေရာ အားလုံးရှိ PM_{10} နှင့် $PM_{2.5}$ level များကို ၂၀၁၅ ခုနှစ် မြန်မာနိုင်ငံအမျိုးသားသဘာဝပတ်ဝန်း ကျင်အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များနှင့်အညီ နှိုင်းယှဉ်ဖော်ပြထားပါသည်။ အဆိုပါတန်ဖိုးများအားလုံးသည် သတ်မှတ်ထားသော ကန့်သတ်ချက်အတွင်းတွင် ရှိနေသော်လည်း ရေတွင်းလှကျေးရွာတွင် သတ်မှတ်ချက်ထက်အနည်းငယ် ပိုနေပါသည်။

SO2 နှင့် NO2 တန်ဖိုးများသည် ၆.၁ မှ ၇.၂ $\mu g/m^3$ နှင့် ၁၉.၆ မှ ၂၁.၂ $\mu g/m^3$ ထိ အသီးသီး ခြားနားမှုရှိပါသည်။ အဆိုပါတန်ဖိုးများအားလုံးသည် ၂၀၁၅ ခုနှစ် မြန်မာနိုင်ငံအမျိုးသား သဘာဝပတ်ဝန်းကျင်အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များအရ သတ်မှတ်ထားသော ကန့်သတ်ချက်များအတွင်းတွင် ကောင်းစွာတည်ရှိနေပါသည်။

Noise Environment (ပတ်ဝန်းကျင်ရှိ ဆူညံမှု)

ပတ်ဝန်းကျင်ရှိ ဆူညံမှု level အားစမ်းသပ်တိုင်းတာခြင်းကို ၂၀၁၇ ခုနှစ် မုတ်သုံရာသီနှောင်းပိုင်းကာလအတွင်းပြုလုပ်ခဲ့ပါသည်။ တည်နေရာ တစ်ခုချင်းစီတွင် ပုံမှန်အချိန်တစ် (၁) နာရီခြားတိုင်းတွင်ရှိမည့် L_{eq} တန်ဖိုးအားသိရှိနိုင်စေရန် ဆူညံမှု စမ်းသပ်တိုင်းတာခြင်းအား ၂၄ နာရီကျော်ကြာ တဆက်တည်းပြုလုပ်ခဲ့ပါသည်။

လူနေဇရိယာများတွင် နေ့အချိန်၌ တိုင်းတာရရှိသည့် ဆူညံမှု level မှာ ၄၇.၅ dB(A) မှ ၅၅.၅ dB(A) အတွင်းရှိပါသည်။ လေ့လာတွေ့ရှိရသည်မှာ ၂၀၁၅ ခုနှစ် မြန်မာနိုင်ငံအမျိုးသားသဘာဝပတ်

ဝန်းကျင်အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များအရ location NQ-1 တွင် သတ်မှတ်ချက်ထက် အနည်းငယ်ပိုမိုနေသည်ကို တွေ့ရှိရပါသည်။ အဆိုပါတည်နေရာရှိ ဆူညံမှု level သည် ယာဉ်ယန္တရားများရွေ့လျားမှုမှ ထွက်ပေါ်လာကြောင်း မှတ်ယူနိုင်ပါသည်။ ညအချိန်တွင်တိုင်းတာရရှိသော ဆူညံမှု level မှာ ၄၁.၅ dB(A) မှ ၄၄ dB(A) အတွင်းခြားနားမှုရှိပြီး ၎င်းသည် standard limit အတွင်းဖြစ်ပါသည်။ study area အတွင်းမည်သည့် စက်ရုံအလုပ်ရုံကိုမျှ မတွေ့ရှိရပါ။

Water Environment (ပတ်ဝန်းကျင်ရှိ ရေထု)

Hydrology and Drainage: (ဇလဗေဒ နှင့် ရေစီးကြောင်း)။ study area သည် ဧရာဝတီမြစ်၏ အနောက်ဖက်ကမ်းတွင်တည်ရှိပါသည်။ မြစ်သည် block ၏ အရှေ့မြောက်ဘက်မှ စတင်စီးဝင်ကာ block အလယ်ပိုင်းတလျောက်၊ ပန်းတောင်းမြို့ဧရိယာမှ ဖြတ်သန်းစီးစင်းသွားကာ တောင်ဘက်ပိုင်း သဲကြီးကုန်းကျေးရွာအနီးမှ ထွက်ခွာသွားပါသည်။

Study area အတွင်းရှိ အဓိကရေအရင်းအမြစ်မှာ ဧရာဝတီမြစ်ဖြစ်ပါသည်။ ထို့ပြင် study area အတွင်းအခြားသော ချောင်းငယ်အနည်းငယ်စီးစင်းနေသည်ကို တွေ့ရှိရပြီး အများစုမှာ တစ်နှစ်ပတ်လုံးစီးစင်းမှုမရှိသော (အချိန်ကာလတစ်ခုသာစီးစင်းသော) ချောင်းများနှင့် မိုးရေသာစီးစင်းသော ချောင်းများဖြစ်ကြပြီး နွေရာသီတွင် ခြောက်သွေ့နေပါသည်။ field survey ပြုလုပ်နေစဉ်အချိန်အတွင်း (မုတ်သုံရာသီအတွင်း) တစ်နှစ်ပတ်လုံးစီးစင်းမှုမရှိသော ချောင်းများနှင့် ရေအိုင်များတွင် ရေအမြောက်အများရှိနေပါသည်။

Water Quality – Surface Water (ရေအရည်အသွေး - မျက်နှာပြင်ပေါ်ရှိရေ)

ရေအရည်အသွေးအကဲဖြတ်မှုမှ ရရှိလာသော အကျိုးရလဒ်များမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- ခွဲခြမ်းစိတ်ဖြာမှုပြုလုပ်ထားသော မြက်နှာပြင်ရေ၏ pH ပမာဏမှာ ၇.၁၅ မှ ၇.၇၅ အတွင်းခြားနားမှုရှိပြီး တည်နေရာအားလုံးသည် alkaline အနည်းငယ်ဆန်သည့် သဘောရှိပါသည်။
- စုစုပေါင်း dissolved solid ပမာဏမှာ ၁၃၄ မှ ၅၆၂ mg/l အတွင်းခြားနားမှုရှိပြီး electrical conductivity သည် ၂၁၂ မှ ၈၉၂ µS/cm အတွင်းခြားနားမှုရှိကာ SW4 (ဒေါင်းမြတ်နားကျေးရွာအနီးရှိရေအိုင်) သည် အမြင့်ဆုံးဖြစ်ပြီး ဆားများ၊ သတ္တုဓာတ်များနှင့် အဟာရများ၊ စုစည်းမှုအားညွှန်ပြနေပြီး ထိုသို့ဖြစ်ရခြင်းမှာ မျက်နှာပြင်ပေါ်ရှိရေများသည် မြေဩဇာများတိုက်စားသယ်ဆောင်လာကာ ရေအိုင်များအတွင်းသို့ စီးဝင်သွားသောကြောင့် ဖြစ်ပါသည်။
- Total suspended solid ပမာဏမှာ ၀.၅ မှ ၁၈၈ mg/l အတွင်းခြားနားမှုရှိပြီး အမြင့်ဆုံးတန်ဖိုးအား ဧရာဝတီမြစ်အတွင်းတွင် တွေ့ရှိရပါသည်။ field visit အတွင်း စီးစင်းမှုနှုန်းမြန်ဆန်သည်ကိုတွေ့ရှိခဲ့ရပြီး ၎င်းသည် အမှုန်များအား ပေါလောပေါ်နေစေပါသည်။

- Disolved Oxygen (DO) တန်ဖိုးမှာ ၆.၁ မှ ၆.၃ အတွင်းခြားနားမှုရှိပြီး ၎င်းသည် အဆိုပါ ရေအတွင်း ပုံမှန်အတိုင်း နေထိုင်ကျက်စားနေသော ငါးနှင့် အခြားရေသတ္တဝါများ ကြီးထွားမှု နှင့် မျိုးပွားနိုင်မှုတို့အတွက် သင့်လျော်သော အခြေအနေဖြစ်ကြောင်း ဖော်ပြနေပါသည်။
- Heavy metals များဖြစ်သည့် mercury, chromium, lead, cadmium နှင့် arsenic တို့သည် တည်နေရာအားလုံး၌ ရှာဖွေတွေ့ရှိနိုင်မှုနှုန်းအောက် လျော့နည်းနေပါသည်။
- မှတ်တမ်းရယူထားသော BOD level မှာ ၁၂ မှ ၂၀ mg/l အတွင်းဖြစ်ပြီး ရေထဲတွင် organic matter ပါဝင်ကြောင်း ဖော်ညွှန်းနေပါသည်။ အမြင့်ဆုံး BOD တန်ဖိုးဖြစ်သည့် ၂၀ mg/l အား သဲကောကျေးရွာ (ရာသီအလိုက်စီးစင်းသောချောင်း)တွင်တွေ့ရှိရပြီး အခြားသော တည်နေရာများထက် အနည်းငယ်မြင့်မားနေသည်ကို တွေ့ရှိရမည်ဖြစ်ပြီး ၎င်းသည် အနီအနားတွင်နေထိုင်သူများစွန့်ထုတ်လိုက်သော အိမ်သုံးရေများသည် လယ်မြေများမှ ဖြတ်သန်းစီးစင်းလာသောကြောင့်ဖြစ်ပါသည်။
- ဧရာဝတီမြစ်အတွင်းတွင် iron ပါဝင်မှုမှာ ၇ mg/l ရှိပြီး faecal coliforms ပါဝင်နေသည်ကို လည်းတွေ့ရှိရပါသည်။

Field visit အတွင်း သိရှိမှတ်သားရသည်မှာ မြစ်ရေအားသောက်သုံးရေအဖြစ်အသုံးပြုကြသောကြောင့် ၎င်းအားတိုက်ရိုက်မသောက်သုံးမီအလျင် ပိုးသတ်ရန် အကြံပြုထားပါသည်။

Groundwater: (မြေအောက်ရေ)

- မြေအောက်ရေနမူနာ၏ pH ပမာဏမှာ ၆.၃၆ မှ ၇.၄၁ အတွင်းခြားနားမှုရှိကာ location GW 6 တွင် အနည်းငယ် acidic ဆန်သော သဘောရှိပါသည်။ pH level နိမ့်သောမြေအောက်ရေများ တွင် toxic metal level မြင့်မားစွာပါဝင်ပြီး အချိန်မတိုင်မီ သတ္တုရေပိုင်လိုင်းများ ပျက်စီးစေခြင်း၊ ချဉ်သောအရသာ ရှိခြင်းနှင့် အဝတ်များအား စွန်းထင်းစေခြင်းစသော ပြဿနာများအား ဖြစ်ပေါ်စေနိုင်ပါသည်။
- Total dissolved solid ပါဝင်မှုသည် ၈၄ မှ ၈၇၂ mg/l အတွင်းခြားနားမှုရှိပြီး electrical conductivity သည် ၁၃၃ မှ ၁၃၈၄ µS/cm အတွင်းခြားနားမှုရှိပြီး အမြင့်ဆုံးတန်ဖိုးမှာ GW 3 (ရေတွင်းလှကျေးရွာ) တွင်ဖြစ်ပြီး ၎င်းသည် သောက်သုံးရန်အတွက် အတော်လေး မြင့်မားသည့်တန်ဖိုးပါသည်။
- အနိမ့်ဆုံး TDS တန်ဖိုးအား GW 6 တွင်တွေ့ရှိရပြီး သန့်ရှင်းသောမြေအောက်ရေအရင်းအမြစ်မှ သဘာဝစမ်းရေသည် မြေပြင်ပေါ်သို့ပန်းထွက်နိုင်ပါသည်။

- Total hardness မှာ ၂၄ မှ ၆၈၈ mg/l အတွင်းခြားနားမှုရှိပြီး အမြင့်ဆုံးတန်ဖိုးအား ရေတွင်းလှကျေးရွာတွင် မှတ်တမ်းရယူခဲ့ပါပြီး ၎င်းသည် သောက်သုံးရန်အတွက် အတော်လေး မြင့်မားသည့် တန်ဖိုးဖြစ်ပါသည်။
- အမျိုးမျိုးသော တည်နေရာများတွင် စမ်းသပ်တိုင်းတာသည့် calcium တန်ဖိုးများသည် ၁၆ မှ ၃၈၆ mg/l နှင့် magnesium တန်ဖိုးများသည် ၈ မှ ၃၀၂ mg/l အတွင်း ခြားနားမှုရှိပါသည်။ ထို့ကြောင့် မှတ်တမ်းရယူထားသောhardness တန်ဖိုးများသည် သက်ဆိုင်ရာ တည်နေရာများတွင် ခွဲခြမ်းစိတ်ဖြာခဲ့သော calcium နှင့် magnesium ions များနှင့် ဆက်စပ်မှု ရှိပါသည်။
- Iron ပါဝင်မှုသည် ၀.၁ မှ ၀.၂ mg/l အတွင်း ခြားနားမှုရှိပြီး အမြင့်ဆုံးတန်ဖိုးအား သဲကောကျေးရွာတွင် မှတ်တမ်းရယူခဲ့ပါသည်။ ထို့ကြောင့် ၎င်းတွင် မနှစ်မြို့ဖွယ် အနံ့၊ အရသာနှင့် သွင်ပြင်လက္ခဏာများအားမသွေရသက်ဝင်သို့ treatment လည်းမလုပ်သင့်ပါ။
- မြေအောက်ရေနမူနာများ၏ fluoride ပါဝင်မှုမှာ သောက်ရေအတွက် ကမ္ဘာ့ကျန်းမာရေးအဖွဲ့ (WHO) ၏ စံသတ် မှတ်ချက်နှင့် ကိုက်ညီကြောင်း တွေ့ရှိရပါသည်။

အထက်ပါခွဲခြမ်းစိတ်ဖြာ လေ့လာမှုရလဒ်များအား အချုပ်အားဖြင့်ဆိုရသော် မြေအောက်ရေနမူနာများ၏ parameters များအားလုံးသည် သောက်သုံးရေအတွက် ကမ္ဘာ့ကျန်းမာရေးအဖွဲ့ (WHO) ၏ စံသတ် မှတ်ချက်အား အတော်အတန်ပြည့်မှီကြောင်း တွေ့ရှိရပါသည်။ ထို့ပြင် မြေအောက်ရေအရည်အသွေးရလဒ်များတွင် မည်သည့်စက်ရုံဆိုင်ရာ ညစ်ညမ်းမှုအနည်းငယ်ကိုမျှ ဖော်ပြထားခြင်းမရှိပါ။

Biological Environment (ဇီဝသဘာဝပတ်ဝန်းကျင်)

Study area တွင် စိုက်ပျိုးမြေ (စပါးခင်းနှင့် သီးနှံ) နှင့် မိုးခေါင်မှုဒဏ်အားခံနိုင်ရည်ရှိသည့် သစ်ပင်များပေါက်ရောက်သောကျတ်တီးမြေ စသည်တို့ ပါဝင်ပါသည်။ Field visit အတွင်း ရွက်ပြတ်ပင်များနှင့် အစိမ်းရောင်ခြုံပုတ်ပင်များအား တွေ့ရှိခဲ့ပါသည်။ Study area ၏ အဓိကစိုက်ပျိုးရေးလုပ်ငန်းမှာ စပါးစိုက်ပျိုးခြင်းဖြစ်ပါသည်။

အမျိုးမျိုးသော အစိုးရရုံးဌာနများ၊ အဆိုပါ ဇရိယာနှင့်ဆိုင်သော သစ်တောရုံးများမှ ကောက်ယူခဲ့သော secondary data များ field visit အတွင်းတွေ့မြင်ခဲ့မှုများ စသည်တို့ကိုအခြေပြုပြီး တိရစ္ဆာန်မျိုးစိတ်များကို အကဲဖြတ်ခြင်းအား ပြုလုပ်ပါသည်။ ခွေးအ၊ မြေခွေး၊ လင်းနို့၊ ရှဉ့်၊ ယုန်၊ ကြွက် အစရှိသည်တို့သည် သဘာဝအတိုင်းတွေ့ရှိရသည့် မျိုးစိတ်များဖြစ်ကြပါသည်။ ယေဘုယျအားဖြင့် တွေ့ရှိရသောဒေသများတွင် ဗျိုင်း၊ စာကလေး၊ ဥဩ နှင့် ခို အစရှိသည်တို့ဖြစ်ပါသည်။ study area အတွင်းတွင် eco-sensitive zone များမရှိပါ။

Plankton နှင့် Benthos မျိုးစိတ်များအားလေ့လာခြင်း (ဇရာဝတီမြစ်အတွင်းတွေ့ရှိသော) အား ဒုတိယအကြိမ်သုတေသနပြုခြင်းကို အခြေပြုလုပ်ဆောင်ပါမည်။ Plankton နှင့် Benthos များကိုလေ့

လာခြင်းသည် waterbodies ၏ အရည်အသွေးကိုအကဲဖြတ်ရာတွင် အကူအညီပေးပါသည်။ ထိုဒေသ ရှိလူမှုအသိုင်းအဝိုင်းသည် waterbody ၏ ဇီဝကမ္မဖြစ်စဉ်များဖြစ်သည့် Alkalinnity, conductivity, nutriants နှင့် BOD အစရှိသည်တို့အပေါ်တွင် အထိခိုက်မခံနိုင်ကြသောကြောင့် အဆိုပါအခြေအနေ နှင့် ရေရှိသဘာဝပြောင်းလဲခြင်းကို အကဲဖြတ်ရန်အတွက် အကောင်းဆုံး indicators အား ထည့်သွင်း စဉ်းစားရပါမည်။

Socio-economic Status (လူမှုစီးပွားရေး အခြေအနေ)

Study area အတွင်းရှိ ကျေးရွာများ၏ လူမှုစီးပွားရေးဆိုင်ရာ အခြေအနေဆိုင်ရာ အချက်အ လက်များအား အများပြည်သူနှင့်တွေ့ဆုံခြင်းများနှင့် secondary sources (သန်းကောင်စာရင်းအချက် အလက်များ၊ ပန်းတောင်မြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှရရှိသော အချက်အလက်များ) စ သည်တို့မှ ကောက်ယူရရှိပါသည်။ အများပြည်သူနှင့် တွေ့ဆုံပွဲများအား drilling site ၏ အနီးပတ် ဝန်းကျင်ရှိ ကျေးရွာများတွင် ပြုလုပ်ကျင်းပခဲ့ပါသည်။

Demography: (လူဦးရေစာရင်း ကောက်ယူမှု)။ အဆိုပြု drilling site သည် ပြည်ခရိုင်၊ ပန်း တောင်းမြို့နယ်အနီးတွင် တည်ရှိပါသည်။ ပန်းတောင်းမြို့နယ်တွင် ကျေးရွာအုပ်စု ၁၇စု ပါဝင်ပါသည်။ ၂၀၁၇ ခုနှစ် ဇူလိုတွင်ကောက်ယူသော စာရင်းအရ အဆိုပါမြို့နယ်တွင် လူဦးရေစုစုပေါင်း ၁၄၇,၁၂၃ ဦးနှင့် စုစုပေါင်းအိမ်ထောင်စု ၃၇,၂၉၈ စုတို့ ရှိကြပါသည်။

Religion and Culture: (ယုံကြည်ကိုးကွယ်မှုနှင့် ယဉ်ကျေးမှု)။ မြန်မာနိုင်ငံလူဦးရေ၏ ၈၀% ခန့်သည် ထေရဝါဗုဒ္ဓဘာသာကို ကိုးကွယ်ကြပါသည်။ ကျန်လူဦးရေများသည် ခရစ်စယာန်ဘာသာ၊ အစ္စလာမ် ဘာ၊ ဟိန္ဒူဘာသာနှင့် နတ် စသည်တို့ကို ကိုးကွယ်ကြပါသည်။ study area တွင် မြန်မာနိုင်ငံ၏ အ များဆုံးကွယ်မှုဖြစ်သော ဗုဒ္ဓဘာသာကိုးကွယ်သူများ နေထိုင်ကြပါသည်။

Education: (ပညာရေး)။ လူဦးရေနှင့် အိမ်အကြောင်းအရာ သန်းခေါင်စာရင်း၊ ပြည်ထောင်စု အစီရင် ခံစာ ၂၀၁၄ ခုနှစ် မေလ ကောက်ခံမှုအရ ပဲခူးတိုင်းဒေသကြီး၏ စာတတ်မြောက်မှုနှုန်းမှာ ၉၄.၇% ရှိပါ သည်။ study area အတွင်း တက္ကသိုလ်နှင့် ကောလိပ်များ မရှိပါ။ အဆင့်မြင့်ပညာအတွက် အနီးဆုံး တက္ကသိုလ်များမှာ ပြည်တက္ကသိုလ်၊ ပြည်နည်းပညာတက္ကသိုလ်နှင့် ပြည်ကွန်ပြူတာ တက္ကသိုလ် စ သည်တို့ဖြစ်ပြီး ၎င်းတို့သည် EP-4 Block ၏ အရှေ့မြောက်ဘက် ၈ ကီလိုမီတာခန့်အကွာ ပြည် မြို့တွင် ရှိကြပါသည်။

Occupations and Incomes (အလုပ်အကိုင်နှင့် ဝင်ငွေ)။ ပဲခူးတိုင်းဒေသကြီးရှိ၊ study area ပတ်ဝန်းကျင်ရှိအဓိကစီးပွားရေးလုပ်ငန်းမှာ စိုက်ပျိုးရေးဖြစ်ပါသည်။ အဓိကစိုက်ပျိုးသီးနှံမှာ စပါးဖြစ်ပြီး ၎င်းအား မုတ်သုံရာသီ (ဖွန်လမှ ဒီဇင်ဘာ) အတွင်း စိုက်ပျိုးကြပါသည်။ ရာသီပေါ်ဟင်းသီးဟင်းရွက် နှင့် အသီးအနှံများကိုလည်း အဆိုပါစိုက်ပျိုးမြေများတွင် စိုက်ပျိုးကြပါသည်။ သို့သော်အများစုမှာ ကိုယ်

တိုင်စားသုံးရန်အတွက်ဖြစ်ပြီး ပိုလျှံသောအရာများအား ဒေသခံများသာစားသုံးနိုင်ရန်အတွက် ဒေသဆိုင်ရာစျေးကွက်များသို့ တင်ပို့ရောင်းချကြပါသည်။ ရွာသားများသည် အိမ်မွေးတိရစ္ဆာန်များဖြစ်သော နွား၊ ဝက်၊ ကြက်၊ ဘဲ စသည်တို့အား အိမ်စားသုံးရန်အတွက် မွေးမြူကြပါသည်။ study area အတွင်းတွင် မည်သည့်စက်မှုလုပ်ငန်းများကိုမျှ မတွေ့ရှိရပါ။ ပြောင်းနှင့် ဟင်းသီးဟင်းရွက်စိုက်ပျိုးမှုအား အချို့နေရာများတွင် တွေ့ရှိရပါသည်။ ကုန်စုံဆိုင်၊ ပန်းပဲလုပ်ငန်း၊ လက်သမားလုပ်ငန်း၊ ဆံသဆိုင်၊ ပန်ရံလုပ်ငန်း စသည်တို့သည် ဒေသခံများအတွက် အခြားဝင်ငွေရင်း မြစ်များ ဖြစ်ကြပါသည်။

Agriculture: (စိုက်ပျိုးရေး)။ study area အတွင်းရှိ အိမ်ထောင်စုများအားလုံးသည် ၎င်းတို့၏ ဝင်ငွေအတွက် စိုက်ပျိုးရေးအပေါ်တွင် မှီခိုနေရပါသည်။ ပန်းတောင်းမြို့နယ်အတွင်းရှိ စုစုပေါင်းစိုက်ပျိုးမြေမှာ ၈၉,၀၉၈ ဧက ဖြစ်ပါသည်။ စပါးစိုက်ပျိုးဧကမှာ ၄၇,၀၈၇ ဧကဖြစ်ပါသည်။ ပန်းတောင်းဒေသတွင် အများအားဖြင့် မုတ်သုံရာသီတစ်ခုသာလျှင် စပါးစိုက်ပျိုးလေ့ရှိပါသည်။ စပါးစိုက်ပျိုးသည့်ကာလမှာ ဇွန်လမှ ဒီဇင်ဘာလအထိဖြစ်ပါသည်။

Fishery: (ငါးလုပ်ငန်း)။ အဓိကအားဖြင့် ရေအရင်းအမြစ်ရှိရာဧရာဝတီမြစ်အနီးတွင် တည်ရှိနေသောကြောင့် ငါးဖမ်းလုပ်ငန်းသည် အဓိကကျသော လုပ်ဆောင်မှုဖြစ်ပါသည် (ရင်းမြစ်။ Public Consultation၊ ဒုညွန်မှူး၊ ငါးလုပ်ငန်းဦးစီးဌာန တို့နှင့် တွေ့ဆုံမေးမြန်းမှု စသည်တို့မှရရှိသော အချက်အလက်များ)။ သို့သော် ငါးဖမ်းဆီးခြင်းသည် အဓိကစီးပွားရေးအတွက်မဟုတ်ဘဲ အိမ်စားသုံးရန်အတွက်သာ အဓိကဖြစ်ပါသည်။ သို့သော် ပိုလျှံပါက အခြားသူများအား ရောင်းချပေးပါသည်။ ငါးလုပ်ငန်းလုပ်ကိုင်သော အိမ်ထောင်စုများသည် စိုက်ပျိုးရေးလုပ်ငန်းများအားလည်း လုပ်ကိုင်ပါကြောင်း မှတ်တမ်းရရှိပါသည်။

ဒုညွန်မှူး၊ ငါးလုပ်ငန်းဦးစီးဌာန ထံမှရရှိသောသတင်းအချက်အလက်များအရ ဧရာဝတီမြစ်အတွင်း စီးပွားဖြစ်ဖမ်းယူရရှိသော ငါးမှာ ငါးသလောက်ဖြစ်ပြီး ၎င်းကို ဒေသအခေါ်အားဖြင့် ပြည်မျိုးစိတ်ဟုသိရှိရပါသည်။ ၎င်းတို့သည် မုတ်သုံရာသီဖြစ်သော ဇွန်လမှ ဩဂုတ်လအတွင်း ဥချသားပေါက်ရန်အတွက် ပင်လယ်မှ မြစ်ဆီသို့ ကူးခပ်ရောက်ရှိလာကြပါသည်။

Infrastructure Facilities: (အခြေခံအဆောက်အအုံ စီမံဆောင်ရွက်မှု)။ EP-4 block တွင် ဧရာဝတီမြစ်သည် သယ်ယူပို့ဆောင်ရေးအတွက် အဓိကလမ်းကြောင်းဖြစ်ပါသည်။ လိုအပ်ချက်ကြောင့် ကြီးမားလေးလံသော ကုန်တင်သင်္ဘောကြီးများသည် အဆိုပါမြစ်အတွင်းမှ ဖြတ်သန်းသွားလာရပါသည်။ မြစ်ကမ်းအနီးတွင်နေထိုင်ကြသော ရွာသားများအနေဖြင့်လည်း သယ်ယူပို့ဆောင်မှုအတွက် လှေများအား အသုံးချကြကြောင်း သိရှိမှတ်သားရပါသည်။ Study area အတွင်းရှိလမ်းအများစုမှ လမ်းခင်းမထားခြင်း၊ တောတောင်လမ်းကျဉ်းများဖြစ်ခြင်း နှင့် ဖုန်ထူထပ်ခြင်းတို့ကို တွေ့ရှိရပါသည်။

Communication: (ဆက်သွယ်ရေး)။ Study area အတွင်း တစ်ခုတည်းရှိသော ဆက်သွယ်မှုစနစ်မှာ မိုဘိုင်းဖုန်းဖြစ်ပါသည်။ တယ်လီနော နှင့် မြန်မာ့ဆက်သွယ်ရေး (MPT) ဟူ၍ အဓိက telecom operator နှစ်ခုရှိပါသည်။

Drinking Water Availability: (သောက်ရေရရှိနိုင်မှု)။ ပဲခူးတိုင်းဒေသကြီးအတွင်းနေထိုင်ကြသူများ၏ ၈၁% နီးပါးခန့်သည် သောက်ရေရရှိကြပြီး ၎င်းသည် တစ်နိုင်ငံလုံးအတိုင်းအတာဖြစ်သည့် ၆၉% ထက် ပိုမိုမြင့်မားပါသည် (ဒေသဆိုင်ရာ အစိုးရအဖွဲ့၊ ပဲခူးမြို့၊ UNDP Myanmar, ၂၀၁၄ခုနှစ်)။ အလားတူပင် အဆိုပြု area အတွင်းရှိကျေးရွာများအားလုံးနီးပါးသည်လည်း သောက်သုံးရေရရှိကြပါသည်။ Study area အတွင်းတွင် မြေအောက်ရေသည် အလွယ်တကူရရှိနိုင်သော ရင်းမြစ်ဖြစ်ပါသည်။

Sanitation Facility: (သန့်စင်ခန်း)။ ယေဘူယျအားဖြင့် ပဲခူးတိုင်းဒေသကြီးတစ်ခုလုံးတွင် အညစ်အကြေးစွန့်မှုဆိုင်ရာ အဆောက်အုံများ အားဆောင်ရွက်နိုင်မှုမှာ (၇၇%) ခန့်ရှိပြီး တစ်နိုင်လုံးအတိုင်းအတာဖြစ်သော (၇၉%) ထက် အနည်းငယ်လျော့နည်းပါသည် (ဒေသဆိုင်ရာ အစိုးရအဖွဲ့၊ ပဲခူးမြို့၊ UNDP Myanmar, ၂၀၁၄ခုနှစ်)။ ကွဲပြားစွာဖြင့် အဆိုပြု study area အတွင်းရှိ ကျေးရွာများအားလုံးတွင် အညစ်အကြေးစွန့်မှုဆိုင်ရာ အဆောက်အုံ (အိမ်သာ) များ ရှိကြပါသည်။ အိမ်သာများဆီမှ အညစ်အကြေးများအား အများအားဖြင့် တွင်းထဲမှမြေကြီးအတွင်းသို့ တိုက်ရိုက်စိမ့်ဝင်စေခြင်းဖြင့်လည်းကောင်း ရေစစ်ကန်များအတွင်းသို့ စီးဝင်စေခြင်းဖြင့်လည်းကောင်း လုပ်ဆောင်ကြပါသည်။

Solid Waste Management: (အစိုင်အခဲအမှိုက်စီမံခန့်ခွဲမှု)။ Study area အတွင်းတွင် အစိုင်အခဲအမှိုက်များစီမံခန့်ခွဲမှု နေရာများကိုမတွေ့ရှိရပါသည်။ အဆိုပါအမှိုက်များအား open area များတွင် စွန့်ပစ်ကြပါသည်။

Health Care Facilities: (ကျန်းမာရေးဆိုင်ရာ အဆောက်အအုံများ)။ ပန်တောင်းမြို့နယ်တွင် ဒေသခံများအတွက် ကျန်းမာရေးဆိုင်ရာ အဆောက်အအုံ/ ဆေးရုံ (၄)ခု ရှိပါသည်။ ထို့ပြင် မြို့နယ်ဇရိယာအတွင်း ကျန်းမာရေးဆေးပေးခန်း (၅)ခု ရှိပါသည်။ သို့သော်လက်ရှိတွင် ကျေးရွာများ၌ ကျေးလက်ကျန်းမာရေးဌာနများအား မတွေ့ရှိရပါ။

Electrictiy (လျှပ်စစ်)။ Study area အတွင်းရှိ ကျေးရွာအများစုတွင် (24 x 7) လျှပ်စစ်မောတ်အားလိုင်းသွယ်မှုမရှိပါ။ ကျေးရွာအနည်းငယ်သည် နေရောင်ခြည်စွမ်းအင်ဖြင့် မီးထွန်းကြပြီး အချို့သောကျေးရွာများတွင် ကားဘက်ထရီများအား ယာယီမီးထွန်းရန်အတွက် အသုံးပြုကြပါသည်။ ကျေးရွာရှိဘုန်းကြီးကျောင်းများတွင် မီးထွန်းရန်အတွက် ဒီဇယ်အင်ဂျင် မီးစက်များအား အသုံးပြုကြပါသည်။

1.6 IMPACT AND MITIGATION MEASURES (အကျိုးသက်ရောက်မှုများနှင့် လျော့ပါးစေရေးအစီအမံများ)

ထိခိုက်မှုများကို ခွဲခြမ်းစိတ်ဖြာလေ့လာခြင်းဆိုသည်မှာ exploratory drilling ပြုလုပ်ခြင်းနှင့် ၎င်းတို့ နှင့်သက်ဆိုင်သော လုပ်ဆောင်ချက်များကို cover ဖြစ်စေခြင်းကို ဆိုလိုပါသည်။ Bashneft ၏ ကနဦး ရည်ရွယ်ချက်၊ အဆိုပြုအမြင်နှင့် Appraisal well drilling တို့အတွက် လိုအပ်ချက်မှာ hydrocarbon reservoir ပါဝင်မှုနှင့် အဆိုပါ reservoir ပါဝင်မှုကို ဆုံးဖြတ်ရန်ဖြစ်ပြီး ၎င်း၏ စီးပွားရေးဆိုင်ရာ ဖြစ်မြောက်နိုင်စွမ်းအတွက် လုပ်ဆောင်ရန်ဖြစ်ပါသည်။

အဆိုပြုစီမံချက်နှင့်ပတ်သက်ပြီး ကြိုတင်ခန့်မှန်းထားသည့် အရည်အသွေးဆိုင်ရာ ထိခိုက်မှု အလားအလာများနှင့် ပတ်ဝန်းကျင်သို့ ၎င်းနှင့်သက်ဆိုင်သော အကျိုးဆက်များသက်ရောက်မှုသည် study area အတွင်း ပတ်ဝန်းကျင်ဆိုင်ရာ အထိခိုက်မခံနိုင်မှုများ (သို့) အရင်းအမြစ်ရရှိနိုင်မှုများ စသည်တို့အပေါ်တွင် မူတည်ပါသည်။ ဆိုလိုသည်မှာ well site မှ ၅ ကီလိုမီတာ ပတ်လည်အကွားအဝေးအား အပြန်အလှန်သက်ရောက်မှုရှိသော matrices အဖြစ်သတ်မှတ်ထားပါသည်။

အကျိုးသက်ရောက်မှုများအား အောက်ဖော်ပြပါစံနှုန်းများအတိုင်း ဖြစ်နိုင်ချေရှိသည့် ၎င်းတို့၏ သဘောသဘာဝအရ တွက်ချက်ခြင်းဖြင့် အလားအလာရှိသည့် အကျိုးသက်ရောက်မှုများအား ဖော်ပြနိုင်ပါသည်။

(က) အကျိုးသက်ရောက်မှုများအား ၎င်းတို့၏ ပျံ့နှံ့ရောက်ရှိနိုင်မှုအကွာအဝေးပေါ်မူတည်ပြီး အတန်းအစားထပ်မံခွဲခြားနိုင်ပါသည်။ ဆိုလိုသည်မှာ-*ဒေသတွင်း*၊ စီမံကိန်းဧရိယာမှ (၀၁) ကီလိုမီတာ radius ခန့် အတွင်းပျံ့နှံ့နိုင်၊ *အတော်အတန်*၊ (၀၁) မှ (၀၂) ကီလိုမီတာ radius အတွင်းပျံ့နှံ့သက်ရောက်မှုရှိနိုင်၊ *ဒေသလုံးဆိုင်ရာ*၊ (၀.၂) ကီလိုမီတာအလွန်အထိရောက်ရှိနိုင်။

(ခ) အကျိုးသက်ရောက်မှုများအား ကာလတို၊ ကာလအတော်အတန်နှင့် ကာလရှည် စသည်ဖြင့် တည်ရှိနိုင်သော အချိန်ကြာမြင့်မှု scale နှင့်ပတ်သက်၍ အတန်းအစားခွဲခြားနိုင်ပါသည်။ အချိန်တစ်နှစ်ထက် တိုတောင်းသော အကျိုးသက်ရောက်မှုများအား ကာလတိုအဖြစ်လည်းကောင်း၊ တစ်နှစ်မှသုံးနှစ်အတွင်းကို ကာလအတော်အတန်အဖြစ်လည်းကောင်း သုံးနှစ်နှင့်အထက်ကို ကာလရှည်အဖြစ်လည်းကောင်း သတ်မှတ်ပါသည်။

(ဂ) အပေါင်းလက္ခဏာဆောင်သော သက်ရောက်မှုများအား ကောင်းကျိုးသက်ရောက်မှုများအဖြစ် သတ်မှတ်ချိန်တွင် အနှုတ်လက္ခဏာဆောင်သော သက်ရောက်မှုများအား ဆိုးကျိုးသက်ရောက်မှုများအဖြစ် သတ်မှတ်ပါသည်။

Risk Assessment (စွန့်စားရမှုများအား အကဲဖြတ်ခြင်း)

Drilling operations တွင်ပါဝင်သော လုပ်ဆောင်မှုများသည် မြန်မာနိုင်ငံ၏ စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှုအတွက် မရှိမဖြစ်လိုအပ်ပါသည်။ သို့သော် အမျိုးမျိုးသော drilling operation အဆင့်များသည် စွန့်စားရမှုများနှင့်ဆက်စပ်နေပြီး drilling operation အတွင်း ဖြစ်ပေါ်တတ်သောကွာဟမှုများကို

ရှောင်ကြဉ်နိုင်ရန်အတွက် drilling operation နှင့်အတူအဆိုပါ risk များအား ပြင်ဆင်ဆောင်ရွက်သင့်ပါသည်။ Drilling operation ၏ ကွဲပြားခြားနားသောအဆင့်တိုင်းတွင် တွေ့ကြုံရမည့် အမျိုးမျိုးသော စွန့်စားရမှုများမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- တွင်းတည်ဆောက်မှုနှင့်ဆက်နွယ်ပြီး စွန့်စားရမှုများ။
- တွင်းတည်ဆောက်စဉ် lost circulation နှင့် ဆက်နွယ်ပြီး စွန့်စားရမှုများ။
- ရေနံနှင့် သဘာဝဓာတ်ငွေ့ထွက်ပေါ်လာခြင်းနှင့် ဆက်နွယ်ပြီး စွန့်စားရမှုများ။
- Drill string များ ကပ်ညှိခြင်းနှင့် ဆက်စပ်ပြီး စွန့်စားရမှုများ။
- Cementing process နှင့်ဆက်နွယ်ပြီး စွန့်စားရမှုများ။

1.7 CUMULATIVE IMPACTS (တိုးပွားလာသော အကျိုးသက်ရောက်မှုများ)

လူမှုစီးပွားရေးဆိုင်ရာ ထိခိုက်မှုအကဲဖြတ်ခြင်းပါဝင်သော EIA study အား စီမံကိန်း၏ အဓိကမဏ္ဍိုင်အဖြစ် စဉ်းစားလုပ်ဆောင်ရာတွင် တိုးပွားလာသော ထိခိုက်မှုအကဲဖြတ်ခြင်းအားလည်း တန်ဖိုးရှိသော သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ အကဲဖြတ်မှု (သို့) VECs တွင် တိတိကျကျဖော်ပြပေးရပါမည်။ တိုးပွားလာသောထိခိုက်မှုများအား အကဲဖြတ်ရန်အတွက် သိသာထင်ရှားသည့် VECs များကိုအောက်တွင်ဖော်ပြထားပါသည်။

(၁) လေအရည်အသွေး
(၂) ဆူညံမှု အရည်အသွေး
(၃) ရေမြောင်းများ၊ ရေအရင်းအမြစ်နှင့် ရေအရည်အသွေး
(၄) မြေအောက်ရေ အရင်းအမြစ်နှင့် အရည်အသွေး
(၅) မြေဆီလွှာနှင့် အနည်အနှစ် အရည်အသွေး
(၆) သီးနှံခင်းများ/ စိုက်ပျိုးခင်းများ
(၇) တောရိုင်းတိရစ္ဆာန်များ/ မွေးမြူရေး

EP-4 Block အတွင်း အဆိုပြုထားသော drilling project အပြင် အခြား တည်ရှိနေသော (သို့) အဆိုပြုထားသော ဖွံ့ဖြိုးတိုးတက်မှုစီမံကိန်းများ မရှိပါ။ သို့သော် EP-4 Block ဧရိယာသည် အခြားအလားအလာရှိသော ရေနံနှင့်သဘာဝဓာတ်ငွေ့တွင်းများ ဝန်းရံနေပါသည်။ မကြာခင်အနာဂတ် အတွင်း အဆိုပါ Block များမှ ရေနံနှင့် သဘာဝဓာတ်ငွေ့ထုတ်ယူရန် အစီအစဉ်ရှိပါသည်။ EP-4 ၏ပတ်လည်ရှိ တွင်းများနှင့် ၎င်းတို့ အားလုပ်ကိုင်မည့်အဖွဲ့များအား **Table 1.6** တွင်ဖော်ပြထားပါသည်။ အဆိုပါ Oil drilling စီမံကိန်း၏ ယာယီ အချိန်ဇယားတွင် ၂၀၁၅ နှင့် ၂၀၁၇ အတွင်း ESIA study နှင့် seismic activity ပြီးစီးမှုနှင့် ၂၀၁၆ မှ ၂၀၁၉ အတွင်း drilling လုပ်ငန်းဆောင်ရွက်မှုတို့ ပါဝင်ပါသည်။

Table 1.6 EP-4 ပတ်ဝန်းကျင်ရှိ ရေနံနှင့် သဘာဝဓာတ်ငွေ့ တူးဖော်ရေးလုပ်ကွက်

S. No.	Blocks	Extractor
1.	EP-3	ONGC Videsh Ltd.
2.	MOGE-4	CAOG.
3.	IOR 4	MPRL.
4.	IOR 5	Petornas Carigali
5.	IOR 6	MPRL E&P Pte. Ltd.
6.	IOR 7	Petronas Carigali.

(Source: Oil Block Open Development Myanmar-2016)

တန်ဖိုးရှိသော သဘာဝပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ အပိုင်းများအား အထူးအလေးပေးသည့် ပြီးပြည့်စုံသည့် သဘာဝပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုစီမံချက် (EMP) အား အဆိုပါ Block တစ်ခုချင်းစီတွင် တူးဖော်ထုတ်လုပ်ရေး လုပ်ငန်းများ မစတင်မီအလျင် ပြင်ဆင်သင့်ပါသည်။

1.8 ENVIORNMENTAL MANAGEMENT PLAN

EMP သည် သင့်လျော်သော လျော့ပါးစေရေးအစီအမံများအား ဖော်ပြထားပြီး စီမံကိန်းကာလတစ်ခုလုံးအတွင်းပြုလုပ်ရပါမည်။ လုပ်ငန်းစီမံခန့်ခွဲသူ (Block operator) နှင့် contractor နှစ်ဦးလုံးသည် EMP အား သေချာကျနစွာ လေးစားလိုက်နာရန် တာဝန်ယူရပါသည်။ ၎င်းသည် EIA အစီရင်ခံစာထဲတွင် ခွဲခြားဖော်ထုတ်ထားသော စီမံကိန်း၏ အလားအလာရှိသော အကျိုးသက်ရောက်မှုများနှင့် ၎င်းတို့နှင့်ဆက်ဆပ်နေသော လျော့ပါးစေရေးအစီအမံများအားလုံးကို စာရင်းပြုစုထားပါသည်။ အကျိုးသက်ရောက်မှု/ အခက်အခဲတစ်ခုချင်းစီတိုင်းအတွက် စီမံချက်ထဲတွင် အောက်ဖော်ပြပါအချက်အလက်များအား ဖော်ပြထားပါသည်။

- ပြီးပြည့်စုံသော လျော့ပါးစေရေးအစီအမံများစာရင်း
- ဆိုးကျိုးသက်ရောက်မှုများအား လျော့ပါးစေမည့်လုပ်ဆောင်ချက်များ

အလားအလာရှိသောထိခိုက်မှုများနှင့် အခါအားလျော်စွာသင့်လျော်သော လျော့ပါးစေရေးအစီအမံများအား နားလည်သဘောပေါက်ပြီး အဆိုပြု စီမံကိန်းအား ဘေးအန္တရာယ်ကင်းရှင်းစွာလုပ်ဆောင်နိုင်ရန် drilling operation အတွက် စီမံခန့်ခွဲမှုစီမံချက်အား ရေးဆွဲရပါသည်။ အဆိုပြုထားသော လုပ်ဆောင်မှုများအတွက် စီမံခန့်ခွဲမှုစီမံချက်အား **Table 1.7** (drilling အဆင့်မတိုင်မီ) နှင့် **Tabe 1.8** (drilling အဆင့်အတွင်း) စသည်တို့တွင် တင်ပြထားပါသည်။

Table 1.7 Environmental Management Plan-Prior to Drilling Phase

(Drilling အဆင့်မတိုင်မီအလျင် ပတ်ဝန်းကျင်ဆိုင်ရာစီမံခန့်ခွဲမှု စီမံချက်)

အခက်အခဲနှင့် အကျိုးသက်ရောက်မှုများ	အဆိုပြု လျော့ပါးအောင်ပြုလုပ်ခြင်း	လိုအပ်သည့် လုပ်ဆောင်မှု
မြေယာရယူခြင်း စီမံကိန်းတည်နေရာအတွင်းနှင့် အနီးတဝိုက်တွင် အခြေချနေထိုင်မှုများ မရှိခြင်းကြောင့် အဆိုပြုစီမံ ကိန်းသည် မြေယာရယူခြင်းများလုပ်ဆောင်ရန် မလိုအပ်ပါ။	• လိုအပ်သော လုပ်ထုံးလုပ်နည်းကျင့်ဝတ်များနှင့်တရားဝင်လိုအပ်ချက်များအားအကောင်အထည်ဖော်ခြင်းကို သေချာအောင်ဆောင်ရွက်ရန်။	လုပ်ငန်းစီမံခန့်ခွဲသူအနေဖြင့် လိုအပ်သောခွင့်ပြုမိန့်များနှင့် အတည်ပြုချက်ယွန္တရားအား ခွဲခြားသတ်မှတ်ရန်အတွက် အမှန်တကယ်တည်နေရာအားမထုတ်ပြန်မီ သက်ဆိုင်ရာ တိုင်းဒေသကြီးအစိုးရအဖွဲ့ အရာရှိများနှင့် အပြန်အလှန်ဆက်သွယ်မှုအား စတင်လုပ်ဆောင်ရပါမည်။

Table 1.8 Environmental Management Plan-During Drilling Phase

(Drilling ပြုလုပ်နေစဉ်အဆင့် ပတ်ဝန်းကျင်ဆိုင်ရာ စီမံခန့်ခွဲမှုစီမံချက်)

အခက်အခဲနှင့် အကျိုးသက်ရောက်မှုများ	အဆိုပြု လျော့ပါးအောင်ပြုလုပ်ခြင်း	လိုအပ်သည့် လုပ်ဆောင်မှု
အမှိုက်နှင့် စွန့်ပစ်ရည်များအား စီမံခန့်ခွဲခြင်း အားနည်းသောစီမံခန့်ခွဲမှုနှင့် အကောင်အထည်ဖော်ဆောင်ရွက်မှုတို့သည် သဘာဝပတ်ဝန်းကျင်အားခြိမ်းခြောက်မှုကို ဖြစ်ပေါ်စေနိုင်ပါသည်။	• လုပ်ငန်းစီမံခန့်ခွဲသူသည် လုပ်ငန်းလည်ပတ်နေစဉ်အတွင်းကြိုတင်မျှော်မှန်းနိုင်သည့်အမျိုးမျိုးသော waste အမျိုးအစားများအား ခွဲခြားသတ်မှတ်ခြင်း၊ အရေအတွက် ခန့်မှန်းချက်များအား တွက်ချက်ခြင်း၊ waste အမျိုးအစားတစ်ခုချင်းစီအား စုဆောင်းခြင်း၊ ကိုင်တွယ်ခြင်း၊ treatment လုပ်ခြင်းနှင့် စွန့်ပစ်ခြင်း စသည်တို့အတွက် လုပ်ငန်းစဉ်များရေးဆွဲခြင်း။	• စွန်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုစီမံချက် (ဤအပိုင်းတွင်ပေးထား) အား drilling ပြုလုပ်နေစဉ်အချိန်အတွင်းအကောင်အထည်ဖော်ဆောင်ရွက်ရမည်ဖြစ်ပြီး သက်ဆိုင်ရာအစိုးရအရာရှိများအနေဖြင့်လည်း siteသို့လာရောက်ကြည့်ရှုစစ်ဆေးနိုင်ရန်စီစဉ်ရပါမည်။
စွန့်ပစ်ရေများနှင့် cutting များထဲတွင်	• လိုင်းကျင်းများပေါ်တွင်ခင်းထားသော	• လုပ်ကွက်ဒီဇိုင်းတွင် စွန့်ပစ်ရေများထည့်ရန်

drill fluid နှင့်ဓာတုပစ္စည်းအကြွင်းအကျန်ပမာဏအနည်းငယ်စီ ပါဝင်နိုင်ပါသည်။	polyethylene sheet ထဲတွင် Washing နှင့် အသုံးပြုပြီးသားရွှံများမှ ထွက်ပေါ်လာသော စွန့်ပစ်ရေများအားလုံးရှိနေပြီး ၎င်းတို့အား မစွန့်ပစ်မီ treatment ပြုလုပ်ရပါမည်။	လုံးလောက်သော တွင်းအရွယ်အစားများနှင့် သင့်လျော်သော treatment plant တို့ပါဝင်ပါသည်။
လောင်စာဆီ၊ ချောဆီနှင့် ဓာတုပစ္စည်းများစီမံခန့်ခွဲမှုလုပ်ငန်းစဉ်သည် ဆိုရွားသော၊ အတော်အတန်ဖြစ်သော၊ အနည်းငယ်မျှသော လျှံထွက်ယိုဖိတ်ခြင်းစသည့် ခြိမ်းခြောက်မှုများအား ဖြစ်ပေါ်စေနိုင်ပါသည်။	• လောင်စာဆီများ၊ ချောဆီများနှင့် ဓာတုပစ္စည်းများအား ကောင်းမွန်စွာ ဒီဇိုင်းပြုလုပ်ထားသော သိုလှောင်ရုံများ အတွင်းထားရှိရမည်ဖြစ်ပြီး ပုံမှန်စာရင်းဇယားဖြင့် စစ်ဆေးရပါမည်။	သိုလှောင်မည့် ဇရိယာ၏ မြေနေရာအား ပြင်ဆင်ပေးရပါမည်။ • အလုပ်သမားအားလုံးအတွက် သင်တန်းပေးခြင်းနှင့် အသိပညာပေးခြင်းများအား လက်တွေ့သရုပ်ပြ လေ့ကျင့်မှုများနှင့်အတူ တိုးတက်လုပ်ဆောင်ရပါမည်။
လောင်စာဆီ/ ချောဆီများယိုဖိတ်ခြင်းနှင့် စိမ့်ထွက်ခြင်းတို့ကြောင့် ညစ်ညမ်းမှုဖြစ်ခြင်း။	• အသုံးပြုပြီးသည့်ဓာတုပစ္စည်းများနှင့် အသုံးမပြုရသေးသည့် ဓာတုပစ္စည်းများအား သိုလှောင်ရန် ယိုစိမ့်စီးထွက်မှုအတားအဆီးများဖြင့် စီမံထား သည့်နေရာ (line & bunded area) များတွင် သိုလှောင်ထားရပါမည်။ • လောင်စာဆီများအား drilling site သို့စည်းကမ်းကျနစွာဖြင့် ကြီးကြပ်ပို့ဆောင်ရမည်ဖြစ်ပြီး အဆိုပါဇရိယာအတွင်း လောင်စာဆီဖြည့်တင်းခြင်းအားဆောင်ရွက်ရန် ရေစိမ့်မဝင်နိုင်သော ကြမ်းခင်းနှင့် oil interceptor ပါဝင်သော မျက်နှာပြင်မြောင်းစနစ်များပြုလုပ်ထားရပါမည်။	• လောင်စာဆီသိုလှောင်ကန်ထားမည့် line & bunded area သည် drums များအတွင်းရှိအသုံးပြုပြီးသည့်ချောဆီနှင့်အသုံးမပြုရသေးသည့်ချောဆီများထားရှိရန် လုံလောက်သောနေရာလွတ်ရှိရပါမည်။ • ကနဦးဆီဖြည့်ခြင်းနှင့် ဆီထပ်မံဖြည့်ခြင်းစသည့် လုပ်ဆောင်မှုများအား စာရင်းသတ်မှတ်ပြုစုပေးရပါမည်။
ဆူညံမှုနှင့် တုန်ခါမှု	• စက်ပစ္စည်းများ၏ ဝယ်ယူ၊ တပ်ဆင်မှုနှင့် သက်တမ်း စစ်ဆေးမှုစာရင်းများအား ပြုလုပ်ထားရပါမည်။	• စက်ပစ္စည်းများအားလုံး၏ ထိန်းသိမ်းမှုမှတ်တမ်းစာအုပ်အား ထားရှိရပါမည်။ • မလိုအပ်သည့်အချိန်တွင် မည်သည့်စက်ပ

	• စက်ပစ္စည်းများအားလုံးအား ပုံမှန်ထိန်းသိမ်းမှု ပြုလုပ်ရပါမည်။ • ဆူညံမှုအားလျော့ချနိုင်ရန်အတွက် ကောင်းမွန်သော လုပ်ငန်းခွင်ဆိုင်ရာအလေ့အကျင့် ကောင်များအားကျင့်သုံးရပါမည်။	စွမ်းကိုမှု အသုံးမပြုရပါ။
လေ (အငွေ့) ထုတ်လွှတ်မှု	• စက်ပစ္စည်းများအားလုံးအား တိကျသော design parameter အတွင်း လည်ပတ်လုပ်ဆောင်ရပါမည်။ • တွင်းစမ်းသပ်နေချိန်တွင် ထုတ်လွှတ်မှုအား လျော့ချရပါမည်။ • ဖုန်ထခြင်းကိုလျော့ချနိုင်စေရန်အတွက် မခင်းရသေးသောလမ်းများအား လိုအပ်ပါက ရေဖြန်းပေးရပါမည်။	• နည်းစနစ်ကျနသော စက်ပစ္စည်းထိန်းသိမ်းမှုများအား သေချာစွာ လုပ်ဆောင်ရပါမည်။ • ထုတ်လွှတ်မှုအား လျော့ချနိုင်ရန်အတွက် Flaring ပြုလုပ်စဉ်တွင် အချက်ပြမီးတောက်စနစ်အား ထိရောက်သောလောင်ကျွမ်းမှုရရှိစေရန်အလို့ငှာ ရွေးချယ်ရပါမည်။
အစိုင်အခဲ စွန့်ပစ်ပစ္စည်း စွန့်ပစ်ပစ္စည်းများတွင် ဇီဝစွန့်ပစ်ပစ္စည်းများ၊ သတ္တုအပိုင်းအစများ၊ စွန့်ပစ်ဆီများနှင့် ဓာတုပစ္စည်းများ၊ အိတ်များ၊ ဆေးပစ္စည်းဆိုင်ရာ စွန့်ပစ်ပစ္စည်းများ စသည်တို့ ပါဝင်ပါသည်။	• အမှိုက်ထွက်ရှိမှုအားလုံးအတွက် သင့်လျော်သောစာရွက်စာတမ်း ပြုလုပ်ထားရပါမည်။ • အမှိုက်သရိုက်နှင့် အစအနများအား site တွင် မစွန့်ပစ်ပဲ site အတွင်းရှိ သတ်မှတ်ထားသော အမှိုက်ကျင်းအတွင်းတွင် ခွဲခြားစွန့်ပစ်ရပါမည်။ • အဆိပ်မသင့်ဘဲ ဆွေးမြေ့နိုင်သည့် စွန့်ပစ်ပစ္စည်းများအား operation ပြုလုပ်နေစဉ်အတွင်း မြုပ်နှံရမည်ဖြစ်ပြီး မည်သို့ပင်ဖြစ်စေ ပတ်ဝန်းကျင်ရှိရေအရင်းအမြစ်အား မညစ်ညမ်းစေရပါ။	• ကြိုတင်လုပ်ငန်းဆောင်ရွက်မှုဆိုင်ရာ စုံစမ်းထောက်လှမ်းမှုများ အနေဖြင့် အမှိုက်စွန့်ပစ်မှု နေရာများ အဆိုပါဇရိယာအတွင်း ရှိနေစေရန်လုပ်ဆောင်ရပါမည်။ • Well site များတွင် ခွဲခြားထားသော ကျင်းများအတွင်း စွန့်ပစ်ပစ္စည်များအား ခွဲခြားသတ်မှတ်ထားသော စည်များအတွင်းသို့ ထည့်ကာထားရှိရပါမည်။ • လုပ်ငန်းစီမံခန့်ခွဲသူအနေဖြင့် သင့်တော်သလို စွန့်ပစ်ရန်နှင့် စွန့်ပစ်ပစ္စည်းအား recycle လုပ်ရန် contractors များစီစဉ်ခန့်အပ် ထားရှိရပါမည်။

ပုံမှန်မဟုတ်သော/ မတော်တဆအဖြစ်အပျက်များ [bore well တွင်းသို့ formation fluid များဝင်လာခြင်း (wellkicks) နှင့် လျှံထွက်ပန်းထွက်ခြင်း (blowouts)]	• Blowouts ဖြစ်ခြင်းကိုတားဆီးရန်အတွက် wellkicks ဖြစ်ခြင်းအား စူးစမ်း/သတိပြုနေရပါမည်။ • ဤနေရာတွင် အဆင့်မြင့်စူးစမ်းရှာဖွေမှုနှင့်အတူ BOP equipment အား ကောင်မွန်စွာထိန်းသိမ်းရပါမည်။	• အဆင့်မြင့်ကိရိယာစနစ်များနှင့် mud logging unit အားလုပ်ဆောင်ရပါမည်။
လူမှုစီးပွားရေးဆိုင်ရာ အကျိုးသက်ရောက်မှုများ	• CSR ဆိုင်ရာ ဗျူဟာကိုကောင်းစွာကျင့်သုံးကာ ဒေသခံပြည်သူများအတွက် လူမှုဖူလုံရေးစီမံကိန်းများအား စီစဉ်ဆောင်ရွက်ပေးရပါမည်။ • ကျွမ်းကျင်မှုနည်းပါးသော ဒေသခံလက်မှုလုပ်သားများအား ယာယီထိတွေ့ အသုံးပြုရပါမည်။	• အဆိုပြုအညစ်အကြေးဆိုင်ရာစီမံခန့်ခွဲမှုစနစ်အား အကောင်အထည်ဖော်ဆောင်ရွက်ကာ operation မတိုင်မီ၊ လုပ်ဆောင်နေစဉ်နှင့် ပြီးနောက် ရေအရည်အသွေးစောင့်ကြည့်လေ့လာမှုများအား တာဝန်ယူ လုပ်ဆောင်ရပါမည်။ • လူမှုဖူလုံးရေးအစီအစဉ်များအား ကုမ္ပဏီ၏ CSR မူဝါဒနှင့် အညီ အကောင်အထည်ဖော်ဆောင်ရွက်ပေးရပါမည်။

Waste Management Plan (စွန့်ပစ္စည်း စီမံခန့်ခွဲမှု စီမံချက်)

Field level ဆိုင်ရာ ကိစ္စရပ်များအား ပြီးမြောက်အောင်မြင်အောင် အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် စွန့်ပစ်ပစ္စည်းဆိုင်ရာ စီမံခန့်ခွဲမှုလုပ်ငန်းစဉ်အား အဆိုပြုရန်လိုအပ်ပြီး လုပ်ငန်းစတင်မလည်ပတ်မီကာလအတွင်း ညှိနှိုင်းဆောင်ရွက်ရပါမည်။ အဆိုပါ စီမံချက်အား အောက်ပါအတိုင်း **Table 1.9** တွင် ဖော်ပြထားပါသည်။

Table 1.9: Waste Management Plan (စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု စီမံချက်)

အတန်းအစား	စွန့်ပစ်ပစ္စည်း အမျိုးအစား	အဆိုပြု အရေးယူဆောင်ရွက်မှု

အိမ်သုံးစွန့်ပစ်ပစ္စည်း	မိလ္လာရေ (ရေဆိုး)	ထွက်ရှိလာသော အိမ်သုံးစွန့်ပစ်ရေ (မိလ္လာရေ နှင့် အိမ်သုံးရေ) စသည်တို့အား project site အတွင်းရှိ ရေစစ်ကန် (septic tank) အတွင်းသို့ ထည့်သွင်းရပါမည်။ မိလ္လာရေ များအားလုံးအား ရေစစ်ကန်နှင့် ရေစိမ့်ဝင်နိုင်သောတွင်း (soak pit) အတွင်းသို့ သွယ်တန်းပို့ဆောင်ရပါမည်။
	မီးဖိုချောင်မှ စွန့်ပစ် ရေ (ရေဆိုး)	septic tank အပေါ်မှလျှံထွက်လာသော ရေများအား drilling site ရှိ soak pit အတွင်းသို့ ရောက်ရှိစေရပါမည်။ မီးဖိုချောင်မှထွက်ရှိသောစွန့်ပစ်ရေများအား soak pit အတွင်းသို့ တိုက်ရိုက်သွယ်တန်းထားရပါမည်။ ပိုလျှံသောစွန့်ပစ်ရေများအား project site အဝင်အထွက်လမ်းများပေါ် တွင်ပက်ဖျန်းပေးနိုင်ပါသည်။
	အစားအသောက် စွန့်ပစ်ပစ္စည်း	၎င်းတို့အား (ပလပ်စတစ်၊ သတ္တု၊ ဖန် စသည်တို့အတွင်းထဲတွင်မပါရှိစေဘဲ) သင့်တော်သလို ခွဲခြားကာ သီးသန့်ခွဲ ခြားထားသော ကျင်းများထဲသို့ထည့်သွင်းရပါမည်။ camp ဧရိယာအတွင်း လွန်တူးစင်အဖွဲ့သားများ စွန့်ပစ်ရာနေရာနှင့်အဝေးတွင် တနေ့တာစွန့်ပစ်မည့် အမှိုက်အခြေအနေ အပေါ်မူတည်ပြီး မြေဆွေးပါဝင်သော ကျင်းငယ်နှစ်ကျင်းအား တူးဖော်ရပါမည်။ မြေဆွေးကျင်းအား မြေကြီးဖြင့် နေ့စဉ်နေ့တိုင်း ဖုံးအုပ်ပေးရပါမည်။
	လောင်ကျွမ်းနိုင်သော စွန့်ပစ်ပစ္စည်း (စက္ကူ၊ အဝတ်စုတ်၊ ထုပ်ပိုးပစ္စည်း၊ အစရှိသည်)	၎င်းတို့အား (ပလပ်စတစ်၊ သတ္တု၊ ဖန် စသည်တို့အတွင်းထဲတွင်မပါရှိစေဘဲ) သင့်တော်သလို ခွဲခြားကာ သီးသန့်ခွဲ ခြားထားသော ကျင်းများထဲသို့ထည့်သွင်းကာ recycling operator ထံသို့ ပို့ဆောင်ရပါမည်။
ဇီဝ ဆေးဘက်ဆိုင်ရာ စွန့်ပစ်ပစ္စည်း	ဆေးဘက်ဆိုင်ရာ စွန့်ပစ်ပစ္စည်း (ရှေးဦးသူနာပြု ဌာနမှ စွန့်ထုတ်လိုက်သော စွန့်ပစ်ပစ္စည်းများ)	၎င်းတို့အတွက် သေတ္တာများအား သတ်သတ်မှတ်မှတ်ထားရှိပြီး syringe cutter များအား အသုံးပြုရပါမည်။ စွန့်ပစ်ပစ္စည်းများအား သင့်တော်သလို ခွဲခြားကာ site အတွင်းတွင် အခြားစွန့်ပစ်ပစ္စည်းများနှင့် ခွဲခြားကာ ခေတ္တမျှသာထားရှိရပါမည်။ ဆေးဘက်ဆိုင်ရာ စွန့်ပစ်ပစ္စည်းများအား ကျွမ်းကျင်စွာ ကိုင်တွယ်နိုင်သော ဆေးရုံများသို့ ပို့ဆောင်ရပါမည်။
Recycle လုပ်နိုင်သော စွန့်ပစ်ပစ္စည်း	သံပတ်များ၊ ပလပ်စတစ်များ၊ ပုလင်းခွံများ နှင့် အခြား သတ္တုပ	၎င်းတို့အား သင့်တော်သလို ခွဲခြားထားကာ Wellsite အတွင်းရှိ ခွဲခြားထားသော ကျင်းများအတွင်းတွင် ခေတ္တာထားရှိရပါမည်။ recycling operator ၏ အတည်ပြုချက်ရရှိနိုင်ရန် ပို့ဆောင်

များ	စွည်းများ	ပေးရပါမည်။
Drilling စွန့်ပစ်ပစ္စည်းများ	လွန်တူးစာများ	Wellsite အတွင်းရှိ HDPE ခံထားသောကျင်းအတွင်းတွင်သိုလှောင်ထားရပါမည်။ လုပ်ငန်းသိမ်းသောအခါ စွန်ပစ်ရေ (leachate) အားခွဲခြမ်းစိတ်ဖြာမှုပြုလုပ်ရာတွင် စနစ်တကျဆေးကြောသန့်စင်ပြီး လွန်တူးစာများအား ကျိုးကြောင်း ဆီလျော်စွာ အခြောက်ခံပြီး နောက်ပိုင်းတွင် ၎င်းတို့အနေဖြင့်အန္တရာယ်မရှိနိုင်တော့ပါ။ ထို့နောက်၎င်းတို့အား မာတ်မပြုသောပစ္စည်းများအနေဖြင့် onsite (သို့) offsite ရှိ cutting pit အတွင်းသို့စွန်ပစ်နိုင်သကဲ့သို့ လမ်းဖောက်လုပ်ခြင်း၊ ဒေသတွင်းရှိမြေပြင် ပေါ်တွင်ဖြန့်ခင်းခြင်းနှင့် လမ်းဖို့ခြင်းများအား လုပ်ဆောင်နိုင်ပါသည်။
	အသုံးမပြုတော့သော လွန်တူးရွံ့များ	အသုံးမပြုတော့သော လွန်တူးရွံ့များအား HDPE အတွင်းတွင် သိုလှောင်ထားရပါမည်။
	လွန်တူးခြင်းနှင့် ဆေးကြောသန့်စင်ခြင်းတို့မှထွက်ရှိလာသော စွန့်ပစ်ရေများ	ဆေးကြောသန့်စင်ခြင်းများမှ ထွက်ရှိလာသော စွန့်ပစ်ရေအားလုံးနှင့် အသုံးပြုပြီးသားရွံ့များအား HDPE-lined pits များအတွင်းသို့ထည့်သွင်းထားပြီး treatment ပြုလုပ်ပြီးမှ နောက်ဆုံးစွန့်ပစ်ခြင်းအား လုပ်ဆောင်ရပါမည်။
	မာတုပစ္စည်းပါဝင်သော စွန့်ပစ်ရေ (waste water treatment ပြုလုပ်မှုမှ ထွက်ရှိလာခြင်း)	pH correlation အတွက် sludge treatment အားပြုလုပ်ပါသည်။ ထို့နောက် ရေဖယ်ထုတ်ခြင်းအား စက်ဒလက် (centrifuge) အားဖြင့်သော်လည်းကောင်း နေရောင်ခြည်ဖြင့် ရေငွေ့ပြန်စေခြင်းဖြင့်သော်လည်းကောင်း လုပ်ဆောင်ပါသည်။ အဆိုပါ treatment အား pit အတွင်းတွင် ရေမစိမ့်ဝင်နိုင်သော HDPE liner ခံ၍ ပြုလုပ်ပါသည်။ စွန်ထုတ်မှုသည် operations များ၏ အဆုံးတွင် အန္တရာယ်ရှိ/မရှိ ပေါ်ထွက်လာမှု သဘာဝ အပေါ်မူတည်၍ လုပ်ဆောင်ရပါမည်။
ဆီပါသော စွန့်ပစ်ပစ္စည်းများ	အသုံးပြုပြီးသားဆီများ	ဆီလဲလှယ်မှုဆိုင်ရာလုပ်ဆောင်မှုအား rig site တွင်သာ လုပ်ဆောင်ခွင့်ပြုထားပါသည်။ rig site တွင် ဆီများအားသိုလှောင်ရန် သတ်မှတ်ထားသော containers များရှိပါသည်။ အသုံးပြုပြီးသား ဆီတိုင်ကီလွတ်များအား အသိအမှတ်ပြု အလုပ်ရုံရှိသော အသိအမှတ်ပြု recycling contractor ထံသို့ ဘေးအန္တရာယ်ကင်းစွာ ပို့ဆောင်ရပါမည်။

သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်လေ့လာမှု စီမံချက်သည် စီမံကိန်း၏ drilling ပြုလုပ်နေစဉ်နှင့် drilling ပြုလုပ်ပြီး အဆင့်များအတွင်း သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ သတ်မှတ်ချက်ဘောင်များအား စောင့်ကြည့်လေ့လာမှုပြုလုပ်ရန် အကြံပြုထောက်ခံချက် ပေးထားပါသည်။ စောင့်ကြည့်လေ့လာမှုစီမံချက်အား Table (1.10) တွင်ဖော်ပြထာပါသည်။

Table 1.10: Recommended Environmental Monitoring/ Audit Protocol-Drilling Operation.

အကြံပြုထားသည့် ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်လေ့လာခြင်း/ Audit Protocol-Drilling Operation

စဉ်	တိုင်းတာစစ်ဆေးမှုလက်ခံသူ	တည်နေရာ	စောင့်ကြည့်လေ့လာရေးယန္တရား	စောင့်ကြည့်လေ့လာခြင်းနှင့် အစီရင်ခံမှုကြိမ်နှုန်း	စောင့်ကြည့်လေ့လာမှုဘဏ္ဍာငွေ (USD/ ကျပ်)
၁။	အရင်းအမြစ်များ	Project site တွင်	ပစ္စည်းအမျိုးအစားတစ်ခုချင်းစီ၏အသေးစိတ်စာရင်း	နေ့စဉ်(drilling ပြုလုပ်ခြင်းအဆင့်အတွင်း)	
၂။	ပတ်ဝန်းကျင်လေထုအရည်အသွေး	Project တည်နေရာတွင်	PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOC_s နှင့် HC	တစ်လတစ်ကြိမ်	တည်နေရာတစ်ခုလျှင် USD 3000 (၄,၁၅၆,၃၇၄ ကျပ်)
၃။	ဆူညံသံနှင့် တုန်ခါမှု	Rig site, DG Sets နှင့် Drilling pump အနီး	ဆူညံသံအဆင့် စောင့်ကြည့်လေ့လာခြင်း	တစ်လတစ်ကြိမ်	USD 150 (၂၀၇,၈၁၈ ကျပ်)
၄။	Drilling စွန့်ပစ်ပစ္စည်းများ	Drilling site တွင်	လွန်တူးမြေစာများ၏ အရေအတွက်နှင့် သွင်ပြင်လက္ခဏာ	• စွန့်ပစ်ပစ္စည်းအရောအတွက်အား နေ့စဉ် ကြည့်ရှုစစ်ဆေးရန် • စွန့်ပစ်ပစ္စည်းများ၏ သွင်ပြင်လက္ခဏာအား လစဉ် ကြည့်ရှု စစ်ဆေးရန်	• အမှတ်တကယ် ကုန်ကျစရိတ်
၅။	စွန့်ပစ်ရေထွက်ရှိမှု	Project Site တွင်	စွန့်ပစ်ရေထွက်ရှိနှုန်း	ပမာဏအား နေ့စဉ်မှတ်တမ်းယူရန်	USD 800 (၁,၁၀၈,၃၆၆ ကျပ်)
၆။	ဆီစွန့်ပစ်ပ	Drilling	အင်ဂျင်များမှ	လွန်တူးအဆင့်အတွင်း	အမှတ်တကယ်

	စွန့်ပစ်	site တွင်	အသုံးပြုခဲ့သောဆီများ	စာရင်းစာအုပ်အား နေ့စဉ် အသုံးချရပါမည်။ အသုံးပြုပြီးသားဆီမထွက်သောအချိန်များတွင်လည်းအလားတူရေးမှတ်ရပါမည်။	ကုန်ကျစရိတ်

Note: 1USD = 1385 Kyats

1.9 PUBLIC/STAKEHOLDER CONSULTATION AND DISCLOSURE (အများပြည်သူနှင့်တွေ့ဆုံခြင်း/စီမံကိန်းနှင့် ပတ်သက်ဆက်နွယ်သူများနှင့် တွေ့ဆုံဆွေးနွေးခြင်း)

အများပြည်သူနှင့်တွေ့ဆုံဆွေးနွေးခြင်းများအား study area အတွင်းတွင် ပြုလုပ်ခဲ့ပါသည်။ ထို့ပြင် ပန်းတောင်းမြို့နယ် အထွေထွေအုပ်ချုပ်ရေးရုံးတွင် ကျင်းပပြုလုပ်ခဲ့သည့် အစည်းအဝေးပွဲမှ မြို့နယ်အုပ်ချုပ်ရေးမှူး၊ ကျေးရွာအုပ်ချုပ်ရေးမှူးနှင့် လူထုကိုယ်စားပြုကိုယ်စားလှယ်များ တို့၏အမြင်များအား သိရှိမှတ်သားခဲ့ရပါသည်။ အများပြည်သူနှင့် တွေ့ဆုံဆွေးနွေးပွဲအား ၂၀၁၇ ခုနှစ် နိုဝင်ဘာလတွင် ကျင်းပခဲ့ပြီး အဆိုပါဆွေးနွေးပွဲသို့ ပြည်ထောင်စုမြန်မာနိုင်ငံတော်အစိုးရ၊ မြန်မာ့ရေနံနှင့်သဘာဝဓာတ်ငွေ့လုပ်ငန်း (MOGE)၊ ပန်းတောင်မြို့နယ် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ သက်ဆိုင်ရာအရာရှိများနှင့် Bashneft မှ ကိုယ်စားလှယ်များ တက်ရောက်ခဲ့ကြပါသည်။ တွေ့ဆုံမေးမြန်းဆွေးနွေးခြင်းအား အဆင့်နှစ်ဆင့်ဖြင့် ပြုလုပ်ခဲ့ပါသည်။

၁) ပထမအဆင့် - ၂၀၁၇ ခုနှစ် နိဝင်ဘာ ၇ ရက် မှ ၁၀ ရက်

အစည်းအဝေးသို့ ပြည်နှင့် ပန်းတောင်းမြို့နယ်များရှိ အစိုးရဌာနများမှ အရာရှိများ တက်ရောက်ခဲ့ကြပြီး Field study နှင့် အများပြည်သူနှင့်တွေ့ဆုံပွဲများ ပြုလုပ်ရန်နှင့် အဆိုပါ study အတွက် secondary data ရယူရန် အစရှိသည့်တို့အား လုပ်ဆောင်နိုင်ရန်အတွက် ခွင့်ပြုမိန့် တောင်းခံရန် အစည်းအဝေးအား ကျင်းပခဲ့ခြင်းဖြစ်ပါသည်။

ပထမအဆင့်အတွင်း အောက်ဖော်ပြပါကျေးရွာများတွင် တွေ့ဆုံမေး မြန်းမှုများအား ပြုလုပ်ခဲ့ပါသည်။

၁) ငါးဆယ်ပေး
၂) ဘုရားပေါ်
၃) တောင်ဘို့ကွင်း
၄) အုတ်ရှစ်ပင်
၅) ဆင်တဲ
၆) ဒန့်သလွန်

၇) ဒေါင်းမြတ်နား

စောင့်ကြည့်လေ့လာမှုအစီအစဉ်၏ အဓိကအကြောင်းအရာများအားတင်ပြနိုင် ရန်အတွက် အဖွင့် အစည်းအဝေးအား ၂၀၁၇ခုနှစ် နိုဝင်ဘာ ၇ ရက်နေ့တွင် ပန်းတောင်းမြို့နယ်အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနရုံးတွင် ကျင်းပပြုလုပ်ခဲ့ပြီး အဆိုပါအစည်းအဝေးသို့ ဌာနဆိုင်ရာမှ အရာရှိများ၊ ကျေးရွာအုပ်ချုပ်ရေးမှူးများ တက်ရောက်ခဲ့ကြပြီး အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ အရာရှိများထံမှ ပတ်ဝန်းကျင်ဆိုင်ရာ စောင့်ကြည့်လေ့လာခြင်းနှင့် နမူနာကောက်ယူခြင်း စသည်တို့အား လုပ်ဆောင်ရန်အတွက် ခွင့်ပြုမိန့်ရရှိခဲ့ပါသည်။

၂) ဒုတိယအဆင့်-၂၀၁၉ ခုနှစ် နိုဝင်ဘာ ၂ ရက်

ဒုတိယအဆင့်အတွင်း အောက်ဖော်ပြပါကျေးရွာများတွင် တွေ့ဆုံမေး မြန်းမှုများအား ပြုလုပ်ခဲ့ပါသည်။

၁) ဒေါင်းမြတ်နား
၂) ညောင်ဖြူ
၃) စွယ်တော်
၄) မြောင်ရှည်
၅) ဒန့်သလွန်
၆) ဘုရားပေါ်၊ ငါးဆယ်ပေး

အဆိုပါတွေ့ဆုံမေးမြန်းဆွေးနွေးပွဲတွင် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ မြန်မာ့ရေနံနှင့် သဘာဝဓာတ်ငွေ့လုပ်ငန်း (MOGE) မှ အရာရှိများ၊ အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာနမှ အရာရှိများနှင့် Bashneft International B.V မှ တာဝန်ရှိသူများ တက်ရောက်ခဲ့ကြပါသည်။

အများပြည်သူနှင့် တွေ့ဆုံမေးမြန်းဆွေးနွေးပွဲ၏ ရည်ရွယ်ချက်မှာ

- အဆိုပြုစီမံကိန်းအား နိုင်ငံသားများ၊ အုပ်စုများနှင့် အဖွဲ့အစည်းများအား သတင်းပေးရန်။
- ပြည်သူများ၏ စိုးရိမ်ပူပန်မှုများအား မှတ်တမ်းရယူရန် (ရှိလျှင်)။
- အဆိုပြုစီမံကိန်းအတွက် အားလုံး၏ အမြင်များအား စီမံကိန်းရေးဆွဲခြင်းနှင့် ဆုံးဖြတ်ချက်ချခြင်းတို့တွင် ထည့်သွင်းစဉ်းစားမှုအား သေချာစေရန်။
- အမျိုးသောစိတ်ဝင်စားမှုများနှင့် စိတ်နေသဘောထားများအား ထည့်သွင်းစဉ်းစားပြီး ပူးတွဲအမြင်များအား ဖန်တီးရရှိနိုင်ရန်။
- ပြဿနာကိစ္စရပ်များအား ပြေလည်စေရန်အတွက် အရေးယူမှုဆောင်ရွက်မှုများအား စတင်ရန်။

1 EXECUTIVE SUMMARY

(This Environmental Impact Assessment (EIA) report is as per the latest EIA Procedure of the Ministry of Environmental Conservation and Forestry, the Government of the Republic of the Union of Myanmar, Notification No. 616 / 2015, dated 29 December 2015 and applicable international guidelines).

1.1 INTRODUCTION (CHAPTER 2)

The Myanma Oil and Gas Enterprise (MOGE), Myanmar Ministry of Energy (MOE) awarded the EP-4 Block to Bashneft International B.V. (hereinafter referred to as Bashneft) on Production Sharing Contract (PSC) basis on 10th August 2014 for exploration and development of the Block. The area of Block EP-4 is a part of the Bago West division, falls in the flat Central Part of Myanmar geologically identified as Pyay Embayment Basin.

Bashneft is the Block operator with 90% shares and the balance stake is held by M/s Sun Apex Holdings Ltd., Myanmar. The Block covers an area of 841 km^2. Based on the sub-surface data analysis of this region, Bashneft has identified its first exploratory well location in EP-4 block where drilling is to be carried out to evaluate the hydrocarbon aspects.

As per PSC with MOGE, Environmental Impact Assessment (EIA) needs to be carried out for the proposed drilling operation. Also, Bashneft is responsible for the implementation of the environmental protection measures and management plan in accordance with the applicable laws, rules, regulations, directive and notifications of the Republic of the Union of Myanmar and in conformity with international petroleum industry's practices.

M/s Asian Consulting Enterprises Pte. Ltd., Singapore (ACE) had undertaken the Environmental Impact Assessment (EIA) study. The report presents the outcome of the Environmental Impact Assessment (EIA) study based on the data collected (primary and secondary) during post monsoon season of 2017.

Block EP-4 with an area of 841 km^2 is located in the Pyay Embayment Basin, Mayaman Area, Republic of the Union of Myanmar. The block is about 280 km North-West of Yangon (largest city of Myanmar) and 140 km South-West of Nay Pyi Taw (Capital city of Myanmar). The Block is part of Bago West division. The geographical coordinate of the wellsite of the EP-4 block is presented in **Table 1.1**.

Table 1.1: Geographical Coordinates of Wellsite

Point No.	Latitude (N)			Longitude (E)		
	Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	18	46	58.19	95	06	37.57

1.2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK (CHAPTER 3)

This chapter presents applicability of national and international legislations, regulations, standards, conventions, etc. to the aspects of drilling operations in Myanmar. The regulatory organizational framework and Bashneft's policy towards the health, safety and environment are also provided.

1.3 PROJECT DESCRIPTION AND SELECTION OF ALTERNATIVE TECHNOLOGY (CHAPTER 4)

This chapter provides background information on the proposed appraisal drilling and its activities in the Block EP-4 and also presents the analysis of alternatives taken into account during the project activity finalization. The proposed appraisal well is to be drilled in Block EP-4, which is located in the Pyay Embayment Basin, Mayaman Area, Republic of the Union of Myanmar. The Block EP-4 covers an area of 841 km^2.

1.4 DESCRIPTION OF THE SURROUNDING ENVIRONMENT (CHAPTER 5)

Topography

The terrain of the Block area is flat and elevated in some region. Topographically, consists of plain to low highland, elevation of which varies between 26 m to 226 m above mean sea level (amsl). The central part of the Block area consists of flat area, whereas it's Northern and Southern part comprises of low highland in patches, which has humid tropical climate with hot summer season.

Geology

Block EP-4 falls in the flat Central part of Myanmar, geologically identified as Pyay Embayment Basin. The Pyay Embayment Basin is an oil rich onshore basin developed parallel to the converging continental and marine plate boundaries. The rocks comprise mainly of Eocene Laungshe Shale, Tilin and Pondaung Sandstones, and the Oligocene-Miocene Pegu Group. This group includes interbedded sandstones, shales and coals of deltaic to fluvial facies and shallow marine shales, limestones and sandstones.

Seismicity

The proposed project site is in Seismic Zone II as per Seismic Zonation map of Myanmar (2005) which signifies that the project site is located on moderate seismic intensity zone and probability of having high intensity earthquake is negligible.

Climate and Micro-meteorology

The climate of Myanmar is dominated by tropical monsoon with typical strong monsoon rainfall, fair share of sun along with high humidity.

The Block area experiences three seasons i.e. winter (November-February), summer (March-May) and Monsoon (June-October). The onset of monsoon takes place towards the end of May and extends till early November. An annual rainfall of 1226 mm was recorded in the year 2014. The Pyay district receives less rainfall and temperature varies from maximum of 40^0C to minimum of 15^0C.

The prominent wind directions at the Block area is from Northwest (21%). The highest wind speed is observed from north-northwest direction with more than or equal to 8 m/s. The calm wind conditions prevailed for 25.96 % of the total time.

Existing Land Setting

The EP-4 block is located in Pyay district of Bago region. The proposed project site is located in EP-4 block. Nawaday bridge is the only connecting bridge over the river joining the townships on either side of the river.

Land Use Land Cover

The Bago region, in general includes agricultural land, arable land, land with plantation, pasture land and built up area.

Land use/ Land cover mapping of the Block was carried out using the LANDSAT imageries of 2019 of the area using GIS and Remote Sensing tools and authenticated by ground truthing during the site visit. From this exercise, it was revealed that almost 55% of the block area constitutes tree and shrubland; followed by fallow and harvested land of 16%; agriculture land (16%); degraded/barren land (8%); waterbodies (4%) and built up area (1%).

The observable changes are found in the land use land cover pattern while compared for last 6 years. From the comparison of LULC Landsat imageries from 2013 to 2019 we conclude as follows:

- that there is major increment in the land coverage by trees and shrubland which is the positive change as per the environment perspective.
- that some part of Agricultural land is converting into barren land and fallow and harvested land.

Changes with respect to LULC between 2015 and 2019 imageries were minimal, when compared to changes between 2013 and 2015.

Soil Quality

The soil quality was assessed by analyzing the samples collected from five villages within the study area. Soil samples were analyzed for physicochemical parameters to understand the nutrient content and soil health.

Soil pH in the study area ranged from 7.28 to 8.3 being maximum at SS2 (Thee Kone village) and found to be slightly alkaline in nature at all the monitoring locations. Organic matter in soil samples varied between 1.15 to 3.47% which is optimum range for soil health. Nitrogen and Phosphorous of the soil were in the range 0.06 to 0.07% and 9.17 to 164.84 mg/kg respectively. Nitrogen and phosphorous are present in good amount and are essential in plant growth and production. The macro nutrients like potassium, calcium and magnesium varied from 1054 to 1875 mg/kg, 1375 to 5045 mg/kg, and 1170 to 2351 mg/kg respectively, which are present in excess amount and are indicative of good soil permeability and structure suitable for cultivation. Sodium Adsorption Ratio (SAR) is the measure of the suitability of water for irrigation purpose. The higher the SAR, the less suitable the water is for irrigation.

The sodium absorption ratio varied from 0.26 to 0.93 indicating permeability of the soil is not affected.

Sand, silt and clay percentage in soil samples of the study area varied between 7.9 to 41.06%, 3.19 to 12.42% and 55.01 to 86.27% respectively. Based on this, textural class of the analyzed samples at all location belongs to clayey loam which is smooth when dry and silky when wet. The fine clay soil can hold more water than the coarse sand soil.

Air Environment

The ambient air quality of the study area was monitored at four locations with respect to PM_{10}, $PM_{2.5}$, SO_2 and NO_2. The data generated with respect to these pollutants in the environment helps to determine the present air quality status in the study area. Out of these four Air monitoring locations, three locations were carried out using Diesel Generator (DG set). DG set were placed away (more than 30 meters) from the combined PM_{10} & $PM_{2.5.}$ Air sampler and in upwind direction to avoid any interference due to the emissions from DG set.

The 24-hourly PM_{10} level varied between 39.5µg/m^3 to 53.1µg/m^3 and for $PM_{2.5}$ varied between 22.4µg/m^3 to 32.5µg/m^3. The level of PM_{10} and $PM_{2.5}$ in all these locations were compared with Myanmar National Environmental Quality (Emission) Guidelines, 2016. All these values are within the specified limit apart from Ye Twin Hla and Yae Win villages where slightly exceeding the limits.

The values of SO_2 and NO_2 varied from 6.1 to 7.2 µg/m^3 and 19.6 to 21.2 µg/m^3 respectively. All these values are found to be well within the specified limits as per Myanmar National Environmental Quality (Emission) Guidelines, 2016.

Noise Environment

Ambient noise level monitoring was carried out in post monsoon season of 2017. At each location, noise monitoring was conducted continuously over a period of twenty-four hours to obtain Leq values at uniform time intervals of 1 hour.

Noise level during day time, in residential areas were observed in the range of 47.5 dB(A) to 55.5 dB(A) being slightly exceeding the limit at location NQ-1as per National Environmental Quality (Emission) Guidelines, Myanmar, 2015. Noise levels at these locations are attributed to vehicular movements. Noise level during night time was observed in the range of 41.5 dB(A) to 44 dB(A) which are within the standard limit. There are no industries in the study area.

Water Environment

Hydrology and Drainage: The study area is located in the western side of Ayeyarwady River (Length 2170 km; drainage area 413,710 km^2) which is country's largest river. The Ayeyarwady River in Myanmar flows from the Himalayan mountain range in the north to the Andaman Sea in the south. The Ayeyarwady River basin and the catchment occupy 60% of the country area traversing Chin, Kachin, Shan states and Mandalay, Magwe, Bago, Yangon and Ayeyarwady divisions. In the study area Ayeyarwady River enters from the North-Eastern part of the block near Nawaday Bridge and flows through the middle of the block bordering the Padaung administrative areas and exits from the Southern part near Te Gyi Kone village.

The major source of water in the study area is the Ayeyarwady River. Besides, few other small streams also pass through the study area and most of which are non-perennial and rain fed and remain dry during hot season. At the time of our field survey, non-perennial streams and ponds were carrying substantial amount of water, i.e. during post monsoon season.

Water Quality – Surface water: The pH of analyzed surface water samples varied between 7.15 to 7.75 with slightly alkaline in nature at all the locations. The total dissolved solids varied from134 to 562 mg/l while electrical conductivity varied from 212 to 892 µS/cm being maximum at SW4 (pond near Taung Myat Nar village) indicates accumulation of salts, minerals and nutrients may be from surface water entering the ponds and fertilizers runoff. Total suspended solids varied from 0.5 to 188 mg/l with maximum value observed at Ayeyarwady River. During the field visit high flow rate was observed in the river which may have kept the particles suspended. Dissolved Oxygen (DO) values varied from 6.1 to 6.3 showing favorable conditions for the growth and reproduction of normal population of fish and other aquatic organisms in these water bodies. Heavy metals namely mercury, chromium, lead, cadmium and arsenic were below the detectable range in all the sampling locations.BOD level recorded was in the range of 12 to 20 mg/l which denotes the presence of organic matter in the water bodies. The maximum BOD value of 20 mg/l was observed at Thea Kaw village (seasonal stream) slightly higher than the other locations which may be due to the discharge of domestic wastewater from nearby settlements and runoff from agricultural lands. At Ayeyarwady River, Iron content was found to be 7 mg/l and presence of faecal coliforms was observed. During the field visit it was noticed that the river water being used for drinking purpose and thus, recommend disinfecting the water before direct usage.

Groundwater: The pH of groundwater samples varied from 6.36 to 7.41 with slightly acidic at location GW 6. The Groundwater with low pH could contain elevated levels of toxic metals and have aesthetic problem like premature damage to metal piping, sour taste and staining of laundry. The total dissolved solids varied from 84 to 872 mg/l while electrical conductivity varied from 133 to 1384µS/cm being maximum at GW3 (Ye Twin Hla village) which is quite high if considered for drinking purposes. Lowest TDS recorded at GW6 which a natural spring water is flows to surface from a clean ground water source. Total Hardness varied from 24 to 688 mg/l with maximum value recorded at village Ye Twin Hla which is quite high when considered for drinking purpose while calcium at different monitored locations ranged between 16 and 386 mg/l and magnesium from 8 to 302 mg/l. Thus, the hardness values recorded was found to be in correlation with the calcium and magnesium ions analyzed at respective location. Iron content varied from 0.1 to 0.2 mg/l with maximum value recorded at village Thea Kaw and should not have an unpleasant odor, taste or appearance and will not require treatment. Fluoride contents in the ground water samples were found to be in accordance with the standard limits for drinking water of World Health Organization (WHO).

From the above analysis results it is found that all the parameters of the groundwater samples fairly meet the standard limits for drinking water of World Health Organization (WHO). Moreover, the groundwater quality results do not indicate any industrial pollution.

Biological Environment

The study area consists of agricultural land (i.e., paddy field and crops) open barren land with some trees resistant to drought. During the field visit deciduous trees and green bushes were observed. Major agricultural practice carried out in the study area is Paddy cultivation.

Assessment of animal species has been done based on secondary data collected from different government offices, forest officials of the area and by visual observation during field survey. Naturally occurring animal species includes animals like Jackals, Foxes, Bats, Squirrel, Hare, Rabbit, mice etc. Common avifauna includes Egrets, House Sparrows, Cuckoos and Pigeon etc. There is no Eco sensitive Zone in the study area.

The study on Plankton and Benthos species found at Ayeyarwady river is carried out based on secondary research. The study of planktons and benthos helps in assessing the quality of waterbodies. These communities are sensitive to various physicochemical characteristics of waterbody such as Alkalinity, conductivity, nutrients, BOD etc and are considered as the best indicators to assess the conditions and change of the freshwater environment.

Socio-Economic Status

Socio Economic Statement

There are 17 village tracts (village group) in the Padaung Township. The information on the socio-economic statement of the villages falling under the study area was collected through primary data collection (public consultation) and secondary data collection. Primary socio-economic data was collected through public consultation, which was conducted in the study area, i.e. 5 km buffer zone with respect to the drilling site. The public consultations were carried out in the presence of officials from the Myanma Oil and Gas Enterprise (MOGE), Govt. of Myanmar, respective area's administrative officials and representatives of M/s Bashneft International B.V.

Demography: The proposed drilling site is located near Padaung township of Pyay district. The total population Padaung township population is 147,123 as on April 2017. The total number of households in the Padaung area is 37,298 as on April 2017.

Religion and Culture: Around 80% of the people in Myanmar practice Theravada Buddhism. The remaining people follow Christianity, Islam, Hinduism and Animism. In line with the same, this area is mainly dominated by Buddhists from main ethnic group of Bamar. Christianity was also reported to be practiced in the study area. The most important architectural feature in Myanmar is the Buddhist temple known as Pagoda. These Pagodas serve as religious school, a community center, a guest house, a place where the government and other agencies post information, a site for sports activities, a center for welfare services for those who are poor and ill, a morgue and a center for music and dance.

Education: The literacy rate of the Bago region is reported to be 94.7% (Myanmar Population and Housing Census - The Union Report, May 2014). There are no colleges in the study area. The nearest institutions for higher education are the Pyay University (PU), Pyay Technological University (PTU) and Government Computer University (GCU) which are located at about 08 km from the northeast end of the EP-4 Block, in Pyay town.

Occupation and Income: The major economic activity of Bago Region in the study area is cultivation. Major crop is paddy and its cultivation mainly takes place during monsoon season (June to December). Seasonal vegetables and fruits are also grown in the cultivated land but mainly for self consumption and excess product is sold in the local market for consumption of local people only. Villagers also keep domestic animals like cow, pig, hen, duck for own consumption. No industrial activity is present in the study area. Cultivation of corn and vegetables was observed at some places. Grocery shops, blacksmith, carpentry, barber, masonry work are the alternate sources of income among the villagers.

Agriculture: Almost all the households are dependent up on agriculture for their income in the study area. Paddy cultivation is the predominant agricultural practice here. The total cultivable area in Padaung Township is 89,098 acres. Area under paddy cultivation amounts to 47,087 acres. In the Padaung region, mostly single season (monsoon) cultivation of rice is practiced. The rice cultivation period is from June to December.

Fishery: Fishing is a predominant activity in those villages that are located near the water resources mainly the Ayeyarwady River. Mostly fishes are caught by the villagers for self-consumption, if any extra fishes are left, it is sold off. Households, which are involved in the fishery, are also reported to be involved in agriculture. Hence, fishery is not a primary occupation in the proposed area.

As per the information provided by the Deputy Director, Department of Fisheries, major commercial fish in Ayeyarwady River is Hilsa, locally known as Pyay species. It migrates from sea to the river for breeding in the monsoon months during June – August. After hatching, the juveniles swim back to the Bay of Bengal.

Infrastructural Facilities: The River Ayeyarwady is the main mode of transportation in the EP-4 Block. All necessary and bulky cargos are being transported through this river only. Villages near the river banks were noted to use boats for transportation. Most of the roads in the study area are unpaved, single track and dusty.

Communication: The only mode of communication in the study area is mobile phone. There are two major telecom operators namely Telenor and Myanmar Post and Telecommunication (MPT).

Drinking Water Availability: Almost 81% of the people residing in the Bago region have access to drinking water, which is higher than the national average of 69% (The state of local governance: Trends in Bago, UNDP Myanmar, 2014). In line with the same, almost all the villages in the proposed study area have access to drinking water. Ground water is the major source of potable water in the study area.

Sanitation Facility: In general, the sanitation facility availability in Bago region (77%) is slightly lesser than that of the National average (79%) (The State of Local Governance: Trends in Bago, UNDP Myanmar, 2014). In contrast to that, sanitation facility (toilet) is available in all the villages in the proposed study area. The sewage from the toilet is mostly connected into soak pit/septic tanks.

Solid Waste Management: There is no solid waste management facility or practice in the study area. The solid wastes are generally dumped in open areas.

Health Care Facilities: There are four (4) health care center's/hospitals in Padaung Township for the local resident's in proposed study area. In addition, there are five (5) clinics in township area. However, it was observed that no healthcare centers are present within villages.

Electricity: Most of the villages in the study area were observed to have no 24 x7 electricity connection. Solar lightnings were noted at few villages though, while at some village's car batteries were seen to be used as a temporary source of electricity. Village monasteries were seen to use diesel generators for lightening.

1.5 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES (CHAPTER 6)

The impact analysis performed is intended to cover only the activities relating to exploratory drilling and associated activities. Bashneft's primary purpose and need for the proposed prospecting and appraisal well drilling is to determine the presence of hydrocarbon reservoir and quantity of such reserves in addition to, establish its economic feasibility.

The anticipated qualitative potential impacts related to the proposed project activities and its consequential effects on the surrounding environment based on the environmental sensitivities/ resources available in the study area, i.e. 5km radial distance from the well site is provided in interactive matrices.

Evaluation of impacts signifies the potential impact in terms of its likelihood nature as per the following criteria:

a. The impacts are further classified based on their spatial distribution, i.e. *local,* when impacting an area of approximately one km radius from the project area, *moderately spread,* when impacting an area of one to two km radial area and *regional,* when it is beyond two km;
b. The impacts are classified as *short term, moderate term* and *long term* with respect to their existence in temporal scale. Impacts less than one year existence as *short term,* while those with one to three years as *moderate term* and more than three years as *long term*;
c. The negative impacts are termed as *adverse impacts* while positive impacts as *beneficial.*

The activities involved in drilling operation are very important for the economy of Myanmar, as these will promote discovery of new oil and gas field in the country, which will substantially increase Oil and Gas Production and will provide additional revenues to Myanmar besides providing additional impetus to the local economy. But the different stages of drilling operations are associated with many risks which should be rectified parallelly along with drilling operation to avoid any discrepancy in the drilling operation. The various risks associated at different stages of drilling operations are as follows:

- Risks associated with in the course of Well Construction
- Risks associated for Lost Circulation during well construction
- Risks associated with oil and gas shows
- Risks associated with sticking of drill string and BHA
- Risks associated during cementing process

1.6 CUMULATIVE IMPACT (CHAPTER 7)

The EIA study conducted, which includes, socio-economic impact assessment too, is considered to be project-centric while cumulative impact assessment, on the other hand, is more of specific to valued environmental and social components or VECs. Within the EP-4 Block, no other existing or proposed developmental projects other than the proposed drilling project were found.

1.7 ENVIRONMENTAL MANAGEMENT PLAN (CHAPTER 8)

An environmental monitoring plan is recommended to monitor environmental parameters during drilling and Post Drilling Phase of the project. The monitoring plan is given in **Table 1.2.**

Table 1.2: Recommended Environmental Monitoring/Audit Protocol - Drilling Operation

Receptor	Location	Monitoring Mechanism	Monitoring & Reporting Frequency	Monitoring Budget (in USD/Kyat)
Resources	At Project site	Inventory of each type of material (including water consumption) and fuel (used for power) quantity	Daily during drilling phase	
Ambient Air Quality	At project Location	Monitoring of PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOCs and HC.	Once in a month	USD 3000 (Kyat 4,566,000) per location.
Noise & Vibration	At Rig Site, near DG sets and drilling pumps.	Noise level monitoring	Once in a month	USD 150 (Kyat 228,300)
Drilling wastes	At drilling site	Quantification and characterization of drill cuttings	• Quantity of wastes to be recorded on daily basis. • Characterization of the waste to be done every month.	• As per actual cost
Wastewater Generation	At Project Site	Wastewater generation rate	Quantity to be recorded every day.	USD 800 (Kyat 1,217,600).
Oil wastes	At Drilling Site	Spent oil from engines.	A logbook should be maintained daily during drilling phase. If no spent oil is produced, the same should be noted in the logbook.	As per actual cost

Note: 1USD = 1522 Kyat.

1.8 PUBLIC /STAKEHOLDER CONSULTATION AND DISCLOSURE (CHAPTER 9)

The Block EP-4 area falls in Pyay District of Bago Region in Myanmar. The proposed well site lies in the block EP-4 of Padaung Township. As part of the EIA for the proposed project activity, Public Consultations were carried out at 4 locations within the study area. In addition

to that, public view of village heads and other administrative & community representatives was also captured through meeting in the Administrative office in Padaung Township.

The Public Consultations were carried out by ACE Team in November 2017, in the presence of officials from the Myanma Oil and Gas Enterprise (MOGE), Govt. of Myanmar, Officials from the respective Administrative Office (Padaung) and representatives of Bashneft.

The objectives of the Public Consultations were as follows:

- Inform citizens, groups and organizations about the proposed project.
- Record the apprehensions of the public, if any.
- Ensure all views are considered in planning and decision making for the proposed project.
- Create joint visions that consider multiple interests and concerns.
- Initiate action to resolve issues and problems, if any.

2

INTRODUCTION

2 INTRODUCTION

2.1 PROJECT BACKGROUND

The Myanma Oil and Gas Enterprise (MOGE), Myanmar Ministry of Energy (MOE) awarded the EP-4 Block to Bashneft International B.V. (hereinafter referred to as Bashneft) on Production Sharing Contract (PSC) basis on 10th August 2014 for exploration and development of the Block. The area of Block EP-4 is a part of the Bago West division, falls in the flat Central Part of Myanmar geologically identified as Pyay Embayment Basin.

Bashneft is the Block operator with 90% shares and the balance stake is held by M/s Sun Apex Holdings Ltd., Myanmar. The Block covers an area of 841 km^2. Based on the sub-surface data analysis of this region, Bashneft has identified its first exploratory well location in EP-4 block, where drilling is to be carried out to evaluate the hydrocarbon aspects.

As per PSC with MOGE, Environmental Impact Assessment (EIA) needs to be carried out for the proposed drilling operation. Also, Bashneft is responsible for the implementation of the environmental protection measures and management plan in accordance with the applicable laws, rules, regulations, directive and notifications of the Republic of the Union of Myanmar and in conformity with international petroleum industry's practices.

M/s Asian Consulting Enterprises Pte. Ltd., Singapore (ACE) had undertaken the Environmental Impact Assessment (EIA) study. The report presents the outcome of the Environmental Impact Assessment (EIA) study based on the data collected (primary and secondary) during post monsoon season of 2017.

2.1.1 *Project Proponent*

Bashneft, a Public Joint Stock Oil Company, which is ranked among the top ten Russia's largest oil companies, commenced its oil production on 16th May 1932. Bashneft's core operations include oil and gas exploration, production, manufacturing of petroleum products and petrochemicals and its marketing. Bashneft's top priorities are improving product quality, business efficiency, environmental sustainability and industrial safety in innovation, scientific and technological development. After being awarded with the Onshore EP-4 Oil Block by MOE, Myanmar, Bashneft as an operator entered a PSC along with Sun Apex Holdings Ltd. to carry out appraisal drilling in the Block.

Contact details of the Project Proponent,

Contact Person: Mr. Grigory Stepanov
Tel.: +95 (9) 43-168-142
Tel/Fax: +95 (1) 230-44-05
Email: StepanovGV@bashneft.ru

Office Address:
Arcc Office. Lvl. 6, 611 Hledan Center,
Corner of Pyay Road and Hledan Road, Kamayut Township,
Yangon, Republic of the Union of Myanmar.

Bashneft has engaged Asian Consulting Enterprises Pte. Ltd., Singapore and its sister concern Asian Consulting Engineers Pvt. Ltd., India, hereinafter referred to as ACE to carry out EIA study and to develop EMP for the proposed drilling operation.

2.1.2 *EIA Consultant*

ACE is a Consulting Firm specialized in water and environment sector. ACE has provided its consulting services and has successfully completed projects in Myanmar, India, Bangladesh, Vietnam, Afghanistan, Kuwait, Mongolia and United Arab Emirates. ACE has carried out EIA study for Oil & Gas, infrastructure and industrial developmental sectors, Health Safety & Environment (HSE) compliance audits and has also designed water supply system, wastewater management system, industrial waste management system, solid waste and hazardous wastes management systems.

2.2 BACKGROUND OF OIL & GAS OPERATIONS IN MYANMAR

Myanmar had exported its first barrel of oil in 1853 and become one of the world's oldest oil producers. The first foreign oil company to drill in Myanmar was Rangoon Oil Company, which was created in 1871. Eventually, Burma Oil Company (BOC) dominated the country's oil industry between 1886 and 1963 which discovered the Yenangyaung field in 1887 and the Chauk field in 1902. Both are still in production. In 1962, the oil and gas industry were nationalized with the socialist military regime coming to power. The State assumed ownership of the resources, either directly operating them or delegating this task to private operators under production sharing contracts (PSCs). The Ministry of Energy is the key manager to any oil and gas policy in Myanmar and controls three state-owned enterprises:

- Myanma Oil and Gas Enterprise (MOGE) a state-owned enterprise which is responsible for the upstream oil and gas sector under the Ministry of Electricity and Energy of the Republic of the Union of Myanmar, created in 1963, is responsible for oil and gas exploration and production, as well as domestic gas transmission through a 1,200-mile onshore pipeline network.
- Myanmar Petrochemical Enterprise (MPE) operates three small refineries, three fertilizer plants and several other processing plants.
- Myanmar Petroleum Products Enterprise (MPPE) is responsible for retail and wholesale distribution of petroleum products.

Since nationalization, the country's oil policy has gone through two distinct periods:

- From 1962 to 1988, oil exploration and production were mainly performed by MOGE; foreign operators were kept out by a strict nationalistic policy and the lack of an appropriate legal framework.
- In 1988, Myanmar passed foreign investment legislation and began relying on outside technology and capital to revive its oil and gas industry.

In 2007, nine foreign oil companies were involved in 16 onshore blocks to explore new areas, to enhance recovery from existing fields, to reactivate fields where production had been

suspended and to produce oil and gas. In the offshore about 31 Oil & Gas blocks are being explored and/or developed. In latest developments in 2014 more blocks became part of PSCs after having undergone bidding. Since late 2004, Myanmar's authorities have pushed the opening of blocks to foreign companies. The country produces around 180, 000 barrels of oil equivalent per day of which 90% is gas. Recently, MOGE intended to establish a total of three joint ventures with internationally proven service companies by the second half of 2017 in the following petroleum services.

Onshore seismic acquisition services-

- Onshore drilling services; and
- Onshore pipeline construction and maintenance services.

2.3 PREVIOUS STUDIES IN THE BLOCK

The 2D seismic surveys were carried out in Block EP-4 which covers 841 km^2 area. It was conducted to study the subsurface geologic setting of the sedimentary sequence in the northern and southern parts of the study area. The data acquired in a 2D mode in the scope of 369.5-line km (includes the source points with recording and with split spreads). The seismic survey operations were done under supervision of MOGE officials. Following activities were supervised by MOGE:

1. The permission was obtained from Myanmar govt. for the storage of explosives as well as for conducting the seismic survey operations.
2. The collection, storage and return of the unused explosives was carried out by the MOGE shooting operations manager. The foreign personnel of the contractor were not permitted to perform the work.
3. Transportation of the explosives were undertaken by two specially equipped pickups by local personnel under control of MOGE shooting operation manager.
4. The plan for seismic survey acquisition and operation were approved by MOGE accordingly the survey was done.

2.4 BRIEF DESCRIPTION OF THE PROJECT

2.4.1. *Block EP-4 Details*

Block EP-4 with an area of 841 km^2 is located in the Pyay Embayment Basin, Mayaman Area, Republic of the Union of Myanmar. The block is about 280 km North-West of Yangon (largest city of Myanmar) and 140 km South-West of Nay Pyi Taw (Capital city of Myanmar). The Block is part of Bago West division. The geographical coordinate of the wellsite of the EP-4 block is presented in **Table 2.1** and the location map of the Block is shown in **Figure 2.1.**

Table 2.1: Geographical Coordinates of Wellsite

Point No.	Latitude (N)			Longitude (E)		
	Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	18	46	58.19	95	06	37.57

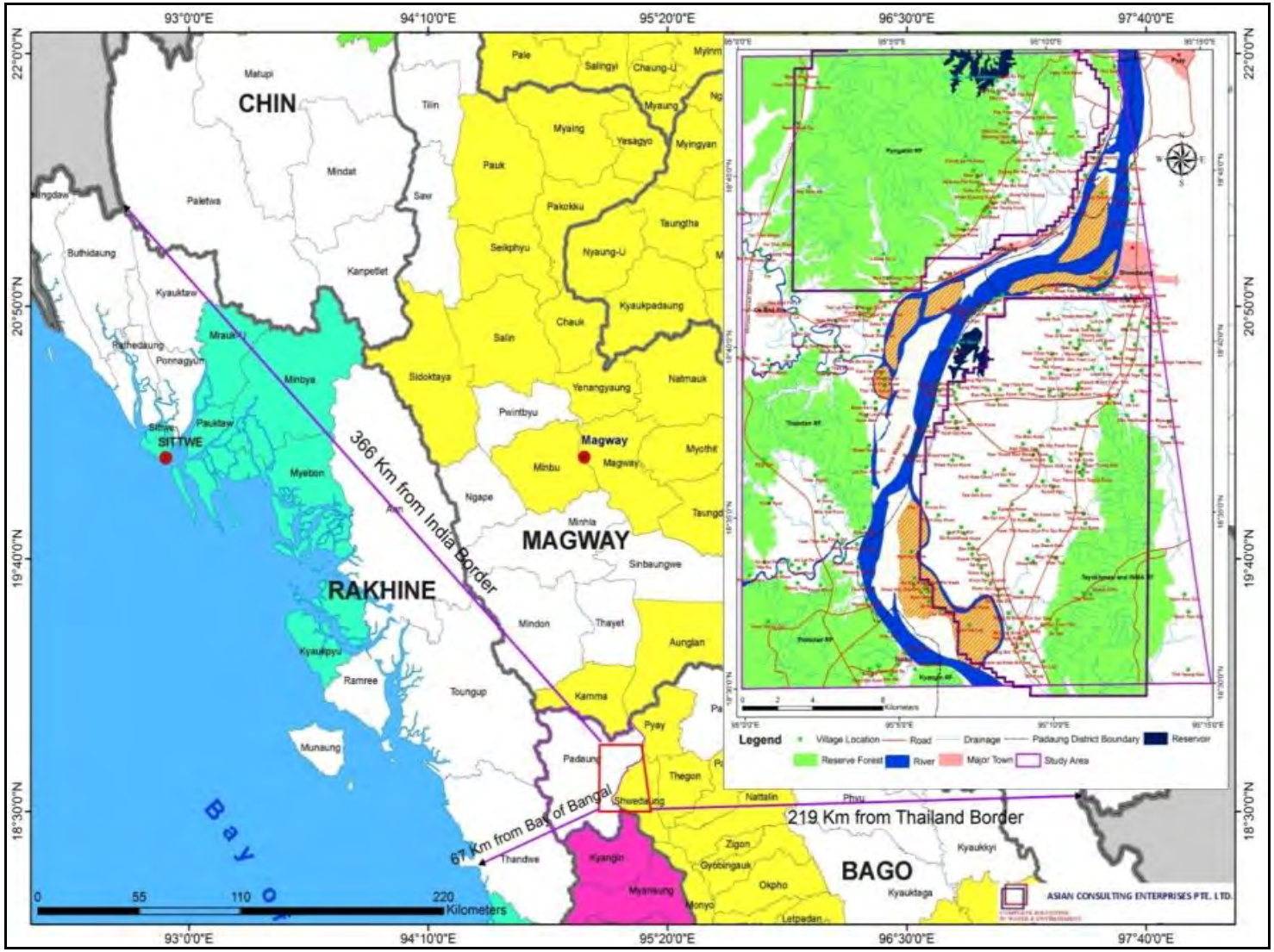


Figure 2.1: Location Map of EP-4 Block

2.4.2. *Proposed Operations*

Based on the subsurface information, block operator has decided to carry out its first prospecting and appraisal drilling in the in EP-4 block. Appraisal drilling is the method of exploring for hydrocarbon reservoir by drilling the well to the target as per the well design to confirm the size and structure of the field and well logging (analysis). If the appraisal well confirms an economically feasible reservoir, then the block operator may proceed to development of the well.

2.4.3. *Importance of the Proposed Project*

Block operator proposes to carryout appraisal well drilling within the EP-4 block based on the geological condition and seismic surveys. Drilling operation will be carried out for a short period and other information's like well diameter and length of the well will be finalized after well design. The entire drilling operation will be conducted as per the norms of regulatory authority.

These activities are very important for the economy of Myanmar, as these will promote discovery of new oil and gas field in the country, which will substantially increase Oil and Gas Production and will provide additional revenues to Myanmar besides providing additional impetus to the local economy.

2.5 EIA STUDY FOR THE PROJECT

2.5.1. Objective

The objective of this assignment is to prepare Environmental Impact Assessment (EIA) in consistence with Myanmar environmental law, in order to obtain environmental clearance for drilling of 1st Appraisal well in block EP-4.

EIA is a systematic process to –

- identify, predict and evaluate the environmental and socio-economic effects of proposed actions and projects,
- provide information on the environmental and socio-economic consequences of the proposed actions and,
- promote environmentally sound as well as sustainable development through the identification of appropriate enhancement and mitigation measures.

It includes the EMP which provides a plan meant for reducing the adverse impacts of the project. It also helps in identifying alternatives that will ensure minimal environmental degradation. This may be via modification in project design, implementation of project alternative(s), environmental protection measures and other solutions, which will help in reducing the severity & magnitude of impacts.

2.5.2. Terms of Reference (ToR) of EIA Study

The Terms of Reference (ToR) (ref: no. EIA-2/ Oil 2455/2019), dated 18th November 2019, was received to Myanma Oil and Gas Enterprises (MOGE) from Ministry of Natural Resources and Environmental Conservation (MONREC), Environmental Conservation Department (ECD) on 19th November 2019. This EIA Report has been prepared as per the ToR prescribed by ECD. The ToR points are given below:

I. **Environmental Impact Assessment (EIA)**

a) Description of the Project and related activities.
b) Comprehensive study of the prevailing baseline conditions of the environmental & social components and systems.

i) Land Environment:
- Geology,
- Geo-morphology,
- Land resources,
- Soil Quality.

ii) Water Environment:
- Surface & Groundwater resources,
- Hydrography and Hydrogeology,
- Water Quality.

iii) Ambient Air and Noise:
- Climate,
- Ambient air quality,
- Noise level.

iv) Biological Environment (Terrestrial and Aquatic):
- Flora and Fauna,
- Eco-sensitive and specially protected areas,
- Endangered/ vulnerable species, if any,
- Migratory path/ breeding ground, rare flora and fauna habitats, if any.

v) Socio-Economic environment:
- Village tracts and villages,
- Demographic profile,
- Economic condition,
- Existing infrastructure.

vi) Cultural heritage sites, historical sites, religious places and tourist places in the study area.

c) Development of aerial maps and layouts.
d) Impact assessment of drilling operation on physico-chemical and biological environmental components in standard operational conditions as well as in cases of potential emergencies & accidents, to develop prevention and mitigation measures and recommendation for environmental monitoring.
e) Impact assessment of drilling operation on social environment.

II. **Environment Management Plan (EMP) – prior to drilling and during drilling phase.**

- Description of adverse environmental impact.
- Development of mitigation measures plan.
- Preparation of environmental monitoring and management plan.

2.5.2 Approach of the EIA Study

The EIA study basically includes establishment of the present environmental scenario within the study area. It consists of study of the specific activities related to the project and evaluation of the potential environmental impacts, thus, leading to the recommendations of necessary environmental pollution control measures. EMP is developed based on the outcome

of the EIA study. The entire EIA study and development of EMP has been carried out as per the Myanmar EIA procedure and legislative framework.

2.5.3 Establishment of Baseline Environmental and Socio-Economic Status

A comprehensive database on the baseline environmental status/conditions at vicinity of the project location (hereafter referred as study area) area of the wellsite has been established through review, compilation & analysis of:

- Existing published secondary data/ literature/ information collected.
- Primary data collected through field study, survey and monitoring.

2.5.4 Secondary Data Collection

The secondary data with respect to the study area was collected from the following offices:

- Administrative Office of the Padaung Township.
- Meteorological Department, Pyay.
- Department of Environment, MONREC -Myanmar's Ministry of Natural Resources and Environmental Conservation (earlier known as –MoECAF), Padaung.
- Department of Fisheries, Pyay.
- Department of Agriculture, Padaung.

Apart from the data collection from the above-mentioned Government offices, secondary data were also collected from the published articles, reports, websites etc.

2.5.5 Field Study/Monitoring for Generation of Primary Data

The collected secondary data has been appropriately supplemented by conducting the necessary primary data generation/ collection through field study/monitoring.

i) **Soil Analysis:** To study the soil characteristics in the block area, soil samples were collected from representative locations and analyzed for important relevant physical & chemical parameters.

ii) **Air Quality Monitoring:** For drawing up the baseline status of air quality in the block area, air quality monitoring in respect of PM_{10}, $PM_{2.5}$, SO_2, and NO_2 has been conducted at representative locations in the block area adopting a 24-hours schedule.

iii) **Noise Monitoring:** To establish the ambient noise scenario in the block area, monitoring of ambient noise level has been carried out at the representative locations in the block area using a suitable portable sound level meter over a period of 24 hours.

iv) **Water Quality Monitoring:** For drawing up the baseline data on water quality, water quality mon

v) itoring was conducted at representative locations in the block area. Ground and Surface water samples were collected and analyzed for important relevant physical and chemical parameters.

vi) **Biological Environment:**

- **Aquatic Ecology:** Secondary information on Zooplankton, Phytoplankton and Benthos and other aquatic species were collected, reviewed and presented.

- **Terrestrial Ecology:** The primary survey for this component was carried out through visual inspection. Secondary data on terrestrial ecology was collected during Field visit, Public consultation and from Department of Forest.

2.5.6 Project Team

A team of experts were involved in carrying out the EIA study. The list of experts and their contribution in the EIA study are tabulated in **Table 2.2**.

Table 2.2: Project Team and their Contribution

Sl. No.	Name of the Staff	Position	Contribution to EIA
1.	Dr. Suparna Mullick	Senior Environment and Social Specialist / Team Leader.	• Overall in-charge of the project • Preparation of schedule for baseline data collection. • Guided the team of experts for baseline data collection. • Assess the water quality status of the block area. • Identify and assess the impacts on water quality and suggestion on mitigation measures. • Preparation of EIA Report.
2.	Mr. Abhaye Mahajan	Environmental Engineer.	• Assess the air and noise quality status of the block area. • Identify and assess the impacts on air and noise and suggestion on mitigation measures. • Preparation of EIA Report and EMP.
3.	Dr. P.G. Shanware	GIS, Land Use and Land Cover Expert.	• Guiding the Preparation of GIS/Remote sensing map. • Asses the soil quality of the block area. • Identify and assess the impacts on soil quality and suggestion on mitigation measures. • Contribution in Preparation of EIA Report.
4.	Ms. Ruchi Sharma	Environmental Specialist.	• Baseline and secondary data collection. • Identification of impacts on environmental and social components due to project operation. • Suggestion of appropriate mitigation measures to minimize the adverse impact on health, safety and environment. • Contribution in Preparation of EIA Report.
5.	Mr. Hindpal	Hydrogeology, and Groundwater Specialist.	• Site visit. • Asses the water quality status of the block area. • Identify and assess the impacts on water quality and suggestion on mitigation measures. • Contribution in Preparation of EIA Report.
6.	Mr. Arul Nath	Environmental Specialist.	• Site visit • Analysis and assessment of data collected in stakeholder consultation. • Identify and assess the impacts on socio-economic environment and suggestion on mitigation measures.

Sl. No.	Name of the Staff	Position	Contribution to EIA
			• Contribution in Preparation of EIA Report.
7.	Mr. R. Subramanian	Risk and Health Hazard Expert.	• Baseline and secondary data collection at the site. • Representation in the local public consultations and stakeholder meetings. • Identification of hazards/risks i.e. possible manmade and natural disasters. • Suggestion of appropriate mitigation measures to minimize the adverse impact on health, safety and environment. • Contribution in Preparation of EIA Report.
8.	Mr. Aung Myat Kyaw	Facilitator (Myanmar)	• Site visit. • Baseline and secondary data collection.
9.	Mr. Nay Lin Aung	Local Coordinator	• Site visit. • Translation and interpretation (Burmese to English). • Baseline and secondary data collection.

2.6 LIMITATIONS OF THIS EIA STUDY

This EIA report is based on the visual inspection and primary data collected during the post monsoon season of 2017 and secondary data collection, discussions with government officials, consultation with local people of nearby villages held in November 2019. It is subjective to change with respect to the change of time and place. The report is also based on certain scientific principles and professional judgment to certain facts with resultant subjective interpretation and additional project information provided by Bashneft for the project.

2.7 STRUCTURE OF THE EIA REPORT

Chapter 1 : Executive Summary. - Summarizes the complete EIA report.

Chapter 2 : Introduction. - This chapter provides a background to the project, the project proponent and the objective of the EIA study, Terms of Reference proposed for EIA study and project team/environmental and social experts.

Chapter 3 : Policy, Legal and Institutional Framework. - The chapter provides information related to national and international legislative framework applicable to the proposed project, tells about the concerned organization /department and company policy towards health, safety and environment, project's environmental and social standards.

Chapter 4	:	**Project Description and Selection of Alternative Technology.**	- This Chapter describes the details of the Project background, location, overview map and site layout maps, proposed drilling operations and analysis of alternative technologies.
Chapter 5	:	**Description of the Surrounding Environment.**	- This chapter depicts the existing surrounding environmental and social conditions of the block area, and the physical, biological, legally protected, socio-economical, cultural and visual components.
Chapter 6	:	**Impact and Risk Assessment and Mitigation Measures.**	- Identifies potential environmental and social impacts due to the proposed project and provides the applicable mitigation measures
Chapter 7	:	**Cumulative Impact Assessment.**	- Identifies cumulative impacts with respect to any existing and future projects and required mitigation measures.
Chapter 8	:	**Environmental Management Plan.**	- Presents the comprehensive environmental and social management and monitoring plans.
Chapter 9	:	**Public/Stakeholder Consultation and Disclosure.**	- Presents the findings of the consultations carried out with public/stakeholders.

3

POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 INTRODUCTION

This chapter describes the national and international legislation, regulations, standards, conventions etc., applicable to the drilling operation in Myanmar. The regulatory organizational framework and Bashneft's policy towards the health, safety and environment are also provided.

3.2 COMPANY HEALTH, SAFETY & ENVIRONMENT (HSE) POLICY

Health, safety and environment (HSE), is one of the priority areas for Bashneft. This is due to both stringent governmental regulatory requirements and the fact that the Bashneft and its management are aware of their responsibility towards society, as taking care of the environment is a necessary prerequisite for the health and happiness of future generations.

Bashneft ranks among Russia's ten largest oil companies. The drilling operations inevitably have an impact on the environment, including the atmosphere, water and land. Bashneft takes a proactive approach for environmental protection, realizing that efficient use of natural resources is an essential part of corporate social responsibility and a necessary condition for sustainable development.

Bashneft is committed for ensuring that their operations are safe. Bashneft believes that ensuring safety should guarantee protection of people and the environment. Therefore, the management tackles these issues focusing on the two main spheres:

Sl. No.	Issues	Description
1.	**Process and occupational safety**	These activities are based on analyzing and assessing risks and are aimed at preventing industrial injuries and improving working conditions, as well as ensuring full compliance with HSE rules and regulations.
2.	**Environmental safety of the production complex**	This area includes efficient use of natural resources and minimizing the negative environmental impact of the Bashneft's operations in its operating regions and at the fields under development.

HSE Strategy

The HSE policy adopted by Bashneft in 2011 (Annexed as ***Annexure –I,*** Health, Safety and Environmental Policy), consists of the Functional HSE Strategy of Bashneft. The strategy, defines the following principles of the corporate strategy for sustainable development:

Ensuring occupational safety for all employees, as well as conserving natural resources for future generations;

i. Complying with the main requirements and spheres of the Government's HSE policy;
ii. Complying with the HSE laws and regulations;
iii. Openness and transparency;
iv. Encouraging employees' personal commitment to implement the HSE management system and providing employees with incentives for their active involvement in it;
v. Continuously improving the HSE management system.

3.3 CORPORATE SOCIAL RESPONSIBILITY

Corporate social responsibility of Bashneft is evident from the following CSR principles adopted by the same:

i. Upholding universal moral and ethical standards, respecting human rights and unconditionally observing them.
ii. Protecting the environment, safeguarding the interests of future generations.
iii. Promoting occupational safety and investing in talent development.
iv. Maintaining a balance of interests between consumers, local communities, regulatory bodies, and non-profit organizations, on the one hand, and the Company's shareholders, partners, and employees, on the other hand.
v. Improving the quality of life of the Company's employees and the population in its operating regions.
vi. Contributing to the development of local communities in the Company's operating regions, including charitable programmes, and promoting an efficient social partnership.
vii. Consistently integrating corporate social responsibility into the Company's day-to-day operations and promoting a dialogue with a broad range of stakeholders.
viii. Raising stakeholders' awareness by ensuring the availability and transparency of information on the Company.

Bashneft is also a signatory of the Social Charter of Russian Business since 2010, which demonstrates the Company's commitment to the above-mentioned CSR principles. The organization structure for the implementation of the CSR activities is given in **Figure 3.1.**

The following internal documents of Bashneft form the key approach to the implementation of the CSR policies:

- Code of Ethics.
- Code of Corporate Conduct.
- Policy on Corporate Social Responsibility.
- Policy on Charitable Activity.
- Anti-Corruption Policy.
- Functional Strategy on Health, Safety and Environment.
- Policy on Health, Safety and Environment.

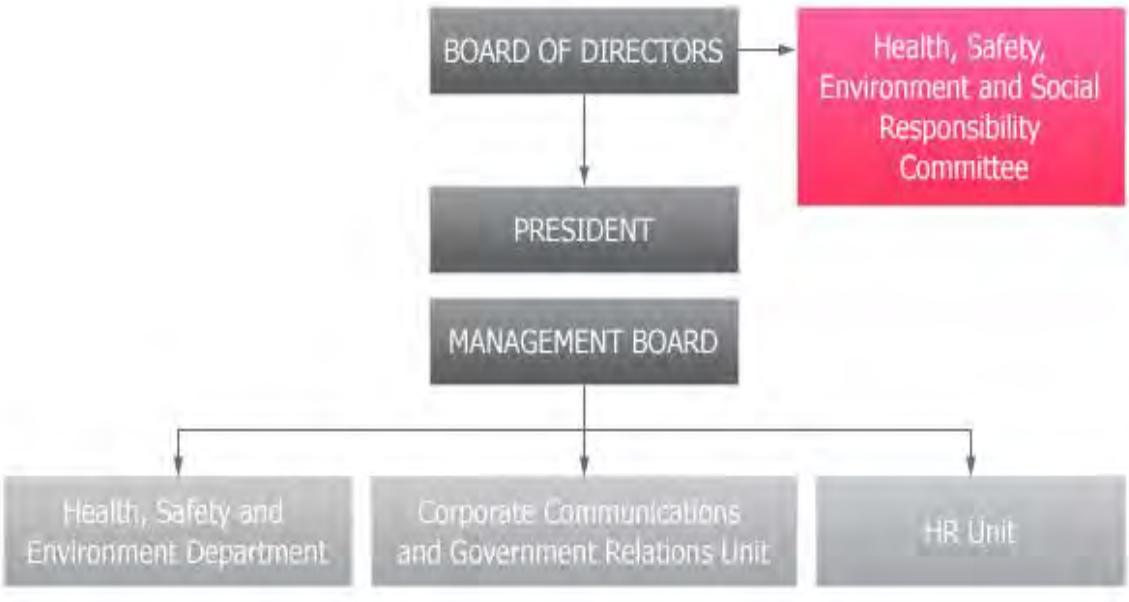


Figure 3.1: Organization Structure for the Implementation of the CSR

Social Responsibility Standards

Bashneft's social responsibility standards are in the spheres of process safety and environmental protection.

To ensure process safety and environmental protection in the course of its operations, Bashneft shall:

i. Conduct its operations in compliance with environmental legislation;
ii. Reduce the environmental impact of all its operations, production processes and products by adopting state-of-the-art technologies and methods of pollution prevention;
iii. Switch to producing environmentally friendly types of fuel complying with Euro 4 and Euro 5 standards by the specified deadline;
iv. Ensure efficient use of natural resources (those used in production, as well as those located in the Bashneft's operating regions) by introducing resource-saving and energy efficient technologies and using alternative energy sources;
v. Achieve greater efficiency in environmental control and internal audit of compliance with the requirements of environmental legislation and ensure the compliance of production with ISO 14001 standards;
vi. Constantly improve the HSE management system in order to meet international OHSAS 18001 and ISO 14001 standards.

3.4 LEGISLATIVE FRAMEWORK

A list of applicable legislations framework for the Project is listed in **Table 3.1**.

Table 3.1: Applicable Legislations

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
MYANMAR ENVIRONMENTAL LAWS, POLICY AND LEGAL FRAMEWORK			
Environmental Impact Assessment Procedure, MoNREC (earlier known as - MoECAF), (29 Dec 2015).	**EIA Study and Reporting**	ESIA Study	Myanmar's Ministry of Natural Resources and Environmental Conservation-**MoNREC (earlier known as - MoECAF).**
Myanmar Investment Commission Notification No. 1/2013, (31st January 2013).	**EIA**	Requires an environmental impact assessment (EIA) for oil and gas projects.	Myanmar Investment Commission (MIC).
Environmental Conservation Law, 2012 – Myanmar.	**Objectives of the Law**	• To have a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations; • To reclaim ecosystems as may be possible, which are starting to degenerate and disappear; • To enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially.	**MoNREC (earlier known as - MoECAF).**
	Compliance to Quality Standards	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.	
	Environment Management Solutions	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.	
The Conservation of Water Resource and Rivers Law (2nd October,	**Objectives**	• To conserve and protect the water resources and rivers system for beneficial utilization by the public;	Directorate of Water Resources and Improvement of River

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
2006)		• To smooth and safety waterways navigation along rivers and creeks; • To contribute to the development of State economy through improving water resources and river system; • To protect environmental impact.	Systems.
	Disposal	No person shall: • Dispose of engine oil, chemical, poisonous material and other materials which may cause environmental damage, or dispose of explosives from the bank or from a vessel which is plying, vessel which has berthed, anchored, stranded or sunk. • Catch aquatic creatures within river-creek boundary, bank boundary or waterfront boundary with poisonous materials or explosives.	Directorate of Water Resources and Improvement of River Systems.
	Permission & Violation	No one shall: • Build lavatories unsuitable to the urban and rural community lifestyle in the bank area and watercourse area. • Drill well or pond or dig earth without the permission of the Directorate.	
		No one shall: • Violate the conditions relating to navigation of vessels in rivers and creeks prescribed by the Directorate for conservation of water resources, rivers and creeks. • Violate the conditions prescribed by the Directorate so as not to cause water pollution and change of watercourse in rivers and creeks.	
The Protection and Prevention of Cultural Heritage Region Law, 1998	**Protection and Prevention Cultural heritage or region**	It states that implementation of the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for many years. To protect and preserve cultural heritage regions and cultural heritage from damage due to natural disaster or man-made destruction. Promote public awareness and will as to the high value of the protection and preservation of the cultural heritage regions. To carry out protection and preservation in conformity with the International Convention approved by the State.	State Peace and Development Council.
The Protection and Prevention of Ancient Monument Law, 2015	**Protection and Prevention of Ancient Monument**	Protection and prevention of ancient monument from destruction by natural disaster or human intervention. It also promotes exploration and preservation of new ancient monuments.	Ministry of Culture.

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
The Protection and Preservation of Antique Objects Law (22nd July 2015)	**Protection and preservation of Antique objects**	• To implement the policy of protection and preservation for the perpetuation of antique objects; • To protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction; • To uplift hereditary pride and to cause dynamism of patriotic spirit by protection and preservation of antique objects; • To have public awareness of the high value of antique objects; • To carry out in respect of protection and preservation of antique objects in conformity with the International Convention and Regional Agreement ratified by the State.	Department of Archaeology and National Museum opened in States and Regions.
	Obligations	• The person who finds any object which has no owner or custodian, he shall promptly inform the relevant Ward or Village-Tract Administrator if he knows or it seems reasonable to assume that the said object is an antique object.	
	Offence	• Whoever carry's or transports an antique object to a foreign country without permission shall, on conviction, be punished with imprisonment for a term from a minimum of five years to a maximum of ten years or with a fine from a minimum of five million kyats to a maximum of ten million kyats or with both.	
National Environmental Quality (Emission) Guidelines, 2015	**Environmental emissions quality**	Provide the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health. The guidelines for emission, effluent and waste levels, sewage, storm water drainage is specifically mentioned, according to IFC EHS guidelines.	**MoNREC** **(earlier known as - MoECAF).**
Myanmar Investment Law, 2018	**Business investment and development**	The objectives of this Law are as follows: • Development of responsible investment businesses which do not cause harm to the natural environment and the social environment for the interest of the Union and its citizens; • Protection of the investors and their investment businesses in accordance with the law; • To create job opportunities for the people;	Ministry of Planning and Finance of the Union Government.

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		• To develop human resources; • To develop high functioning production, service and trading sectors. • To develop technology, agriculture, livestock and industrial sectors; • To develop various professional fields including infrastructure around the Union; • To enable the citizens to be able to work alongside with the international community; • To develop businesses and investment businesses that meet international standards.	
The Farmland Law, 2012	**Right for farming on farmland**	The law states the rights applicable to farmer for farming and allocation of land.	Ministry of Agriculture and Irrigation
The Forest Law, 2018	**Forest Conservation**	The Law states the basic principles of forest conservation, also guiding for forest management, establishment of forest plantation. The Law includes certain objectives to ensure long-lasting forest management and sustainable development. It is directed towards implementation of the forest policy and environmental conservation policy and endeavors to reduce the occurrence of natural disasters in line with international standards.	Ministry of Forestry.
	Provision for Plantation	According to this Law: If permission is obtained from the Government: • The Government and any person or any organization have the right to carry out in joint-venture, the stipulation cultivation and maintenance of forest plantations except for village-owned firewood plantations cultivated by the villagers for their use.	
	Offences and Penalties	In this Law, there is a provision that if anyone commits any of the following acts shall, on conviction be punished with fine which may extend to kyats 5000 or with imprisonment for a term which may extend to 6 months or with both: • Trespassing in a reserved forest; • Pasturing domestic animals or permitting domestic animals to trespass; • Breaking up any land, clearing, digging or causing damage to the original condition of the land without a permit in a reserved forest; • Causing damage to a water-course, putting poison in the water, using chemicals or explosives in the water in a reserved forest; • Catching animals, hunting or fishing in a reserved forest;	

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		• Kindling, keeping, carrying any fire or leaving any fire burning which may set fire to the forests in a reserved forest; • Moving forest produce without submitting to examination at the revenue station; • Violating any provision of the rule, procedure, order, directive or notification issued under this Law.	
Fisheries Act (III – 1905)	**Protection for Turtle and Turtle Hatching areas**	Protection for the turtle hatching areas and turtles was included and those, who were trespassing on those areas without official consent were effectively penalized.	
The Freshwater Fisheries Law (4th March 1991)	**Protection and development of Fisheries**	**Objectives** • To further develop the fisheries; • To prevent the extinction of fish: • To safeguard and prevent the destruction of freshwater fisheries waters; • To obtain duties and fees payable to the State; • To manage the fisheries and to take action in accordance with the Law.	Minister for the Ministry of Livestock Breeding and Fisheries.
	Offense	Envisage that no one shall cause harassment of fish and other aquatic organisms or pollution of the water in freshwater fisheries waters.	Director General of the Department of Fisheries.
The Government of Burma, Agriculture (Forest Department) Notification No.1 (1924)		An official announcement, not to trespass within 3 miles radius from the turtle hatching areas.	
Department of Fisheries Notification No.2/93 (1993)		Sea Turtle Conservation	
The new protection of Wildlife, Wild plants and Conservation of Natural Areas Law		Replacing the old Myanmar Wildlife Protection Act of 1936 was enacted in 1994 (Forest Department).	
Environmental	**Environmental**	The business, department, organization or person who would carry out categories of	**MoNREC (earlier known**

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
Conservation Rules, (2014)	**Conservation**	plan, business or activity stipulated under rule: • shall carry out environmental impact assessment for his plan, business or activity; • shall submit to the ministry in advance by which organization or person, the environmental impact assessment is intended to be carried out; • submit the environmental impact assessment report to the ministry.	**as - MoECAF)**
Other Related Environmental Laws, Rules and Policies			
Oil and Gas Laws: Oil Field Act (1918), **The Petroleum Act (1934),** **The oil field Rules (1936),** **The Petroleum Rules (1937).**		The Laws are still applicable, in practice, investors generally enter into production sharing contracts, performance, compensation contracts or improved petroleum recovery contracts with MOGE, the terms and conditions of which governs the process so long as they are not contrary to the law in force.	MOGE.
Petroleum Products Law, 2017	**Issuance of relevant license**	This law has the provision of import and export, transportation, storage, refinery, distribution, inspection and testing of petroleum and petroleum products and issuance of relevant licenses.	Ministry of Energy and Electricity
National Environmental Policy (1994).	**Utilization and conservation of natural Resources**	This policy states "To establish sound environmental policies, utilization of water, land, forest, mineral, marine resources and other natural resources in order to conserve the environment and prevent its degradation, the Government of the Union of Myanmar hereby adopted this policy".	
Other Laws, Rules and Policies			
Firefighting Law, 2015	--	--	Ministry of Energy and Electricity
Prevention from Danger of Chemical and Associated Materials Law (26th August 2013)	**Prevention from danger of chemical and associated material law.**	**Objectives:** • to prevent from damaging the environmental resources and from endangering the lively creatures due to the chemical and associated materials; • to control systematically for the safety in carrying out in accord with the approval for chemical and associated materials business; • to carry out the data information acquiring system and to widely do the educating and	Union Government.

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		research works in order to utilize the chemical and associated materials systematically; • to carry out continuous development for worksite safety, health and environmental conservation.	
	Obligations for licensing	The license holders: • Shall follow the principles contained in the license; • Shall follow the directives for safety in handling the chemical and associated materials and shall ask the workers to follow strictly; • Shall keep the necessary safety equipment sufficiently in the chemical and associated materials business and shall issue personal protective equipment and clothing to the workers free of charge; • Shall give the course to use personal protective equipment and clothing systematically, to give the training and shall instruct as necessary the chemical and associated materials business; • In respect of whether affecting the danger to the health of man and animals, environment or not, shall be examined by the relevant supervising teams and inspection teams; • Shall give the medical check-up to the workers who shall do the chemical and associated material business and shall allow to work in the said business if they have the recommendation to fit for the health. Shall keep the records of the medical check-up of them systematically; • If the dangerous chemical and associated materials can store, shall give the copy of the permit to the relevant township general administration department; • If the business is prone to the fire hazard using inflammable materials or explosives, the prior consent, directive of the relevant fire service department must be taken; • Shall transport the allowed amount in accord with the stipulations upon transporting the chemical and the associated materials in the country; • Shall get the approval of the central supervising body if the chemical and the associated materials are transported from the permitted region to any other region; • Shall follow to abide by the law relating to the environment in order not to harm the	

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		environment in doing the chemical and the associated materials business. A. The license holder shall keep the insurance in accord with the stipulations to pay for the compensation if any loss occurred to man and animals or environment in respect of the chemical and associated materials business. B. The registered certificate holder: • Shall apply again to the central supervising body to register if he wants to use the chemical in the associated materials which are not contained in the registered list; • Shall inform to the central supervising body if he does not want to use the chemical in the associated materials which are contained in the registered list. C. The license holders shall follow the stipulations of the following items to control, prevent and alleviate the danger relating to the chemical and associated materials: • To classify the danger level according to the properties of the chemical and associated materials so as to prevent the danger in advance; • To reveal the danger warning sign and safety level certificate; • To attend the training for keeping the personal protective equipment and using them systematically to prevent and elevate accident; • To carry out in accord with the stipulations in connection with transporting, keeping, storing, using and disposing the chemical and associated materials; • Importing or exporting the chemical and associated materials which are prohibited by the central supervising team, the equipment which are used inside the said materials.	
The Labour Organization Law (11th October 2011)	**Rights**	The labour organizations: • will have the right to establish the fund, in accord with the constitution or rules of their organization, with admission fees for the labour organization, monthly contribution not exceeding two percent of the wages or salary obtained by the worker who is a member of the organization, income from the cultural and sports works which are undertaken by the labour organizations and the money donated by the relevant employer; • will deposit to the Fund if money is included in the grants provided by the	Myanmar Labour Confederation and the Labour Federations.

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		Government.	
	Duties of Employer	• The employer shall recognize the labour organizations of his trade as the organizations representing the workers. • The employer shall allow the worker who is assigned any duty on the recommendation of the relevant executive committee. • The employer shall assist as much as possible if the labour organizations request for help for the interest of his workers.	
Settlement of Labour Dispute Law, 2012	**Settlement of Dispute**	This Law State following provisions regarding settlement of disputes: • The employer or worker may complain individual dispute to the conciliation body and if he is not satisfied, may apply to competent court or by the legal representative. • The relevant Conciliation body will settle the dispute within three days, not including the official holidays, from the day of receipt of dispute. • If the dispute does not settle, the conciliation body shall handover the case to the relevant Arbitration Body within two days and will make decision within seven days. • If the relevant party is not satisfied by Arbitration body then they can apply to the Arbitration Council within seven days. The Arbitration council shall assign the duty to Tribunal to make decision. • The Arbitration council shall pass the decision of Tribunal to the Minister and the relevant Region or State Governments. • The relevant parties may agree to amend the decision of the Arbitration Body or Arbitration Council after three months from the day of coming into force. In such circumstances, the new agreement shall supersede the relevant part of the Arbitration decision.	Workplace Coordinating Committee & Minister and the relevant Region or State Government.
	Prohibitions	• No employer shall fail to negotiate and coordinate in respect to the complaint within the prescribed period without sufficient cause. • No party shall proceed to lock-out or strike without accepting negotiation, conciliation and arbitration by Arbitration Body in accord with this law in respect of a dispute. • No person shall prohibit the right to work independently of the workers who are not	

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		desirous to participate in the strike nor impede the right of a worker to strike.	
Minimum Wages Law, 2013	**Duties of the employer**	According to this law: The Employer- • Shall pay the minimum or more than minimum wages stipulated under this law, • Shall not have right to deduct the wages except the wages for which they have right to deduct as per this law. • Shall pay the minimum wages to the workers working in the commercial, production or service business in cash. • Shall inform about the minimum wages to the workers. • Shall do proper documentation of the wages they are giving to the workers. • If the worker is unable to work due to sickness, shall give them holiday for medical treatment.	Union Committee, Region and State Committees.
	Rights of the Workers	The workers working in any establishment relating this law: • has the right to obtain minimum wage. • has the right to enjoy the stipulated minimum wage for the time worked in the part time job, hourly job, • has the right to enjoy the stipulated minimum wage without discriminating between man and woman.	
Payment Wages Law, 2016	**Methods of Payment and Time Frame**	According to this law the employer: • Must pay in local currency or foreign currency recognized by the Central Bank of Myanmar. This may be in cash, check or deposit into the bank account of Employee. • Must pay in Part-time, daily, weekly or other part-time job, temporary or piecework when the work is done or at the agreed time. • Upon termination, wages must be paid within 2 days from the date of termination. • If a resignation letter is submitted, wages must be paid at the ending day of the payment period. • If an employee dies, wages must be paid to the legally recognized heir within 2 working days after the day he/she has died. • All wages must be paid during the working day.	Ministry of Labor, Employment and Social Security

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
Leave and Holidays Acts, 1951	**Obligations**	Every employee shall be granted by his employer the public holidays with full wages and pay, i.e given under this law. • A holiday without wages or pay may be granted on the occasion of religious festivals to non-buddhist employee by mutual agreement between employers and the employees. • An employee shall be admissible,	Ministry of Labor, Employment and Social Security
Import and Export Law, 2012	**Objectives**	• to enable to implement the economic principles of the State successfully, • to enable to lay down the policies relating to export and import that support the development of the State, • to cause the policies relating to export and import of the State and activities are to be in conformity with the international trade standards, • to cause to be streamlined and speedy in carrying out the matters relating to export and import.	Ministry of Commerce of the Union Government
Public Health Law, 1972.	**Provisions**	• 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.	National Health Committee.
The Prevention and Control of communicable Disease Law, 1995.	**Functions and Duties of Health Officer.**	This law states about the functions and duties of Heath officers to cope with the principal epidemic disease or a notifiable disease in an area. The functions also include having an inspection around the infected area, carrying out disinfections to mitigate the risk of transmission of such diseases.	Department of Health.
The Control of Smoking and Consumption of Tobacco Product Law, 2006.	**Objectives**	The objectives of this law are: • To convince public that health can be adversely affected due to smoking and tobacco consumption, • To obtain healthy life style of the public including child and youth by preventing the habit of smoking and consumption of tobacco product.	Central Board of the Control of Smoking and Consumption of Tobacco Product.
The Motor Vehicle Law, 2015	**Provisions**	The purpose of this law to regulate the import, sale, manufacture and repair market of motor. Also, there is an interesting provision concerns the environmental impact and safety of motor vehicles: most likely in the rules, there are provisions for requirements a motor vehicle needs to fulfill in order to be eligible of import, manufacture or sale in	Union Ministry, Myanmar.

Law/ Standard	Focus Area	Details	Concerned Department/ Organization
		Myanmar.	
Myanmar Insurance Law, 1993.	**Effecting Insurance and Granting of Benefits**	This Law states about the provisions of insurance in different sectors like government servants, entrepreneur, state and economic organizations, capital and profit allocation through Myanmar Insurance.	Myanmar Insurance.
The Employment and Skill Development Law, 2013.	**Development of employment and skill.**	This law states the different terms related to employment agreements, formation of employment and skill development teams, their duties, and responsibilities.	Union Ministry of Labour, Employment and Social Security.

The Bashneft International B.V. is committed to comply with the above listed legislations, during the block EP-4 project Implementation.

3.4.1 International Conventions, Treaties and Agreements:

Burma has signed 31 international treaties related to the environment. It is unclear, however, how the contents of those treaties have been incorporated into domestic law. Below is a more in-depth discussion of the most significant conventions in the context of environmental protection in Burma today. The details have been discussed in **Table. 3.2.**

Table 3.2: International Conventions

Sl. No.	Name of Conventions
1.	Treaty Banning Nuclear Weapons Tests in the Atmosphere in Outer Space and Under Water.
2.	Outer Space Treaty: Treaty on Principles Governing the Activities of States in the Exploitation and Use of Outer Space including the Moon and other Celestial Bodies.
3.	Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and Ocean Floor and in the Subsoil there of (Seabed Treaty).
4.	Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological and Toxin Weapons, and their Destruction.
5.	Plant Protection Agreement for the Southeast Asia and Pacific Region
6.	MARPOL: International Convention for the Prevention of Pollution from Ships as amended 1978.
7.	Agreement on the Networks of Aquaculture Centers in Asia and the Pacific Region.
8.	United Nations Framework Convention on Climate Change (UNFCCC)— Burma has been receiving funds from GEF to implement two projects: A Project for Initial National Communication (INC) under UNFCCC and a National Action Plan for Adaptation (NAPA). The INC is to implement Article 6 of the UNFCCC. The current INC project is a stock taking exercise for analyzing levels of greenhouse gas emission, climate change scenarios, associated risks and vulnerabilities, potential measures and technology transfer for mitigating climate change and the degree of public awareness on climate change issues.
9.	Convention on Biological Diversity (CBD)— Burma ratified the Convention on Biological Diversity (CBD) in 1994. It is the first global agreement on conservation and sustainable use of biological diversity. A significant article for indigenous people is Article 8j which states, “Signatories must respect, preserve and promote indigenous knowledge, innovations, and practices relevant for the conservation and sustainable use of biological diversity.”
10.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)—Burma is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES signatories, including Burma, agree to regulate or prohibit trade in endangered species or animal parts such as bones, horns, or fur, according to the species’ level of endangerment listed in the appendices of CITES.
11.	ASEAN Agreement on the Conservation of Nature and Natural Resources.
12.	Kyoto Protocol to the United Nations Framework Convention on Climate Change.
13.	Stockholm Convention on Persistent Organic Pollutants.
14.	Convention on the Prohibition of the Development, Production and Stockpiling and Use of Chemical Weapons and on their Destruction.
15.	Ramsar Convention on Wetlands.
16.	Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer.

3.5 INSTITUTIONAL FRAMEWORK

The Myanmar Institutional/institutional framework for the proposed project is shown in **Figure 3.2**. As per the requirement of PSC, ACE had undertaken EIA study for the proposed exploratory drilling operation. ACE has prepared Draft EIA and Final EIA as per the Myanmar legislative framework. The final reports will be submitted to the MoNREC (earlier known as - MoECAF) for review and approval. The MoNREC shall issue the Environmental Compliance Certificate (ECC) after reviewing the final ESIA report.

After obtaining the ECC, Bashneft International B.V., will submit the application for investment license/approval along with ECC and approved EIA report to Myanmar Investment Commission (MIC).

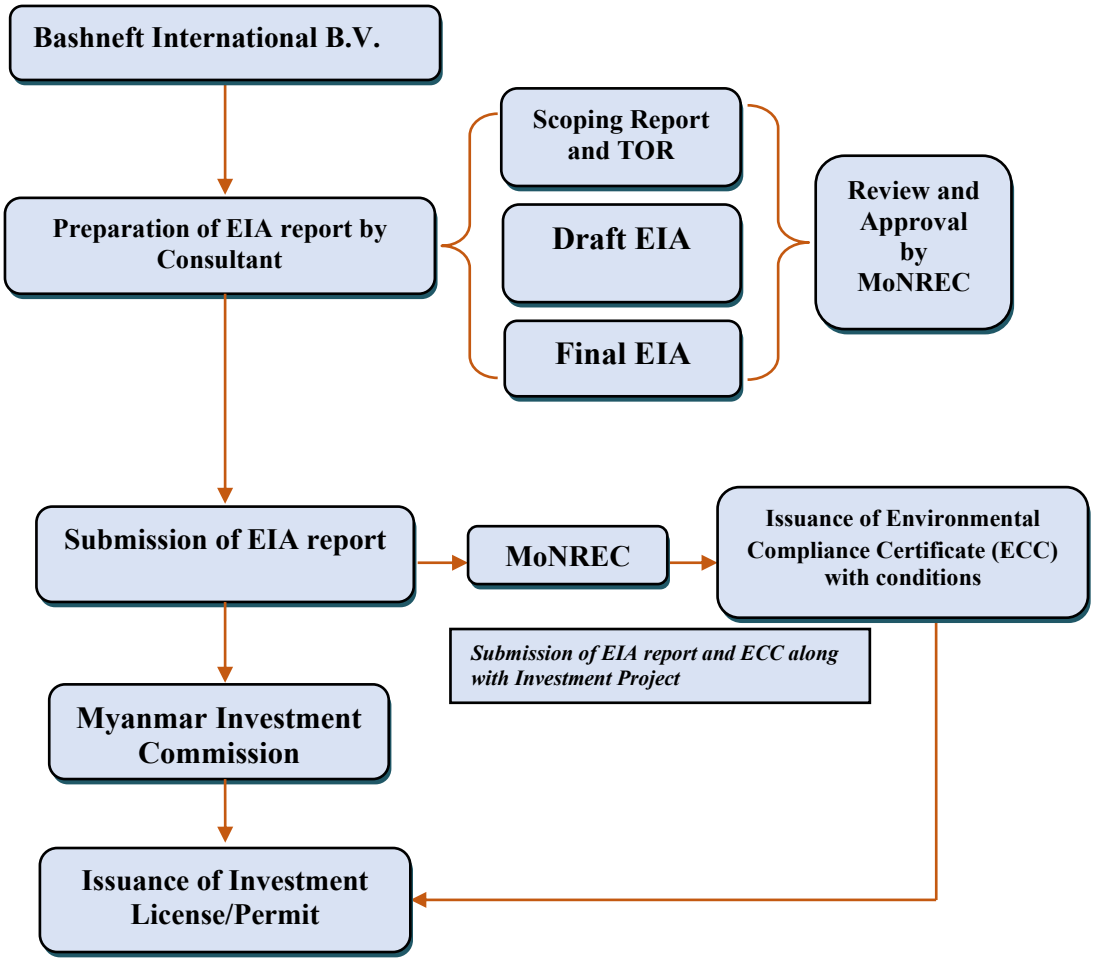


Figure 3.2: Institutional Framework

3.6 PROJECT'S ENVIRONMENTAL AND SOCIAL STANDARDS

The International Standards of Environmental and Social Aspects of the Project has given in the below **Table 3.3**.

Table 3.3: Environmental and Social Standards

Sl. No.	Law/ Standard	Focus Area	Details
1.	**ISO 14001 & OHSAS 18001.**	**Occupational Health and Safety.**	Achieve greater efficiency in environmental control and internal audit of compliance with the requirements of environmental legislation and ensure the compliance of production with ISO 14001 standards; Constantly improve the HSE management system in order to meet international OHSAS 18001 and ISO 14001 standards.
2.	**IFC Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development (2007).**	**Environmental, Health, and Safety.**	The Guidelines for Onshore Oil and Gas Development include information relevant to 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. For onshore oil and gas facilities located near the coast (e.g. coastal terminals marine supply bases, loading/offloading terminals), additional guidance is provided in the EHS Guidelines for Ports, Harbors, and Terminals. Potential environmental issues associated with onshore oil and gas development projects include the following: • Air Emission • Wastewater/Effluent Discharges • Solid and Liquid waste management • Noise Generation • Terrestrial Impacts and Project Footprints • Spills The Guidelines also has provision of Environmental Monitoring programs and Performance Indicators for Effluent and Emissions. Both the guidelines lay down prerequisites for Occupational health and safety and major hazard issues as a part of comprehensive health and safety planning.

4

PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4 PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4.1 INTRODUCTION

This chapter provides background information on the proposed appraisal drilling and its activities in the Block EP-4 and also presents the analysis of alternatives taken into account during the project activity finalization.

4.2 BLOCK EP-4

The proposed appraisal well is to be drilled in Block EP-4, which is located in the Pyay Embayment Basin, Myanmar Area, Republic of the Union of Myanmar. The Block EP-4 covers an area of 841 km^2. The geographical coordinates of the wellsite is presented in **Table 4.1**. The Block location map is shown in **Figure 4.1**.

Table 4.1: Geographical Coordinates of Wellsite

Point No.	Latitude(n)			Longitude(e)		
	Deg.	Min.	Sec.	Deg.	Min.	Sec.
1	18	46	58.19	95	06	37.57

On the basis of the sub-surface data analysis of this region, Bashneft has identified its first appraisal well location where drilling is proposed to be carried out to evaluate the occurrence of hydrocarbons and to assess its commercial viability. The Appraisal wellsite is shown in **Figure 4.2**.

4.3 APPRAISAL DRILLING OPERATION

Background

The objective of the appraisal drilling is to establish the presence of hydrocarbons. The process includes site preparation, well foundation, rig building, drilling and post drilling restoration of the site. Under normal conditions this activity takes approximately 3-4 months. Drilling rig is used for drilling the well and involves rotation of drill bit attached to a long string of a drill pipe down the well. Drilling mud is pumped through the drill string through the drill bit, which returns up the annulus between the drill string and bore. It is used to cool the drill bit while drilling, remove cuttings from the well, control formation pressures, suspend and release cuttings, seal permeable formations, maintain wellbore stability, minimize reservoir damage, cool and lubricate the bit etc.

The drill cuttings are separated from the drilling mud in shale shaker and the fluid is recirculated. If the presence of hydrocarbons is detected during drilling, production testing is normally conducted. The production testing is carried out to ascertain the reserves and economic viability. The appraisal well shall provide essential and important data on rock and fluid property, initial reservoir pressure, reservoir productivity and economic viability which are required for the development of the well but not all appraisal well will result in discovery.

However, the basic details are described in the following sections.

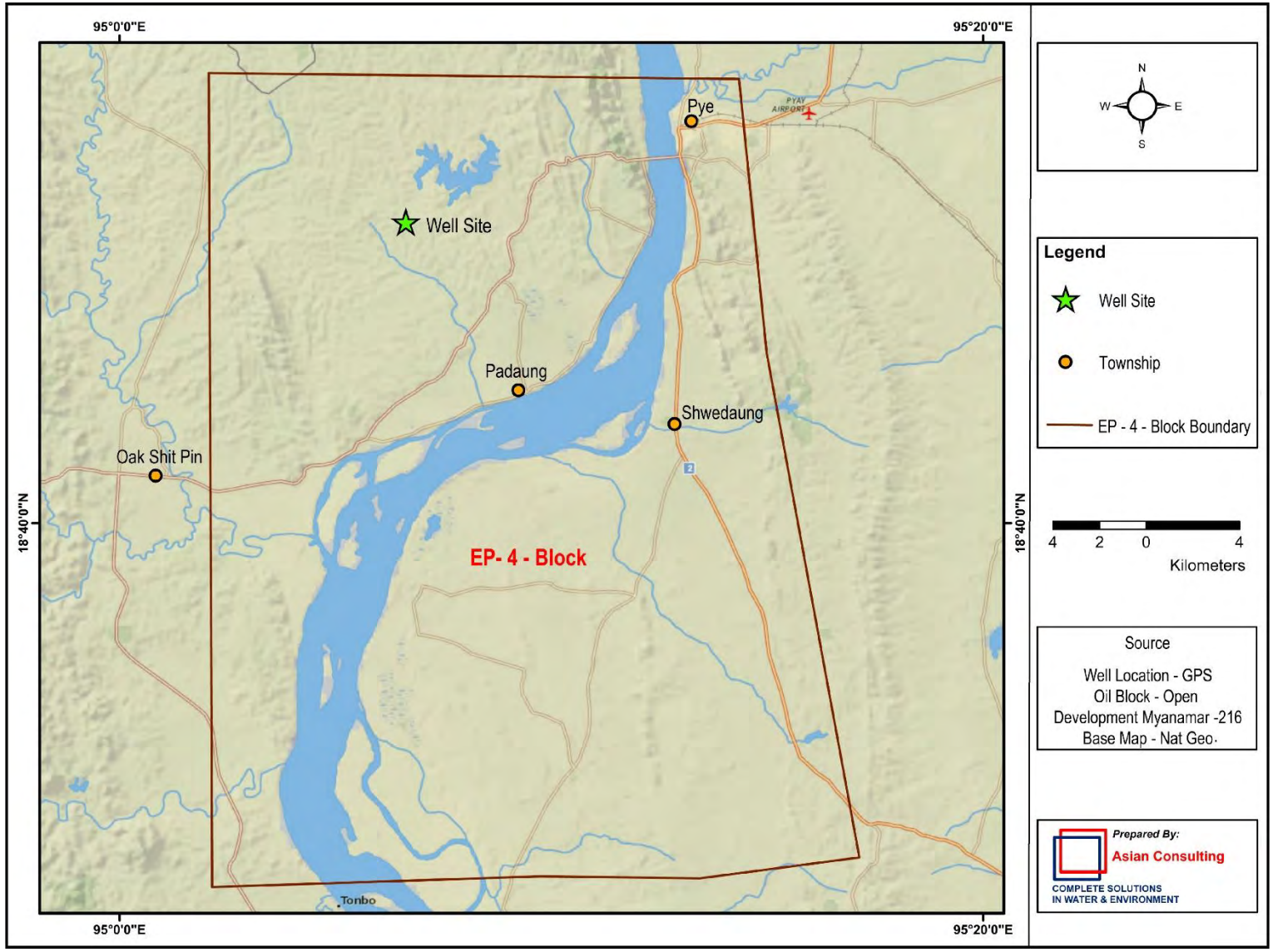


Figure 4.1: Location Map of Well Site

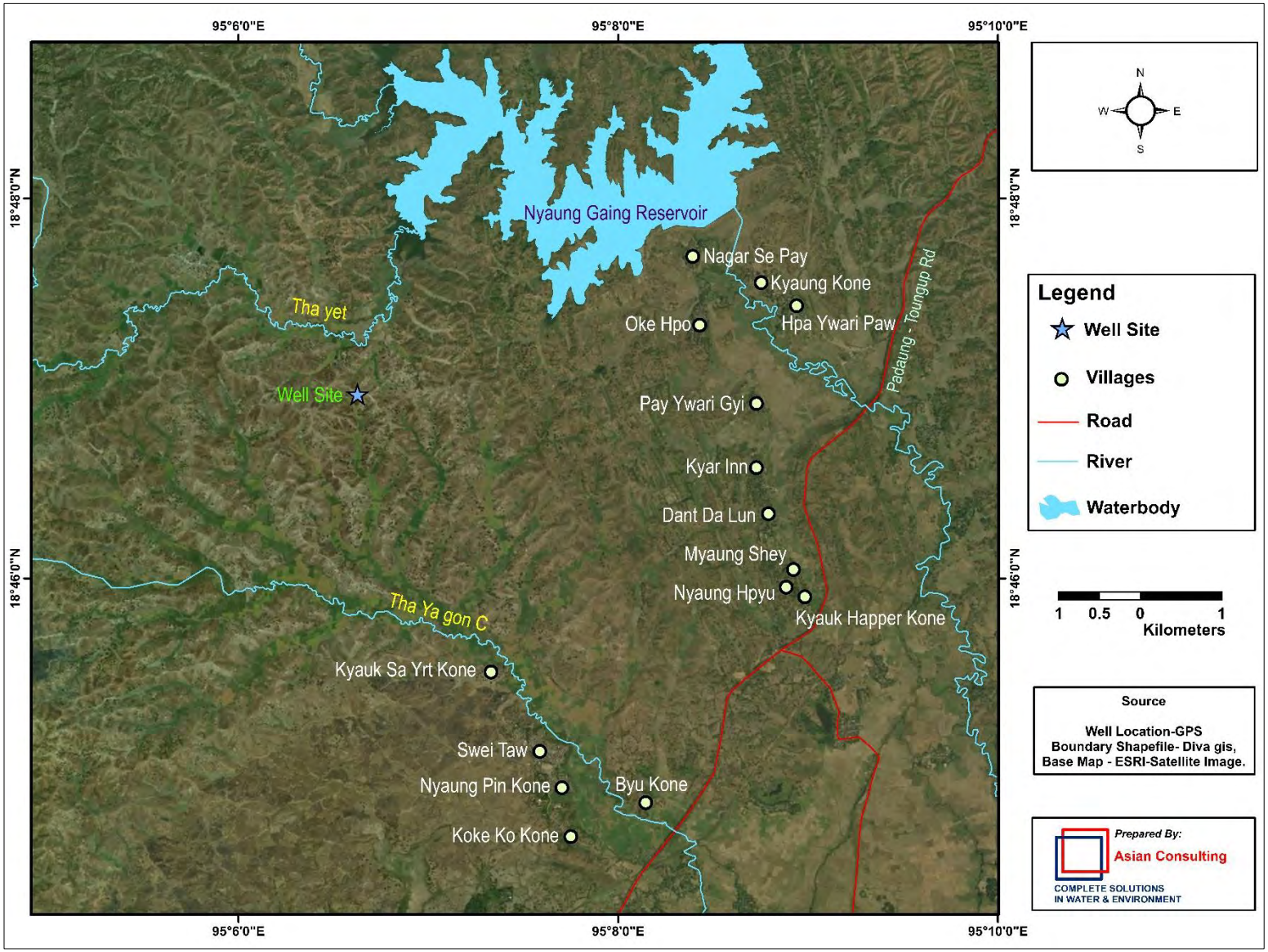


Figure 4.2: Map Showing Well Site and Surrounding Features_

4.4 ACTIVITIES INVOLVED IN APPRAISAL DRILLING

After identification of the promising geological structures through seismic surveys, the appraisal drilling is planned to access the reserve and its economic viability. The appraisal drilling is essential for obtaining actual temperature measurements, rock samples, and retrieving fluid samples for chemical analysis. The best location for the drilling is determined based on the subsurface information by geophysical methods. The **Figure 4.3** shows the flowchart illustrating the various phases of appraisal drilling.

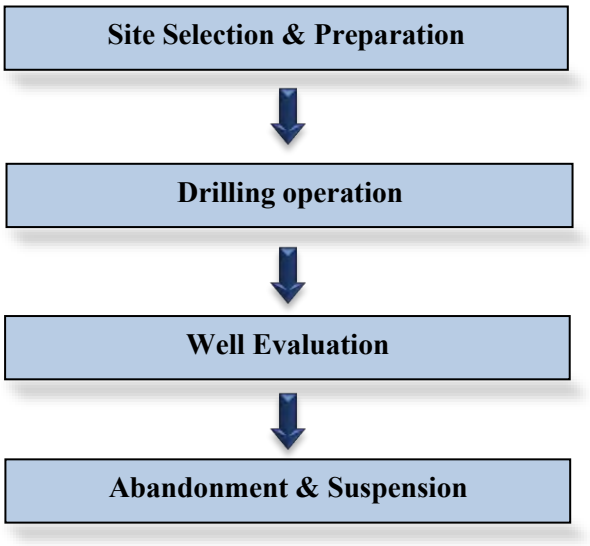


Figure 4.3: Various Stages of Appraisal Drilling

4.4.1 Site Selection & Preparation

On the basis of the sub-surface data analysis of this region exhibits potential presence of oil and gas. An initial survey through 2D seismic survey process is already initiated in the area and the interpretation of data obtained from seismic survey will give the exact location of drilling well.

The proposed drill site is located far away from the human settlement and there is no any major water body present within the study area. The topsoil will be removed, levelled and compacted at site to facilitate drilling. Reinforced cement concrete will be employed for the construction of foundation to accommodate drilling equipment's and support services.

4.4.2 Drilling Operation

The exploitation of hydrocarbons requires the construction of a conduit between the surface and the reservoir. This is achieved by the drilling process. Drilling operations are conducted around the clock. Though the time taken for drilling the well is depended on the depth of the geological settings and hydrocarbon bearing formation, it is usually completed in less than 2-3 months.

The well will be drilled using a drilling rig of capacity not less than 1000 HP equipped with rotary drive system. After drilling, well evaluation will be conducted to assess the economic viability which generates oil and formation water which will be disposed off in an environmentally friendly manner.

The pre-drilling layout of Drilling Equipment on drill site of the 1st exploration well on the block EP-4, Myanmar is shown in **Figure 4.4.**

Pre-drilling layout of drilling equipment on drilling site of the 1st exploration well on Block EP-4, Myanmar

Legend

1 Drilling Rig
2 Mud cleaning sysyem
3 Drilling mud mixing system
4 Mud tank
5 Mud pump
6 Blowout preventer station
7 Ladder
8 Cementing blending equipment
9 V-door
10 Choke valves
11 Diesel generators
12 Variable speed drive
13 Fuel station
14 Temporary storage of cutting waste (min 663 m³)
15 Temporary storage of cutting waste (settling section) (min 442 m³)
16 Flow line
17 Chemical storage
18 Casing storage
19 Personal facilities / Amenity space
20 Admin buildings
21 Canteen
22 WC
23 Blowout preventor pit
24 Concrete pad
25* Water well
26 Containers for solid domestic garbage
27 Anti-fire pit (min 400m³)
28 Water storage pit for drilling needs (min 400m³)
29 Reserve pit (min 400m³)

Comments:
** If it will be required the 2nd water well can be drilled*

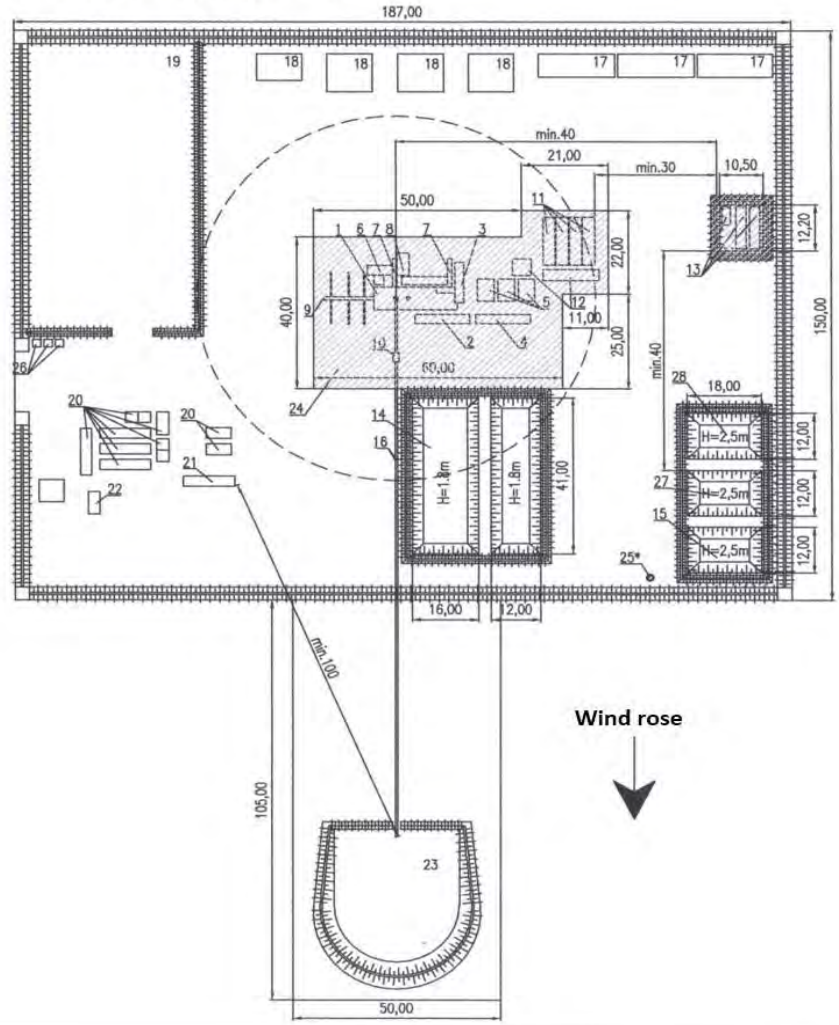


Figure 4.4: The Pre-drilling layout of drilling equipment

4.4.2.1 Well Design

The selection of exploration well design is based on the following factors:

- geological forecasting,
- previous drilled wells analysis,
- values of formation pressure and hydraulic fracturing pressure of rocks by well log,
- temperature gradient,
- Possible complications and risks for well log during drilling and,
- well completion and testing requirements.

An Exploration Well Design is shown in **Figure 4.5.**

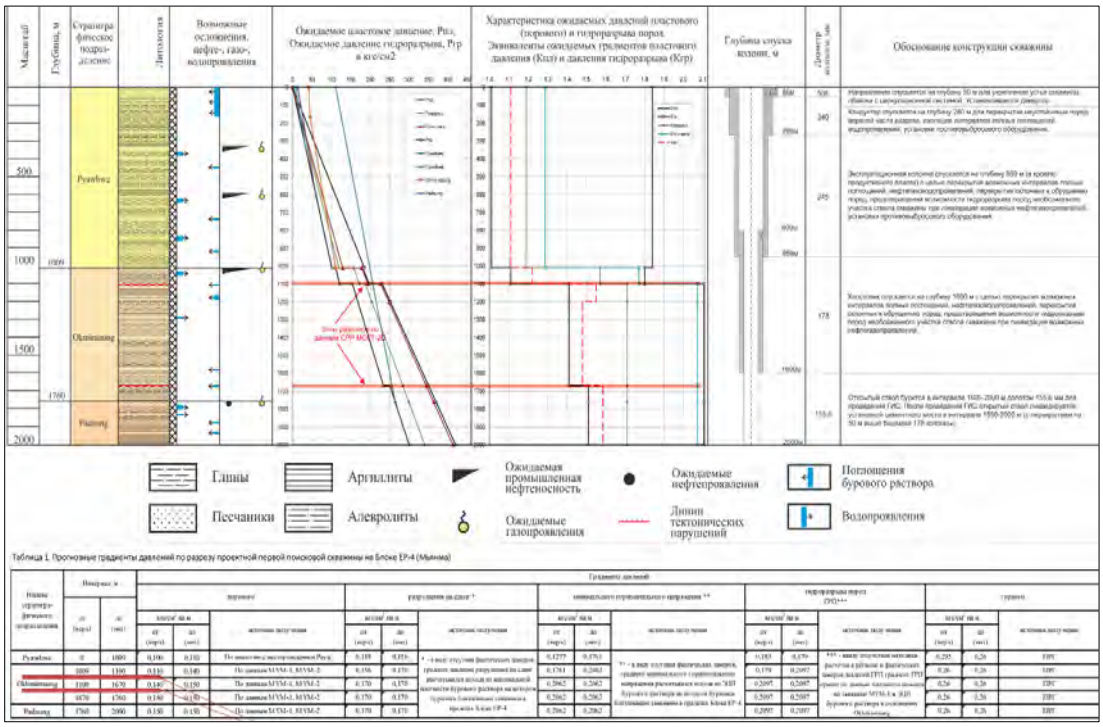


Figure 4.5 Exploration Well Design

The applicable design rules/standards which should be kept in mind for design selection are described below in **Table 4.2**

Table 4.2 Applicable Design Standards

Sl. No.	Applicable Standards	Description
1.	API 5C3 bulletin	Bulletin of formulas and calculation for casing strings, tubing, drill pipes and properties of line pipe". (GOST R 54918-2012 (ISO/TR 10400:2007)
2.	API 5CT specification	"Specification for casing strings and tubing" (GOST 31446-2017 (ISO 11960:2014))
3.	Federal norms and regulations in the field of industrial safety "Safety rules in oil and gas industry".	Federal Environmental, Engineering & Nuclear Supervision Agency, No.101 dated 12.03.2013 (as amended on 12.03.2015)

Sl. No.	Applicable Standards	Description
4.	Instruction for calculation of casing strings for oil and gas wells.	M.: Federal Committee for Mining and Industrial Supervision, No. 10-13/127 dated 12.03.97.
5.	Instruction for leak testing of casing strings	M.: Federal Committee for Mining and Industrial Supervision, No. 10-13/137 dated 11.03.1998, 1999.

4.4.2.2 Casing String Structure Designing

The Casing String Structure designing includes the following tasks for the prospecting and exploration well:

- Study of the geologic structure and prospects of oil-and-gas content of EP-4 Block.
- Selection and design of the optimal structure as per the well construction safety requirements.
- Depth of casing shoe installation to eliminate the hydraulic rock fracturing due to the opening of production horizons and well bore substitution with formation fluid.

Strength Analysis Task for Casing Strings

The Strength analysis task of casing strings is the process of assessing the loads by the different operations of the well to confirm the strength of the selected components in all the anticipated conditions. The safety factor is defined as the relationship between the pipe specification and design load for the given condition of the well i.e,

safety factor = $\frac{\text{nominal load}}{\text{design load}}$

The Standard design parameters are widely used in the oil and gas industry for effective well operations.
The Casing String Design Structure and casing pipe parameters are shown in the **Table 4.3** and **4.4.**

The casing string setting depths justifications are shown as **Appendix 1.**

Table 4.3: Design Structure

Description	Type	Outside		Depth		Drill Bit Diameter		Annular Fluid
		(inch)	(mm)	from (top)	to (bottom)	(inch)	(mm)	
Conductor Casing	Casing	20	508.0	0	50	26	660.4	1.15 loamy
Surface Casing	Casing	133/8	339.7	0	280	171/2	444.5	1.18 polymer loamy
Production	Casing	95/8	244.7	0	959	121/4	311.2	1.28 potassium chloride polymer
Production	Liner	7	177.8	809	1600	8.69	220.7	1.65 potassium chloride polymer
	Open Hole			1600	2000	61/8	155.6	1.65 potassium chloride polymer

Table 4.4: Parameters of Casing

Description	Type	Pipe body										Connection			Section Weight (ts)
		Outside diameter		Internal Diameter		Drift Diameter		Weight		Wall thickness (mm)	Grade	Description	Maximum Diameter		
		(inch)	(mm)	(inch)	(mm)	(inch)	(mm)	(pound per foot)	(kg/m)				(inch)	(mm)	
Casing Conductor	Casing	20	508.0	19.124	485.75	18.936	480.974	94.0	139.887	11.125	J-55	BC	21	533.4	6.99
Surface Casing	Casing	133/8	339.7	12.615	320.42	12.46	316.46	54.5	81.105	9.652	J-55	BC	14.375	365.125	22.71
Production	Casing	95/8	244.5	8.921	226.60	8.765	222.631	36.0	53.574	8.941	N-80	BC	10.625	269.875	51.38
Production	Liner	7	177.8	6.366	161.70	6.24	158.52	23.0	34.228	8.052	R-95	BC	7.6561	194.462	27.07

4.4.2.4 Requirements for Well Drilling operation

The basic requirements for well drilling operation are as follows:

- Well Profile Drilling technology
- Profile elements, Drill String Configurations and drilling technology
- Process drilling practices
- Pipes with threaded joints

4.4.2.4 Drill muds

Drill mud selection

The types of drill mud proposed based on lithological information and previously drilled well analysis are as follows:

- Clay (for conductor casing);
- Polymer clay (for conductor string);
- Potassium chloride polymer mud treated with partially hydrolyzed polyacrylamide (for production string) and;
- Potassium chloride polymer drilling mud (for liner and open hole).

Drilling muds considered for construction of first prospecting well should include the following features:

- which minimize the drilling day number,
- which can reduce the downtime in work and risks,
- which ensure good stability of the well bore,
- which can preserve physical integrity of drilling waste and
- which can reduce formation damage.

During the well exploration phase the drill cuttings should be maintained with minimum content in the active mud system and the available required material should be operated with maximum efficiency. To achieve the geological and technological objectives qqualitative planning, development and introduction of the drilling mud technology, control and monitoring of muds should be required.

The detailed drill mud program should be followed for all regulations, instructions and other important technical information during well construction. The Section by section review of flush water is shown in the **table 4.5.**

Table 4.5 : Section-by-section review of flush water

External diameter of string (mm)	Drilling interval along hole (m)		Possible problems	Mud type	Drill mud density (g/cm^3)
	from	to			
508	0	50	mud losses	clay	1.15
340	50	280	losses/slides/ collapses/ oil, gas and water show	Polymer clay	1.18

External diameter of string (mm)	Drilling interval along hole (m)		Possible problems	Mud type	Drill mud density (g/cm³)
	from	to			
245	280	600	no returns/ oil, gas and water show/ slides/collapses	potassium polymer chloride mud partially treated with hydrolyzed polyacrylamide	1.20
	600	959		potassium polymer chloride mud partially treated with hydrolyzed polyacrylamide	1.28
178	959	1150	no returns/ oil, gas and water show/ slides/collapses	polymer potassium chloride mud	1.57
	1150	1600**			1.65*
155.6	1600	2000**	no returns/ oil, gas and water show/ slides/collapses	polymer potassium chloride mud	1.65*

** – flush liquid density in 1,150–2,000 m interval is taken as 1.65 g/cm³ based on the analysis of previously drilled wells Mayaman – 1, Mayaman – 2, Mayaman – 3, considering shear destruction pressure gradients (0.17 kgf/cm² per 1 m) and minimum horizontal stress (0.2062 kgf/cm² per 1 m);*

*** – upon occurrence of the first signs of GOWI/instability of the well bore the flush water density increase to1.92 g/cm³ shall be agreed upon with the Customer. It is required to have various fractional calcium carbonate and barite in double volume upon weighting of the flush water.*

The chemicals or the mud system expected to be used in drilling are listed below in **Table 4.6.**

Table 4.6: Chemicals to be used for drilling and their Properties.

Sl. No.	Chemicals to be used for Drilling	Mud Properties			
1.	Bentonite Mud System	Mud Weight (sg) - 1.05～1.10 Funnel Viscosity (sec/ quart) - 100～80 API FL (ml) - NC			
2.	Low Solid Polymer Mud	Mud Weight (sg)	1.10～1.30	PV (mPa.s)	10～20
		API Fl (ml)	≤8/30mins	Gels (lbs/100ft²)	6～10/12～20
		Yield Point (lbs/100ft²)	10～20	MBT (kg/m³)	30～40
		PH	8～9	Solid Content (%)	≤14
3.	KCI-Polymer Mud	Mud Weight (sg)	1.30～1.70	PV (mPa.s)	18～36
		API Fl (ml)	≤5	Gels (lbs/100ft²)	6～12/10～22

Sl. No.	Chemicals to be used for Drilling	Mud Properties			
		Yield Point (lbs/100ft^2)	12～30	MBT (kg/m^3)	20～30
		PH	9～10	K+ (mg/l)	≥12000
4.	KCl- Sulphonated Polymer Mud	API Fl (ml)	≤4	PV (mPa.s)	20~40
		Yield point (lbs/100ft^2)	14～36	Gels (lbs/100ft^2)	8～12/16～40
		PH	9～10	MBT (kg/m^3)	20～30
		Friction Efficient	≤0.15	Solid Content (%)	≤40

The details of the finalized chemicals/ mud system appropriate for drilling will be provided by the contractor, who to be appointed based on tender results.

4.4.2.5 Drill mud cleaning equipment

Primary vibro-screen

Weighted drilling mud are placed on vibro-screen consisting of mesh to speed up the solid phase transportation. The corresponding size meshes will be selected by mesh reserve present at the facility. Then meshes filled with the drilled-out cuttings will be cleaned by the high-pressure washer present at the facility.

Vibro-screen hydro-cyclone unit

Hydro-cyclone units works at 0.35MPa pressure which helps to clean the mud.

Centrifuge system

Centrifuges systems should be set at maximum performance range for the following purposes:

- for the preservation of drilling mud properties,
- to remove drill cuttings to the maximum and,
- to reduce dilution and decrease total volume of waste discharge.

Degasser

Degassers should be installed in pump and tank farm piping with flare line outside the cluster site cleaning the mud considering its capacity larger than the volume of the solution. Flocculation and coagulation unit should also install in line reduce process water which facilitates the formation of drilling muds.

4.4.2.6 Wall Casing

Wall casing should be done with following objectives:

- For separation & their isolation,
- For providing support to the casing string,
- For the protection of casing string against corrosion environment and,
- For increasing casing string durability.

Packing materials and their solutions can be selected based on following considerations:

- should meet the static temperature range in the well for the whole cementing interval;
- the cementing slurry formulation by dynamic temperature and pressure in the cemented well interval and;
- cementing slurry density should not lower than drilling mud density.

4.4.2.7 Well head

Well head equipment's ensures the performance of scheduled tests & drill stem test. The performance of scheduled tests is based on the formation evaluation results. The drill stem test is performed for each potential reservoir.

Well head equipment's allows to perform inflow stimulation by well test program methods. Established procedure or the special plan should be followed for all the work under the well head operations with due consideration of risks.

Prospecting Well head designs should be reviewed, and corresponding changes should be done before the mobilization or drilling operations. Well survey (by formation tester during drilling) results help to analyze the X-tree specifications. The well head diagram is shown in the **figure 4.6.**

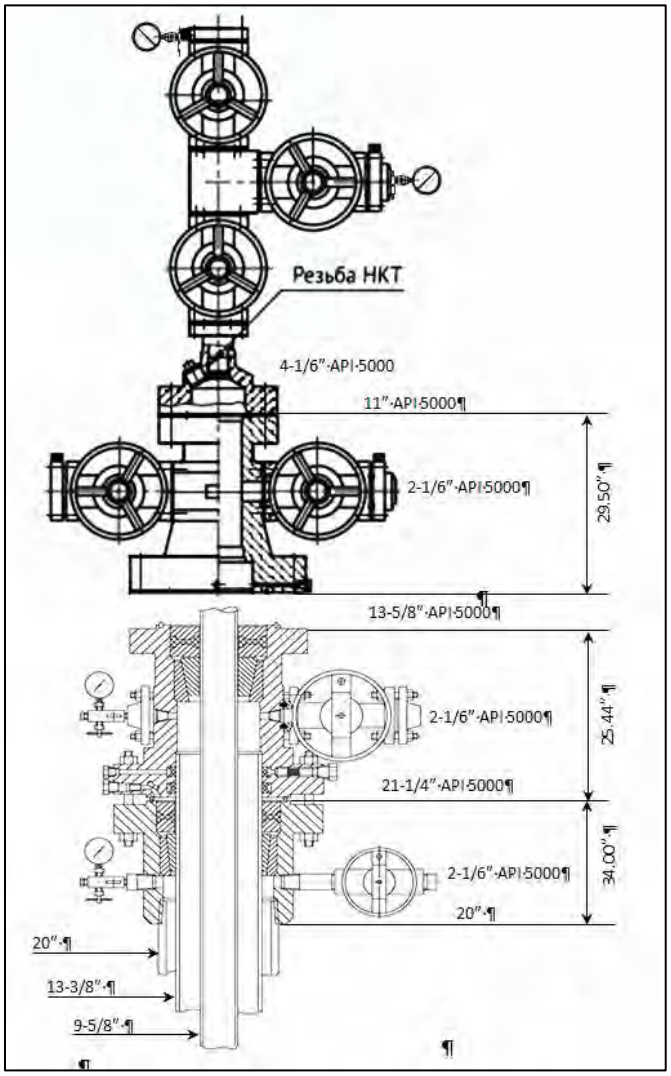


Figure 4.6: Well head Diagram

4.4.3 Well Evaluation/testing

Well testing should be performed for both open hole as well as cased hole. Studies conducted for solving geological problems during the construction of prospecting well are as follows:

- sampling and testing, receipt of commercial inflows of hydrocarbons in the opened section;
- study of different characteristics of rocks and properties of formation fluids;
- determination of productivity factors and flow rate capabilities of wells;
- analyses of previous opened deposits and;
- hydrocarbon reserve calculation.

Methods adopted for well surveying during drilling operations:

- geophysical well loggings;
- pressure transient test during drilling;
- sampling and testing of promising intervals and;
- core, cutting sampling, water, oil sampling and their laboratory study.

Tasks of parameter control for drilling operation of the first prospecting well are as follows:

- collection, processing and immediate provision of information to the geological service of the Customer considering a lithological composition, fluid content and reservoir features of rocks opened during drilling, issue of recommendations for clarification of core sampling intervals, bed testing and performance of geophysical studies of the well and;
- collection, processing and immediate provision of information on drilling process parameters and indicators of the circulation system to the process service of the Customer.

4.4.4 Well Abandonment and Suspension

The purpose of well abandonment is to bring the wells in the condition which ensures safety, preservation protection of the environment in the affected areas of the abandoned facilities. Timely and qualitative execution of work for well abandonment will be maintained by the subsoil user. Well Abandonment technology requires-

- assurance of qualitative isolation of pay beds,
- water bearing beds containing mineralized and fresh water,
- sealing capacity of casing strings meeting the conditions of subsoil and,
- environment conditions confirmed by geophysical studies and physical performance of work certificates.

Well abandonment plan should be prepared & followed in order to eliminate complications and emergencies during insulation and abandonment work. The Cement Plug Installation is followed for well abandonment process. Well abandonment can be performed due to geologic causes (with lowered casing) and technical cases.

"**Well Inspection Report**" should be prepared by the inspection committee to determine the technical condition of the checked well. This report helps to evaluate whether the well needs repairing before the start of abandonment works.

Well Suspension

The purpose of well suspension is to bring the wells in the condition which ensures safety, preservation and protection in the affected areas of mothballed facilities and well preservation for the entire duration. Timely and qualitative execution of work for well suspension will be maintained by the subsoil user.

All the work performed under the well suspension phase should be done as per the norms and rules in the industrial safety sphere. Well suspension should be performed as per the plan which is developed on the basis of technical solutions of the project considering mining and geological conditions, productivity of opened section, physical and chemical properties of formation of fluids, well design, conducted tests and surveys results, technical condition of the well, suspension causes, planning works for equipping of the well hole and well head with indication of the responsible officers.

The Sub soil user can initiate the well suspension during drilling, after drilling completion and during operation. Well suspension can be done in the course of drilling & upon drilling completion. Well suspension should be performed because of the following reasons:

- change of geological and technical conditions during drilling and mining-and-geological conditions during operation;
- upon disasters;
- upon seasonal nature of works;
- formalization of well handover to the customer;
- money-losing well operation;
- if requested by government supervision and oversight authorities and
- up-coming well workover.

4.5 RESOURCES, UTILITIES AND INFRASTRUCTURE REQUIREMENTS

All supplies, both for the drilling rig package and for the drilling site will be transported from any storage area temporarily hired nearer the well site. This will include but not limited to cements, bits, casings and chemicals for drilling mud, spare parts for the rig package.

4.5.1 Power Supply

The drilling process requires movement of drill bit through the draw works which require power. The power requirement of the drilling rig will be met by DG sets of capacity depending on the requirement. However, only three Diesel Generator sets will remain operational during peak load and one DG set will be as standby.

4.5.2 Water Consumption

The water requirement in a drilling rig is mainly meant for preparation of drilling mud apart from washings and domestic use. Water requirement for domestic and wash use will be less. Moreover, the proposed activity is for short duration and temporary.

4.5.3 Chemical and Fuel Storage

Various chemicals will be stored at the project site and used during the drilling phase. At the planning stage, an estimate of the potential usage for every chemical will be made. During the

operation phase, chemical usage will be monitored and efforts will be made to reduce or conserve chemical consumption as much as technically possible.

While storing, the drilling rig will have normal storage facilities for fuel oil, required chemicals and the necessary tubular and equipment. The key features of the Chemicals, Lubricants and Fuel Storage area are as follows:

- Well-designed storage facility
- Storage facility for Barites and Bentonite near mud tank.
- Impervious liners in place for fuel, lubricants storage area.
- Fuel/lubricant containment & generator area to have drains with oil entrapment provision.
- Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials to be used for fuel/lubricant storage area.
- The Diesel which will be used for power consumption, stored at drill site in covered MS tanks of required quantity.

4.6 MAJOR SOURCES OF POTENTIAL IMPACTS

Sources of impacts from noise, effluent discharges, solid wastes, air emissions and spills, leaks and dropped objects associated with the appraisal drilling programme are discussed below.

A. Noise

Noise will be emitted during all the phases of the activities such as site preparation for appraisal drilling, drilling and restoration. Major noise is generated from diesel powered generators, drilling equipment's such as electric motors, rotary table, draw works etc. and operation of vehicles. The noise generated during the preparation of site are due to the operations of construction equipment's and vehicles for transporting the materials. Drilling noise would occur continuously for 24 hours per day for one to two months or more depending on the depth of the formation. These can be minimized by proper maintenance of equipment's.

B. Air Emissions

Air emission generated during drilling activities include vehicles, site preparation (clearing, excavating, trenching) and combustion of diesel in diesel engines and power generators which will be operative to meet power requirement of the drilling rig.

No treatment of air emissions may be required as these involve burning of diesel with low Sulphur content (108 mg/kg). The disposal of the air emissions will be through adequate stack height as per norms.

Air emissions may result from gas flaring activities during the production testing of well is temporary for few weeks. The test flare boom will be located at a distance from the drilling rig.

C. Effluents and Solid Waste

The following **table 4.7** shows the types of wastes are likely to be generated during the drilling activities.

Table 4.7: Types of wastes generated during drilling activities

Sl. No.	Wastes to be Generated	Description
1.	Drill Cuttings	It comprises of drilled formation cuttings, mainly shale, sands and clay;
2.	Under flow from solid removal equipment	Generated from solids control/removal equipment;
3.	Drill cuttings wash water	This is generated while washing the mud laden cuttings/cavings separated through shale shaker/vibrating screen.
4.	Drainage discharges	Drainage discharges will occur from a variety of sources. These include: • Cleaning at derrick floor area • Machine area floor drains; • Cleaning of shale shaker screens
5.	Sewage	Waste water generated from office toilets and labour/staff accommodation.
6.	Chemical Sludge	Waste water treatment would result in generation of chemical sludge.
7.	Hydrocarbon Wastes	Used oils during replacement of oil in machineries.
8.	Non-hazardous solid waste	Non-hazardous wastes like paper, clothe rags, jute, wood, plastics, containers, etc.
9.	Medical Wastes	Small quantities of medical wastes like used bandages, syringes, empty medicinal bottles etc.
10.	Biodegradable waste	Food waste or fallen leaves constituting biodegradable wastes will be generated from drilling and labour/staff accommodation.

i) Wastewater and Sludge

In addition to the drill cuttings, wastewater is likely to be generated from washings & spent mud.

ii) Fuels and Chemicals

Used fuels, oils, and chemicals will be stored in containers in areas lined with impervious floors and surrounded by containing dykes at the rig site. Recyclable material will periodically be transported out of the project area and given to the recyclers/contractors. Disposal of off specified hazardous wastes including discarded containers will be sent back to the chemical supplier and ensured that all surplus or residual chemical additives are also given back to them on restocking basis.

iii) Solid Waste

Solid waste including domestic waste, combustible and recyclable waste generated shall be collected, segregated and stored in specified containers and shall be transferred to authorized contractors for its disposal.

iv) Sewage

As part of the site preparation stage, a drainage and sewerage system will be constructed. The sewerage system will consist of septic tanks followed by soak pits for the collection and treatment of wastewater. Overflow from the soak pits, if any will be sprayed over the ground allowing it to soak away or evaporate. The semi-solid residue from septic tanks will be periodically cleaned and transported to nearest available municipal solid waste disposal site.

v) Medical Waste

Small amounts of medical waste like used syringes, bandages, empty medicinal bottles etc., might be generated. Usually this may not be more than few grams. After proper segregation, this waste will be disposed properly as per norms.

vi) Camp Waste

All biodegradable waste (left over food, kitchen waste etc.) will be disposed off into small humus pits in campsite area away from use by rig crew members. The pits are to be covered to avoid any odour nuisance and check contact with flies or insects. The sewerage system will consist of soak pits for collection of waste water from the camp kitchen, laundry and showers.

5

DESCRIPTION OF THE SURROUNDING ENVIRONMENT

5 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

5.1 INTRODUCTION

In the following sub-sections of this chapter, the existing environmental conditions around the proposed wellsite (hereafter will be referred as study area) with respect to land (including topography, geology, and seismicity), air, noise and water, are described in detail . The chapter also describes the biological and general socio-economic conditions of the study area. The environmental status of the this area has been studied in November 2017 (post-monsoon season).

5.2 STUDY AREA

The proposed project site is located at the EP-4 Block, Pyay district of Bago region, in the Republic Union of Myanmar. The Block lies between latitudes 18º30'00" N and 18º48'30" N and longitudes 95º00'00" E and 95º15'00" E and the total area of this block is 841 km^2.The well site is located 130 km south-west of Nay Pyi Taw city and 160 km north-west of Yangon city. Administratively, the block falls under Bago West division. The location of the drilling wellsite is shown in **Figure 5.1.**

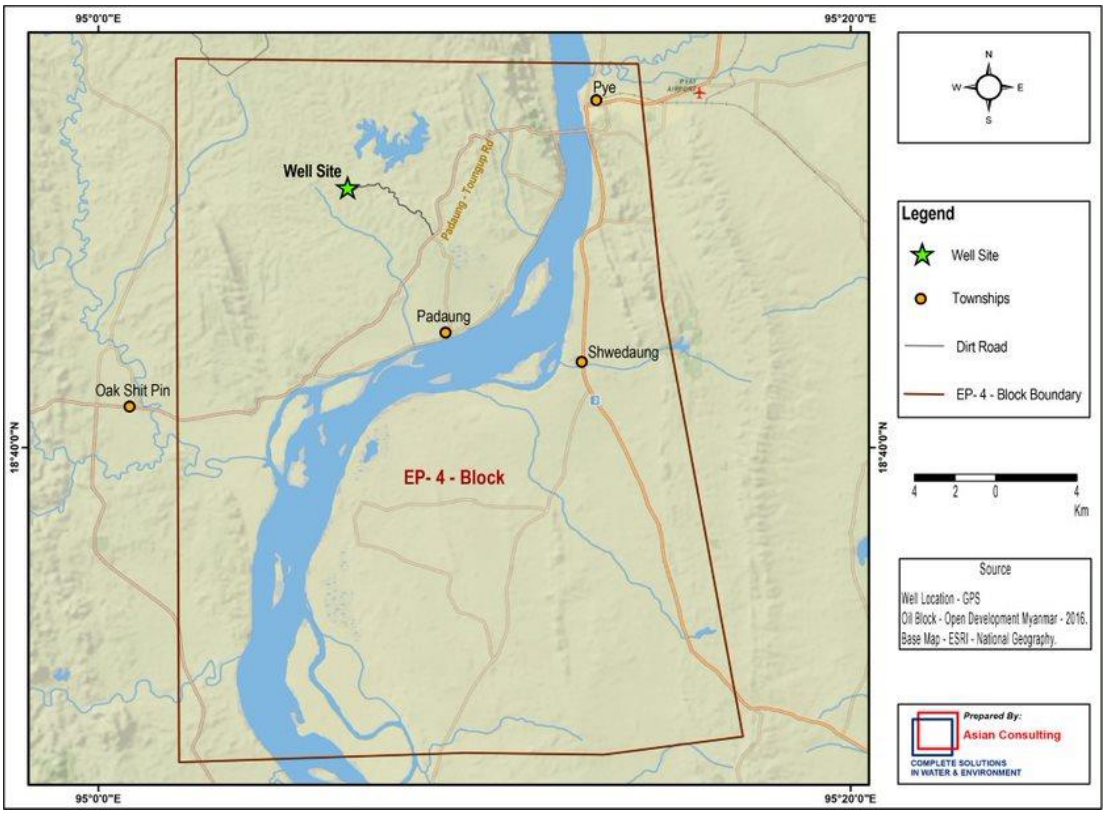


Figure 5.1: Location of Wellsite

The environmental conditions around the wellsite area were inspected during the field survey and the same have also been assessed with the help of toposheet and satellite imageries

5.3 REGIONAL SETTING

5.3.1 Topography and Geology

Topography

The terrain of the study area is flat and elevated in some regions. Topographically, it consists of plain to low highland, elevation of which varies between 26 m and 226 m above mean sea level (amsl). Overall, the topography is flat with some hilly patches. The elevation map of the study is provided in **Figure 5.2.**

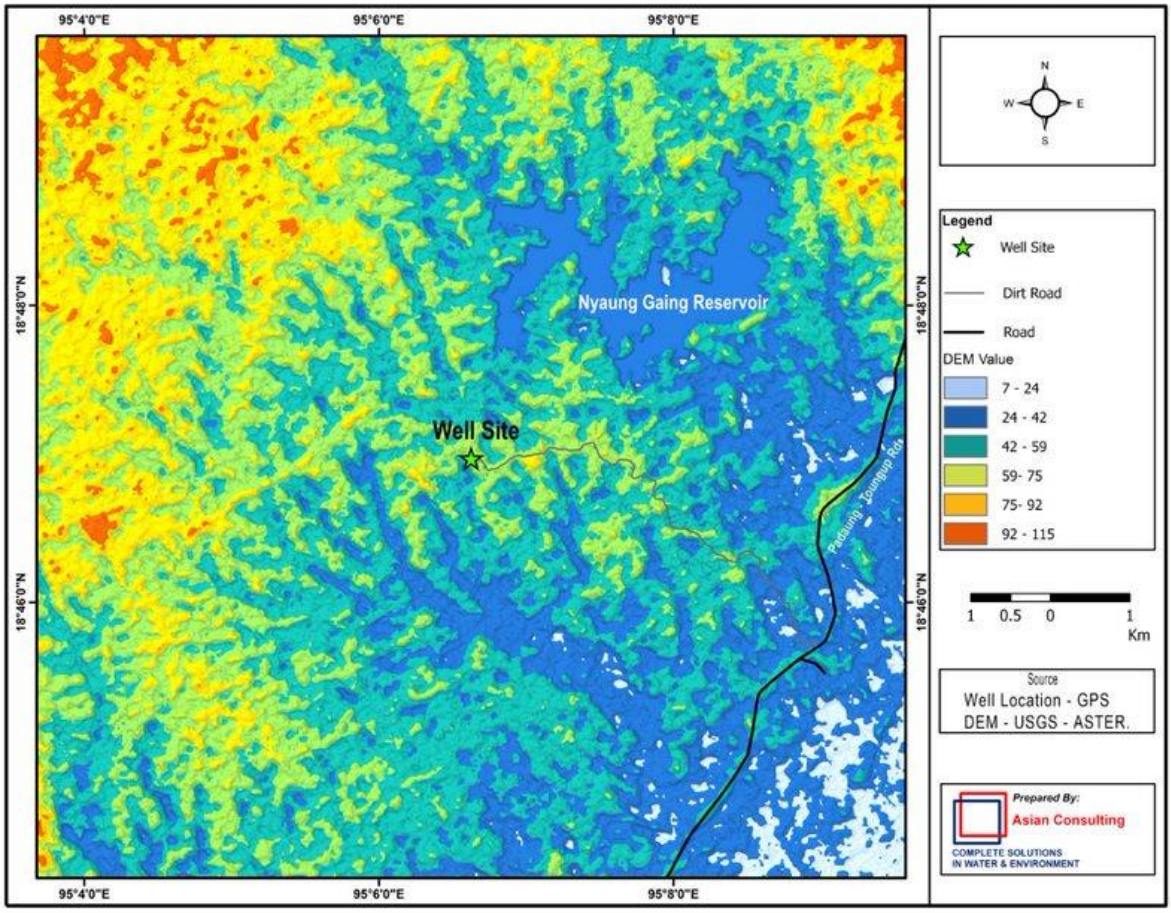


Figure 5.2: Elevation Map of the Study Area

Geology of the EP-4 Block

Block EP-4 falls in the flat central part of Myanmar, geologically identified as Pyay Embayment Basin. This is an oil-rich onshore basin developed parallel to the converging continental and marine plate boundaries. The rocks mainly comprise Eocene Laungshe Shale, Tilin and Pondaung Sandstones and the Oligocene-Miocene Pegu Group. This group includes interbedded sandstones, shales, and coals of deltaic to fluvial facies, and shallow marine shales, limestones, and sandstones. The major geological formation of the block is listed in **Table 5.1.**

The Block region is characterised by the three isolated anticlines trending in NNW-SSE direction and Ohne-Monzintaung anticline.

Table 5.1: Geology of EP-4 Block

Age	Formation	Dominant Lithology	Thickness (ft)
Pliocene	Ayeyarwady	Coarse Grained sandstones	3000+
Unconformity			
U. Miocene	Obogon	Sandy Alternations	3000+
M. Miocene	Kyaukkok	Sandstones	2600+
L. Miocene	Pyawbwe	Clays	4020
Unconformity			
U. Oligocene		Sandstones	1500
M. Oligocene		Clays	3000
L. Oligocene	----------**Missing**----------		
U. Eocene	Yaw	Clays	2800-3000
L. Eocene	Paunggyi	Conglomerates	2470+
Cretaceous		Slaty Shales/ Limestones in Places	2500+

(Source: Myanma Oil & Gas Enterprise)

5.3.2 Seismicity

The Indo-Burma Orogenic Belt is an important geotectonic element of Southeast Asia and seismically active region as it falls under the Alpine-Himalayan Earthquake Belt. There exist four tectonic plates in and around Myanmar: the Indian, Eurasian, Burma, and Sunda Plates. Earthquakes in Myanmar mainly occur due to the continuous subduction of the northward-moving Indian plate under the Burma platelet(a part of the Eurasian Plate) and the northward movement of the Burma platelet along the Sagaing Fault from a spreading centre in the Andaman sea. As per the Regional Tectonic Setting of Myanmar, the proposed project area falls in the Burma Plate and in the right of Sagaing Fault (**Figure 5.3)**.

The proposed project site is in Seismic Zone II as per Seismic Zonation Map of Myanmar (2005), with probable range of ground acceleration, i.e. intensities ranging from 0.1 to 0.15 g and VII Modified Mercalli (MM) Scale class, which signifies that the project site is located on moderate seismic intensity zone. Hence, probability of having high intensity earthquake is negligible. The project site is marked on the Seismic Zonation Map of Myanmar and is shown in **Figure 5.4.**

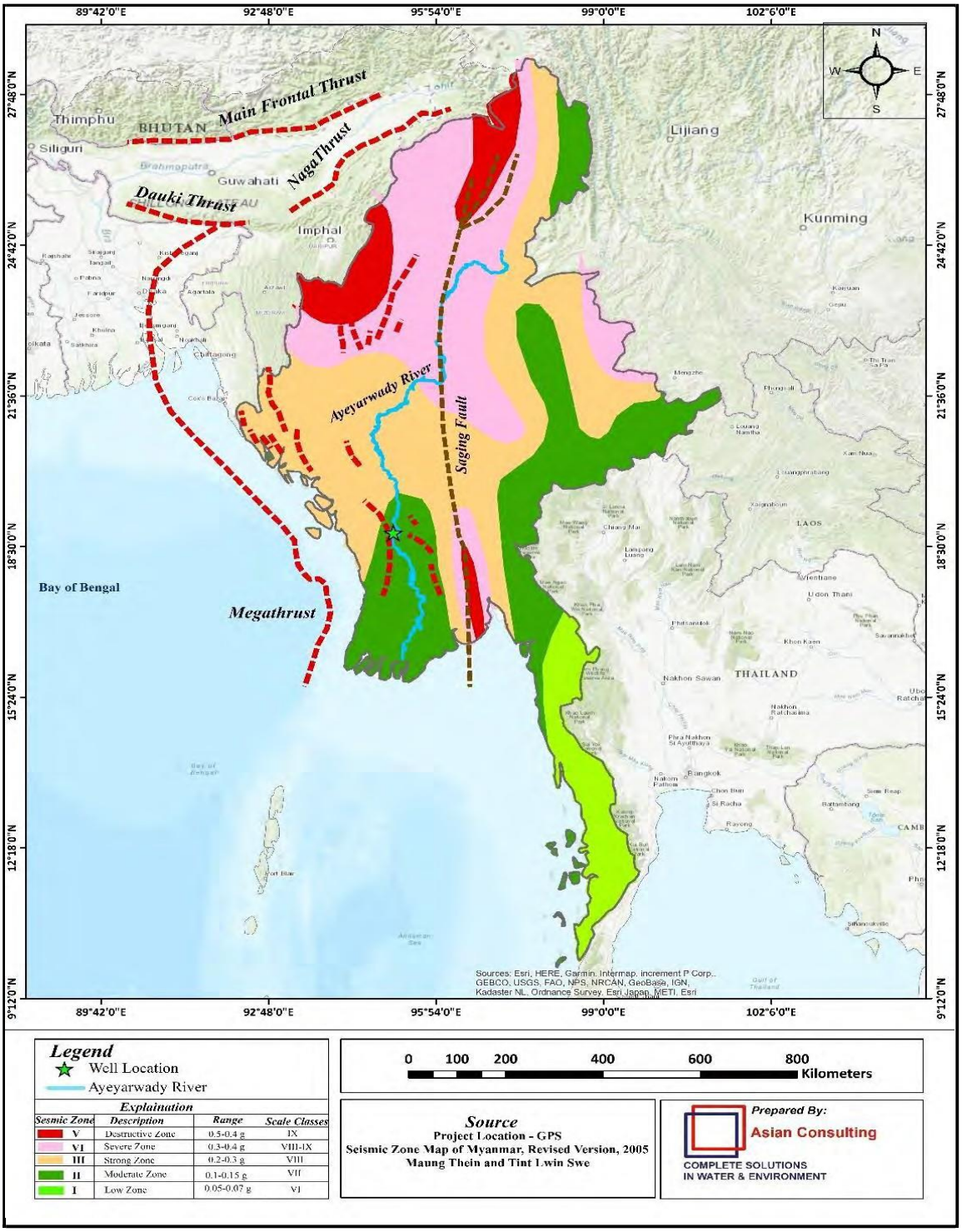


Figure 5.3: Regional Tectonic Setting of Myanmar

Earthquakes

Myanmar is earthquake-prone zone as it lies in one of the two main earthquake belts of the world, known as the Alpide Belt. The major historical earthquakes of Myanmar, which were recorded centuries ago in terms of damages of well-known pagodas around the country are listed in the **Table 5.2**. There is lack of detailed study on the events such as the paleo-seismological studies, because there is no record available for most of the events about exact magnitudes (M), locations and the depths.

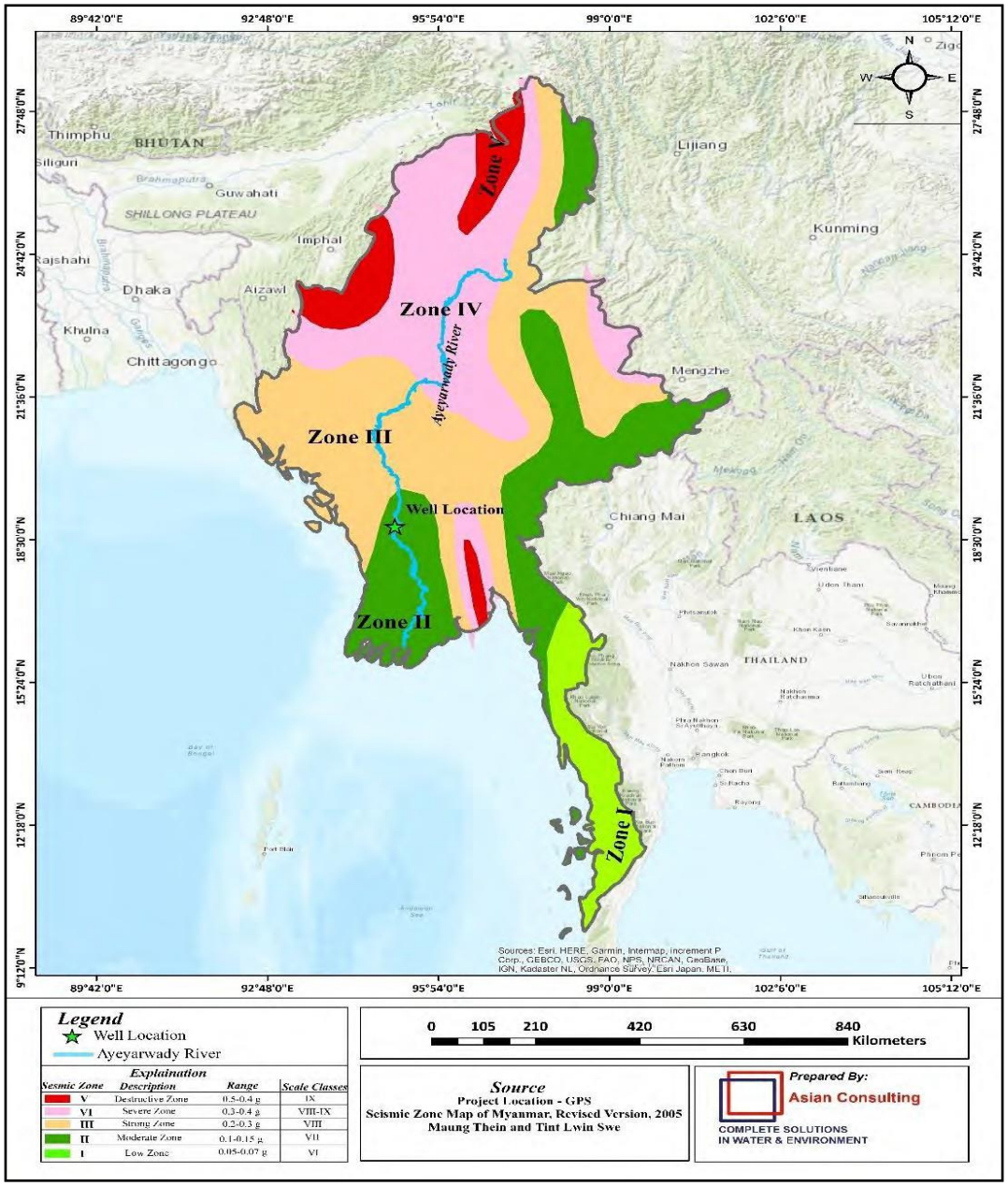


Figure 5.4: Deterministic Seismic Hazard Map of Myanmar
(Maung Thein and Tint Lwin Swe, 2005)

Two important segments of the Fault (Taungoo – Bagoand Sagaing – Tagaung) have shown no seismic activity for more than half a century. Consequently, there is a possibility of strong and major earthquake in near future along the Sagaing Fault. It is a 1500 km long tectonic fault, which passes through the cities of Nay Pyi Taw, Bago, Sagaing and Mandalay and is adjacent to Yangon.

Table 5.2: List of the Historical Earthquakes in Myanmar

SI. No.	Date	Location	Magnitude
1.	12th September 1946	Tagaung	M=7.5 RS.
2.	12th September 1946	Tagaung	M=7.75 RS.

SI. No.	Date	Location	Magnitude
3.	16th July 1956	Sagaing	M=7.0 RS; Several pagodas were severely damaged (40 to 50 persons killed).
4.	8th July 1976	Bagan	M=6.8 RS; Several pagodas in Bagan Ancient City were severely damaged (only 1 person killed).
5.	22nd September 2003	Taungdwingyi	M=6.8; RS Severe damage to rural houses and religious buildings (7 persons killed).
6.	2011	Tarlay	M= 6.8 RS.
7.	24th March 2011	Eastern Shan State	M=6.8 RS.
8.	2012	Thabeikyn	M=6.8 RS.
9.	3rd August 2012	80 Miles of Northeast of Myitkyina	M=5.0 RS.
10.	11th November 2012	Sagaing Fault	M=6.8 RS.
11.	28th November 2014	17.18° N & 96.66 ° E	M=5.1 RS.
12.	2nd January 2013	Myanmar	M= 3.2 RS.
13.	3rd April 2013	Thayet -Aunglan	M=5.4 RS.
14.	11th April 2013	Myanmar	M=5.4 RS.
15.	2nd August 2013	Myanmar-India Border	M=5.0 RS.
16.	20th September 2013	Myanmar	M= 5.3 RS.
17.	29th October 2013	Myanmar	M= 4.7 RS.
18.	17th December 2013	Myanmar-India Border	M=4.2 RS.
19.	19th February 2015	Myanmar	M=3.8 RS.
20.	15th April 2015	Myanmar	M=4.1 RS.
21.	20th November 2014	Myanmar India Border	M= 5.6 RS.
22.	21st December 2014	Myanmar	M= 5.0 RS.
23.	26th December 2014	Myanmar	M= 3.3 RS.
24.	5th January 2017	Myanmar	M= 4.3 RS.
25.	18th January 2017	Myanmar	M=4.2 RS.
26.	23rd February 2017	Myanmar	M=3.4 RS.
27.	24th May 2017	Myanmar	M=3.7 RS.
28.	3rd June 2017	Myanmar	M= 4.8 RS.
29.	2nd September 2017	Myanmar	M= 4.9 RS.
30.	23rd September 2017	Myanmar	M= 3.5 RS.
31.	11th August 2017	Myanmar	M= 4.1 RS.
32.	29th December 2017	Myanmar	M= 4.7 RS.
33.	18th April 2018	Yangon	M= 5.5 RS.
34.	24th April 2018	Burma	M= 5.1 RS.
35.	27th May 2018	Myanmar	M=4.5 RS.
36.	5th June 2018	Myanmar	M=4.8 RS.
37.	16th August 2018	Yangon	M= 4.9 RS.

SI. No.	Date	Location	Magnitude
38.	16th January 2019	Myanmar	M= 5.1 RS.
39.	10th February 2019	Myanmar	M=5.2 RS.
40.	13th March 2019	Myanmar	M=4.5 RS.

Source: Hazard profile of Myanmar

5.3.3 Flood

Flooding has been one of the major threats in Myanmar which may occur due to several reasons such as heavy precipitations, rapid snow melts, coastal storm surges, failure of dams and other control works. Floods occur during monsoon season (mid-May to October) with July and August the most vulnerable months. The major flood records of Myanmar are listed in **Table 5.3.**

Table 5.3: Major Flood record of Myanmar (since 1966)

Sl. No.	Stations	Danger Level DL (cm)	Max. WL (cm)	Flood Duration	Above DL (m)	Year
1.	**Ayeyarwady**					
i.	Hinthada	1342	1582	23 days 12 hrs	2.40	1966
ii.	Chauk	1450	1532	12 days 12 hrs	0.82	1974
iii.	Minbu	1700	1982	17 days 12 hrs	2.82	1974
iv.	Aunglan	2550	2737	15 days	1.87	1974
v.	Pyay	2900	3025	13 days	1.25	1974
vi.	Myitkyina	1200	1411	4 days 12 hrs	2.11	1979
vii.	Katha	1040	1154	7 days 6 hrs	1.14	1979
viii.	Bhamo	1150	1338	8 days 2 hrs	2.38	2004
ix.	Mandalay	1260	1382	16 days	1.22	2004
x.	Sagaing	1150	1274	17 days 6 hrs	1.24	2004
xi.	Nyaung Oo	2120	2263	16 days 12 hrs	1.43	2004
2.	**Chindwin**					
i.	Hkamti	1360	1771	18 days 6 hrs	4.11	1991
ii.	Homalin	2900	3107	18 days 6 hrs	2.07	1968
iii.	Mawlaik	1230	1608	15 Days 12 hrs	3.78	1976
iv.	Kalewa	1550	1920	10 days 12 hrs	3.70	2002
v.	Monywa	1000	1099	9 days 6 hrs	0.99	2002
3.	**Sittoung**					
i.	Toungoo	600	725	16 daya 18 hrs	1.25	1973
ii.	Madauk	1070	1244	31 days	1.74	1997
4.	**Dokhtawady**					
i.	Hsipaw	600	618	12 hr	0.18	1971
ii.	Myitnge	870	1048	8 days 6 hrs	1.78	2006
5.	**Shwegyin**					
i.	Shwegyin	700	927	4 days 12 hrs	2.27	1997
6.	**Thanlwin**					
i.	Hpaan	750	936	38 days	1.86	2002
7.	**Bago**					
i.	Bago	910	950	2 Days and 6 hrs	0.4	1995

Source: Department of Meteorology and Hydrology (DMH).

Heavy rainfall triggering the monsoonal seasonal floods in 2018 majorly affected the Bogo region of Myanmar and other regions, namely Mon State, Mon State Kayin State, Ayeyarwardy, Yangon & Tanintharyi. About 1,40,000 people were displaced by this flood including the death of about 16 people. Out of these, some of the peoplewere able to return to their homes but about 1,22,000 of people remained displaced in 263 evacuation sites of the affected areas *(Source: Situation Report, 2018 by World Health Organization)*. The flood-affected areas of 2018 are shown in the **Figure 5.5.**

5.4 PHYSICAL ENVIRONMENT

5.4.1 Climate and Micro-Meteorology

The climate of Myanmar is dominated by the tropical monsoon with typical strong monsoon rainfall and a fair share of sun along with high humidity. Rainfall is highly seasonal and concentrated in the hot humid months of the southwest monsoon (May – October) and in almost dry months during the northeast monsoon (December - March).

The Block area experiences three seasons i.e. winter (November-February), summer (March-May) and Monsoon (June-October). Temperatures remain on the higher side throughout the year, especially in the summer months (March to May). The winter months (November-February) are somewhat milder (temperature varies between 10°C and 20°C) than the rest of the year. The onset of monsoon takes place towards the end of May and extends till early November. An annual rainfall of 1226 mm was recorded in the year 2014. The Pyay district receives less rainfall and temperature varies from maximum of 40°C to minimum of 15°C. **Table 5.4** shows the temperature profile of Pyay town (1.5 km towards North-East corner of EP-4) for 2014.

In general, the climate in the Block is moderately hot and humid, with a moderately cold winter and hot summer seasons. Mostly, the Block does not have high precipitations.

Wind Pattern

The dispersion of pollutants is influenced by the wind speed and wind direction in an area. It is considered as the important data for predicting the air quality impacts during drilling and testing activities. The prominent wind directions at the Block area is from North-west (21%). The highest wind speed is observed from north-north west direction with more than or equal to 8 m/s. The calm wind conditions prevailed for 25.96% of the total time. Pattern of wind direction in the Block is presented in **Figure 5.6.**

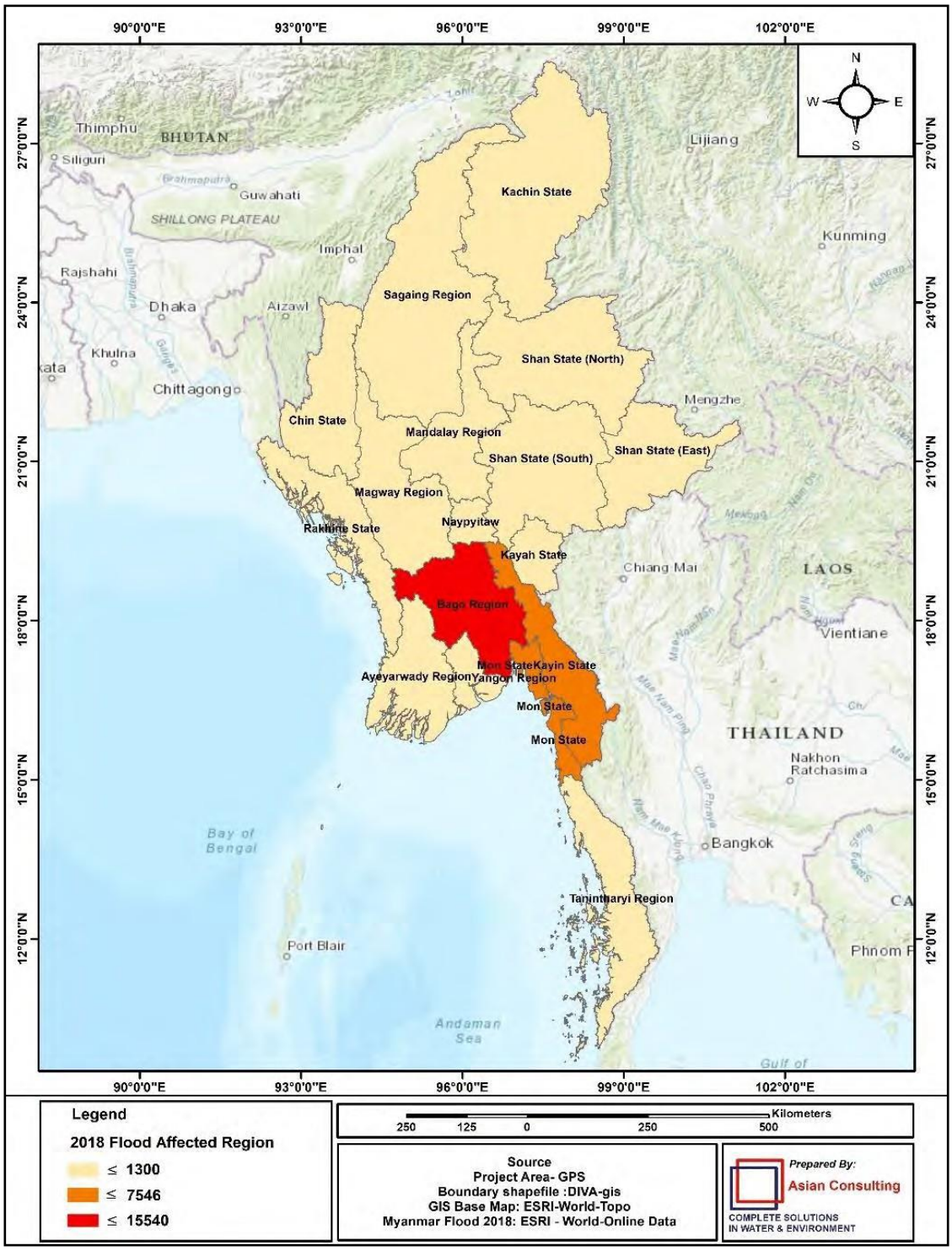


Figure 5.5: Flood-affected Areas in Myanmar, 2018

Source: Myanmar Information Management Unit (MIMU), website

5.4.2 Existing Land Setting

The EP-4 Block is located at Pyay district of Bago region. The proposed project site is located at EP-4 Block. Nawaday bridge is connecting between two township of Pyay and Padaung across Ayeyarwaddy river.

Table 5.4: Average Monthly Temperature & Rainfall Data of Pyay Town (Year-2014)

Month / Temperature	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
Maximum (°C)	32.2	35.0	38.8	40.2	37.7	33.4	31.2	31.6	33.0	33.7	33.3	-	**35**
Minimum (°C)	15.7	16.0	18.3	23.6	24.2	23.7	22.9	22.8	22.5	22.2	20.2	-	**21**
Precipitation (mm)	-	-	-	-	57.2	289.3	400.3	282.7	86.4	32.0	78.0	-	**1225.8**

Source: Ministry of Metereology and Hydrology Pyay District, Pyay

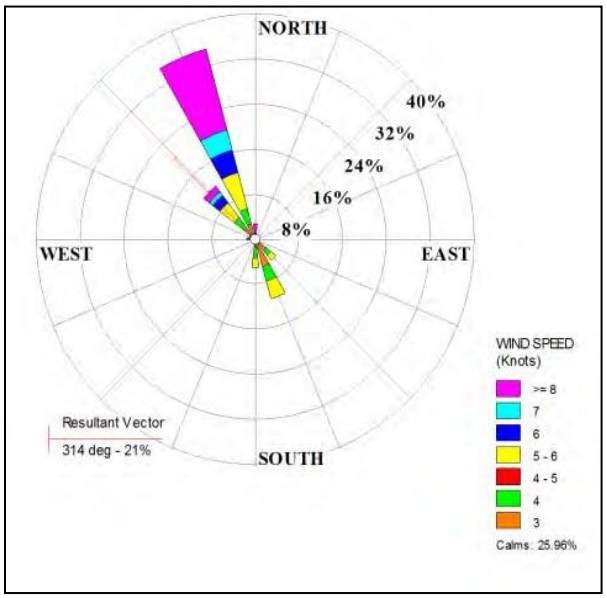


Figure 5.6: Wind Rose Showing Prominent Wind Directions for Block EP-4 (October to November 2017)

5.4.3 Land Use Land Cover (LULC)

The Bago region, in general, includes agricultural land, arable land, plantation land, pasture land and builtup areas.

Land Use Land Cover mapping of the Block was carried out using GIS and remote-sensing tools and authenticated by the ground truthing during the site visit. LANDSAT imageries of 2019 of the area were used to conduct this mapping What was discovered after this exercise was that almost 55% of the Block area constitutes trees and shrubland followed by fallow and harvested land of 16%; agriculture land (16%), degraded/barren land (8%), waterbodies (4%) and builtup area (1%). **Table 5.5** describes various categories of Land Use Land Cover in the study area. **Figure 5.7** & **Figure**

Table 5.5: Landuse Area Details: Study Area

Sl. No.	Land Use Classes	Area (ha)	Percentage
1.	Agriculture	1232.91	15.65
2.	Fallow & Harvested Land	1264.63	16.06

Sl. No.	Land Use Classes	Area (ha)	Percentage
3.	Builtup Area	90	1.14
4.	Trees and Shrubland	4339.27	55.09
5.	Waterbodies	314.41	3.99
6.	Barren Land	635.35	8.07
	Total	**7876.57**	**100**

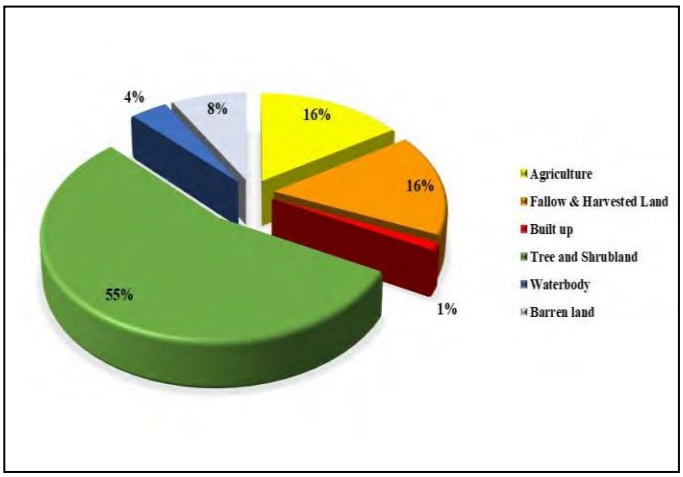


Figure 5.7: Land Use Classification of the Study Area

The changes in Land Use Land Cover of 2013, 2015 and 2019 with respect to EP-4 Block areas along with land use classification are shown in **Figures 5.9 & Figure 5.10.**

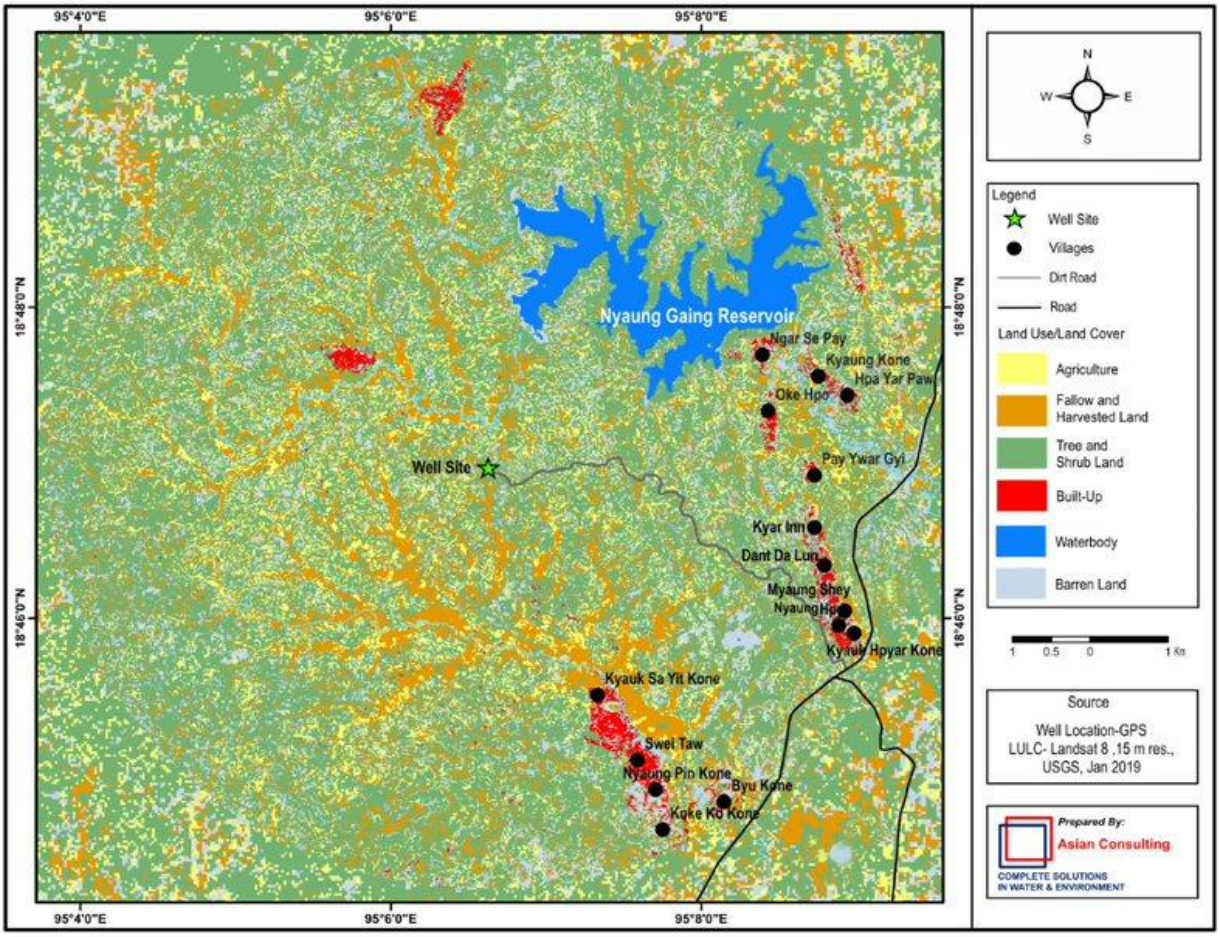


Figure 5.8: Landuse/ Land Cover Map of the Study Area
(LANDSAT imageries of Jan 2019)

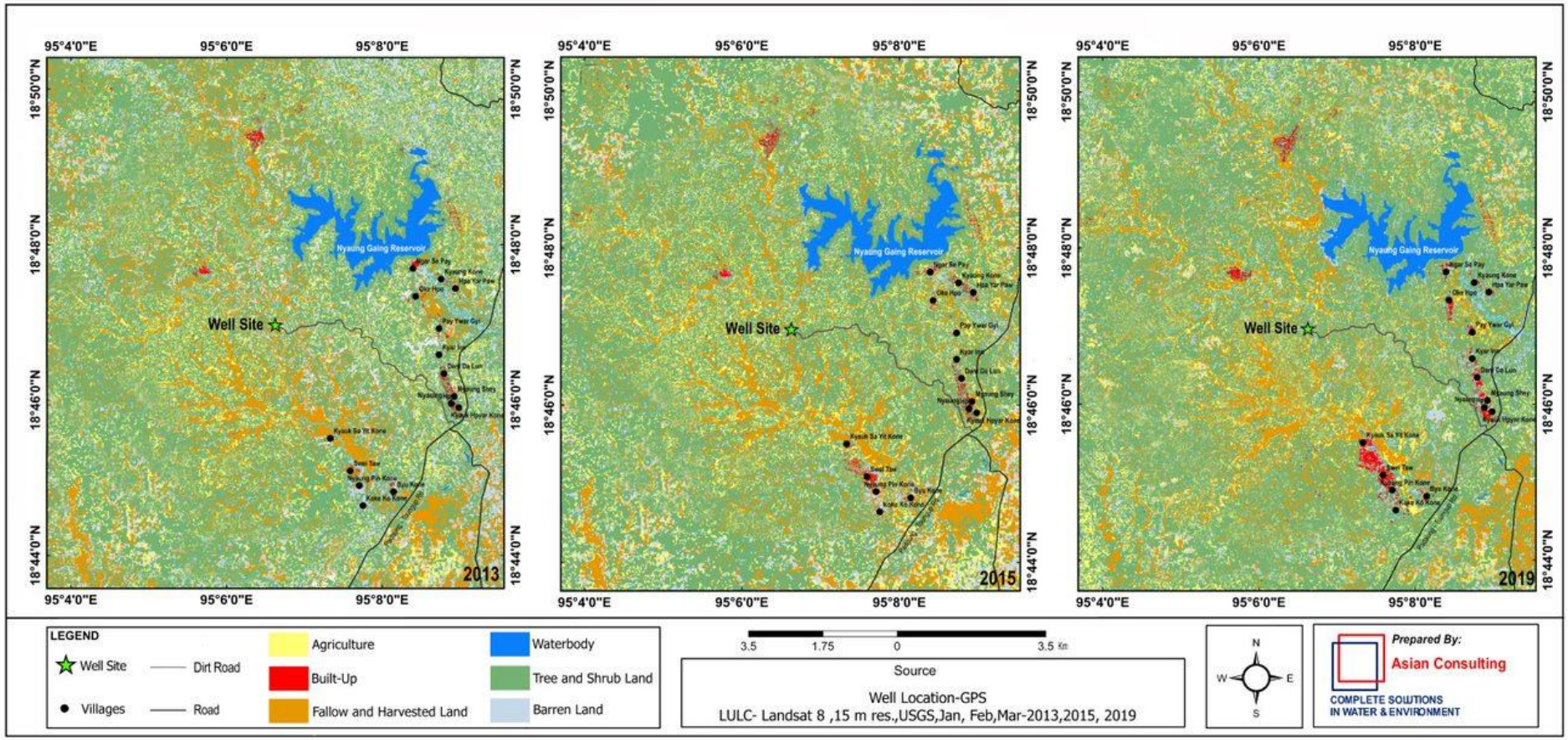
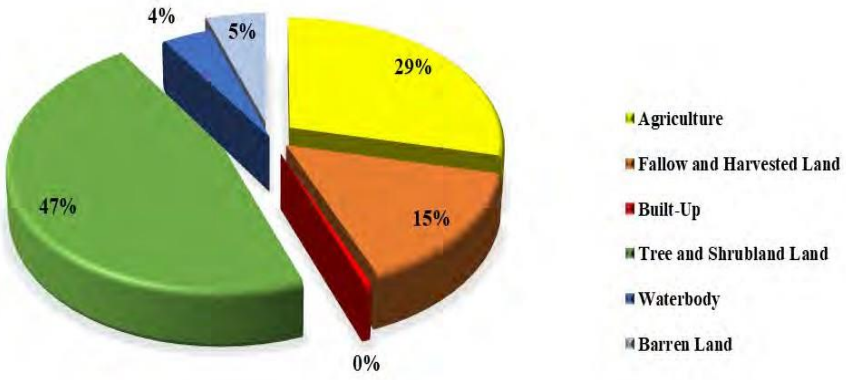
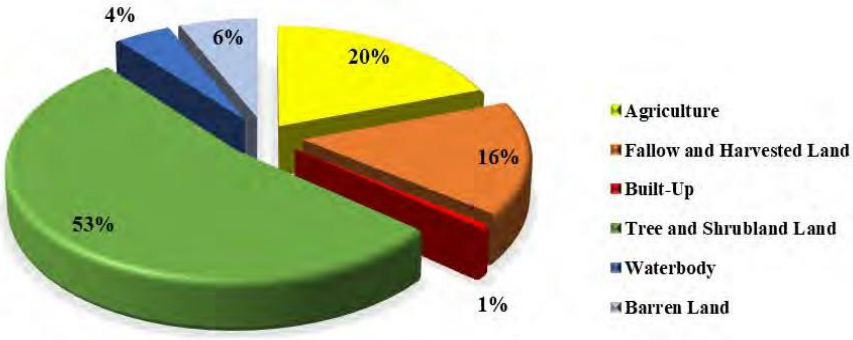


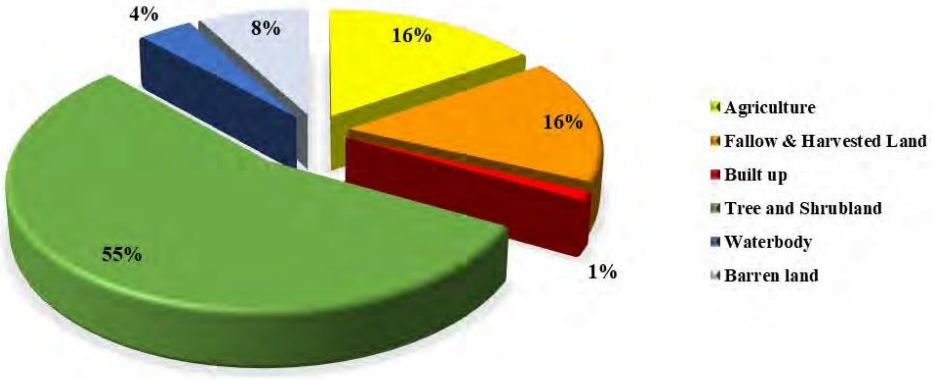
Figure 5.9: Changes in Landuse Pattern (2013, 2015, 2019)



Land-use Pattern 2013



Land Use Pattern 2015



Land use Pattern 2019

Figure 5.10: Changes in Land Use Pattern classification (2013, 2015 & 2019)

Land Use changes in 2013, 2015 & 2019

Landsat 8 (15 m resolution) Imagery of 2013 shows that about 47% i.e. maximum area was covered by trees & shrubland. Approximately 4% area was covered by water bodies/rivers, 5% area was covered by degraded /barren land, 29% of area was covered by Agricultural land, 15% of area was covered by fallow and harvested land with no settlements/builtup area.

Landsat 8 (15 m resolution) Imagery of 2015 shows that the area covered by trees and shrubland increased up to 53% from 47%. Trees and shrub land is again found out to occupy the maximum coverage area. Approximately 4% area was covered by water bodies/rivers, 6% area was covered by degraded /barren land. There was no change observed in the Land Use pattern of waterbodies and barren /degraded land. The Land Use pattern of Agricultural land was reduced to 20% this year whereas 1% increments was observed in both builtup and fallow and harvested land use patterns in 2015. Approximately 1% of land was covered by settlements/builtup area and 16% of area was covered by fallow and harvested land.

Landsat 8 (15 m resolution) Imagery of 2019 shows that there is no change observed in waterbodies, builtup area/settlements and in the fallow and harvested Land Use pattern in the year 2019 as the percentage of coverage remain similar to 2015 Land Use pattern. There is slight increment in the land coverage of degraded /barren land and trees and shrubland. The land coverage of trees and shrubland increased up to 55% from 53% whereas the barren land increased to 8% from 6% as in year 2015. In addition, the land coverage of agricultural land decreased to 16% from 20%.

The comparison of LULC Landsat imageries from 2013 to 2019 has led to the following conclusions:

- That there is major increment in the land coverage by trees and shrubland, which is the positive change from the environmental perspective.
- That some part of agricultural land has been converting into barren land, and fallow and harvested land.

Changes with respect to LULC between 2015 and 2019 imageries were minimal, when compared to changes between 2013 and 2015 (**Figure 5.9)**.

5.4.4 Soil Characteristics

The soil quality was assessed by analysing the samples collected from five (05) villages from the study area. The coordinates of the soil sampling locations and their directions from the wellsite are given in **Table 5.6** and represented in **Figure 5.11** respectively. Soil samples were analysed for physico- chemical parameters to understand the nutrient content in soil and soil health. Soil quality reflects how well a soil performs the functions of maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient cycling and providing support for plants. Sampling locations were chosen based on reconnaissance survey of the study area, prevailing activities and accessibility within the study area.

Table 5.6: Details of Soil Sampling Locations

Sample Code	Location	Geographical Coordinates		Direction from the Wellsite
		Latitude	Longitude	
SS 1	Thea Kaw	18° 41' 54.7" N	95° 04' 46.7" E	South
SS 2	Thee Kone	18° 43' 37.1" N	95° 07' 24.2" E	South-East
SS 3	Ye Twin Hla	18° 44' 36.0" N	95° 02' 24.5" E	West
SS 4	Yae Win	18° 43' 05.8" N	95° 06' 35.9" E	South-East
SS 5	TaungMyat Nar	18° 45' 11.1" N	95° 09' 08.7" E	North-East

Methodology

Samples were collected by hand-driven sampling Auger. U.S. EPA Standard Operating Procedure (2012) method was followed for soil sampling. All the soil samples were taken at desired sampling depth (sub-surface) from the exposed soil surface depending upon the soil

quality. Analytical results of the soil quality are presented in **Table 5.7.**

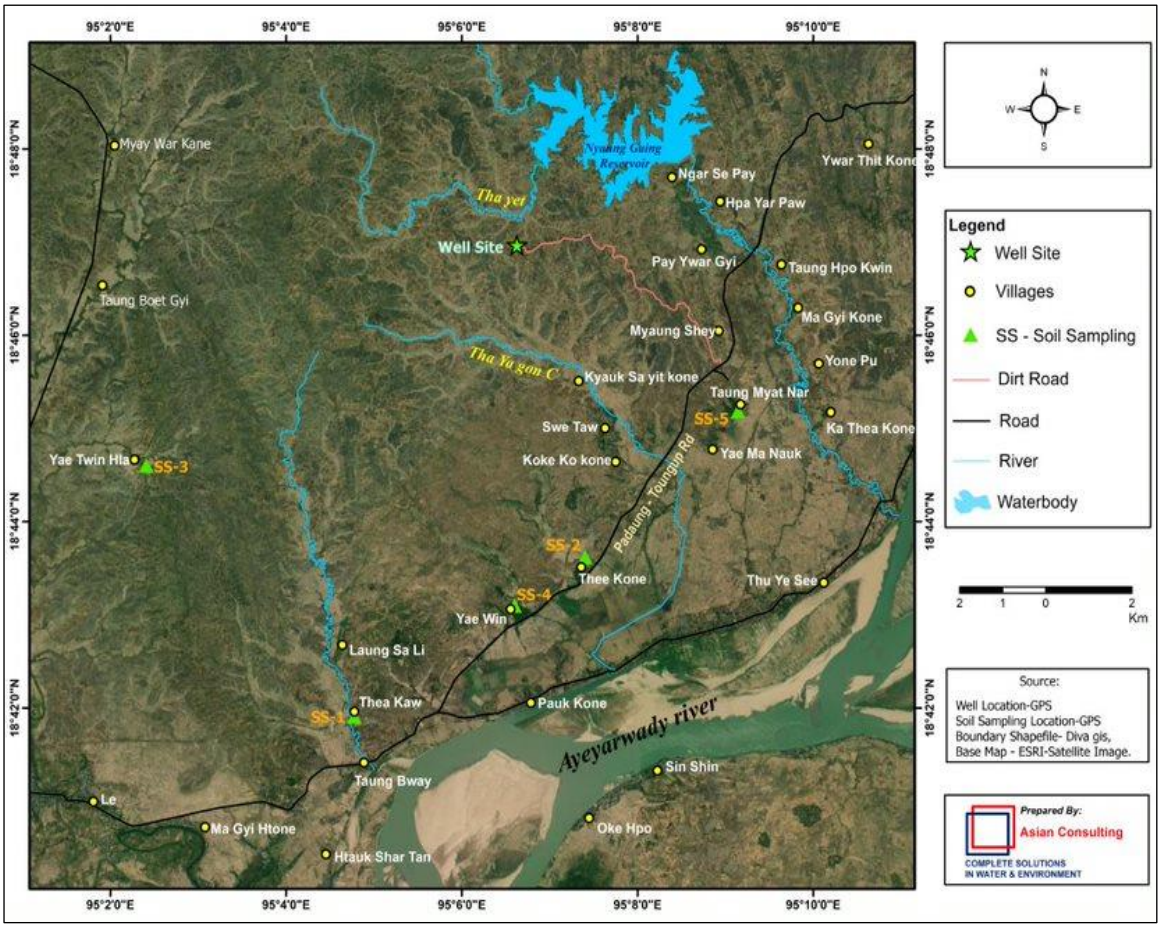


Figure 5.11: Soil Sampling Locations

Photo Plates 5.1and **5.2** show the soil quality monitoring at different locations in the study area. Soil quality results are given in **Table 5.7.**

Photo Plate 5.1: Soil Sampling near Yae Win

Photo Plate 5.2: Soil Sampling at Thea Kaw Village

Table 5.7: Soil Quality Analytical Results

Sl. No.	Sampling Locations / Parameters	Units	Thea Kaw	Thee Kone	Ye Twin Hla	Yae Win	Taung Myat Nar
	Location Code		**SS 1**	**SS 2**	**SS 3**	**SS 4**	**SS 5**
1.	pH	-	7.28	8.3	8.25	8.06	7.36
2.	Color, Hazen units	-	Blackish Grey	Grey	Grey	Blackish Grey	Blackish Grey
3.	Moisture,	%	12.46	16.77	2.72	8.47	4.71
4.	Organic Matter,	%	1.83	2.26	1.15	1.45	3.47
5.	Organic Carbon,	%	1.06	1.31	0.67	0.84	2.01
6.	Total Kjehldal Nitrogen,	%	0.07	0.06	0.07	0.06	0.07
7.	Chloride	mg/kg	744.64	897.52	228.57	177.06	89.47
8.	K available	mg/kg	1054.38	1869.32	1875.89	1243.58	1804.29
9.	Na available	mg/kg	186.22	582.41	204.65	547.99	584.49
10.	P available	mg/kg	91.32	126.57	60.93	9.17	164.84
11.	Ca available	mg/kg	1375.21	5045.22	2473.21	4597.1	4091.43
12.	Mg available	mg/kg	1301.47	1876.45	1962.35	2351.86	1170.47
13.	Bicarbonates	mg/kg	304.47	2082.08	1624.54	760.69	419.81
14.	Na adsorption ratio	-	0.26	0.64	0.31	0.73	0.93
15.	Texture (sand)	%	22.04	41.06	7.9	15.45	27.41
16.	Texture (clay)	%	74.76	55.01	86.27	72.13	61.82
17.	Texture (silt)	%	3.19	3.92	5.83	12.42	10.77
18.	Oil & Grease	%	0.17	1.02	0.21	0.1	0.01

Soil Quality: Analytical Results

The parameters were selected with an objective of acquiring insights into the characteristics of the soil. Interpretation made from the soil quality results are:

- Soil pH in the study area ranged from 7.28 to 8.3 being maximum at SS2 (Thee Kone village) and found to be slightly alkaline in nature at all the monitoring locations.
- Organic matter in soil samples varied between 1.15 and 3.47%, which is optimum range for soil health. Nitrogen and phosphorous in the soil were found in the range from 0.06 to 0.07% and from 9.17 to 164.84 mg/kg respectively. Nitrogen and phosphorous are present in good amount in the examined soil and these both are essential in plant growth and production.
- The macro nutrients like potassium, calcium and magnesium varied from 1054 to 1875 mg/kg, 1375 to 5045 mg/kg, and 1170 to 2351 mg/kg respectively, which are present in excessive amount and are indicative of good soil permeability and a structure suitable for the cultivation.
- Sodium Adsorption Ratio (SAR) is a ratio to measure the suitability of water for irrigation purposes. The higher the SAR, the less suitable the water is for irrigation. The Sodium Absorption Ratio varying from 0.26 to 0.93 indicates that the permeability of the soil is not affected.
- Sand, silt and clay percentage in soil samples of the study area varied between 7.9 and 41.06%, 3.19 and 12.42%, and 55.01 and 86.27% respectively. Based on this, textural class of the analysed samples at all locations displays clayey loam, which is smooth when dry and silky when wet. The fine clay soil can hold more water than the coarse sand soil.

5.4.5 Air Environment

The ambient air quality of the study area was monitored at four (04) locations with respect to PM_{10}, $PM_{2.5}$, SO_2 and NO_2. The data generated with respect to the air pollutants in the environment helped to determine the present air quality status in the study area. The details were also used to assess the background concentration of pollutants, which will help in determining the effects of the proposed project on the environment.

The main considerations involved in selecting the monitoring stations were availability of reliable power supply, accessibility to the site, topography, security, dominant wind direction and even distribution of sampling locations in the study area. Of all these criteria, electricity was the primary criteria on basis which the locations were selected since many of the villages within the study area did not have Government-supplied electricity.

Out of these four (04) air monitoring locations, sampling at three (03) locations was carried out using Diesel Generator (DG) sets. DG sets were placed away (more than 30 meters) from the combined PM_{10} & $PM_{2.5}$. Air sampler was placed in the upwind direction to avoid any interference due to the emissions from DG sets. The equipment was placed at open space free from trees and vegetation, which otherwise could have acted as a sink of pollutants resulting in lower levels in the monitoring results.

At locations close to the road, the equipment was placed at least 100 m away from these roads to avoid resuspension of road dust particles. Ambient air quality monitoring for the above parameters was conducted at each station adopting a 24 h schedule. Combined PM_{10} & $PM_{2.5}$ sampler and impingers with absorbing solution were used to collect samples for SO_2 and NO_2.

The methods of analysis for different air quality parameters are given in Table 5.8 below**.**

Table 5.8: Methodology for Ambient Air Quality Monitoring

Parameters	Method of Measurement
PM_{10}	Gravimetric
$PM_{2.5}$	Gravimetric
SO_2	Improved West and Gaeke
NO_2	Modified Jacob & Hochheiser (Na-Arsenite)

Ambient Air Quality Standards as per Myanmar National Environmental Quality (Emission) Guidelines, 2016 were compared with the results of the baseline survey carried out to determine the background status of the air quality. The air quality standards as per National Environmental Quality (Emission) Guidelines, 2016 are provided below in **Table 5.9.**

Table 5.9: Air Quality Standards as per National Environmental Quality (Emission) Guidelines, 2016.

Parameter	Averaging Period	Guideline Value(µg/m^3)
Particulate matter (PM_{10})	1-year 24-hour	20 50
Particulate matter ($PM_{2.5}$)	1-year 24-hour	10 25
Sulfur dioxide (SO_2)	24-hour 10-minute	20 500
Nitrogen dioxide (NO_2)	1-year 1-hour	40 200

(Source: National Environmental Quality (Emission) Guidelines, 2016.)

There are no industries located within the study area. These areas were mainly surrounded by the agricultural land and open land covered with sparse vegetation. Most of the roads within the study area were unpaved roads, which are a source of inexhaustible supply of dust. The entry of these dust particles into air by every passing vehicle may also contain other airborne pollutants and hence, these are considered as the major contributor to the air pollution. The locations of the Ambient Air Quality Monitoring Stations within the study area are given in **Table 5.10** and shown in **Figure 5.12.**

Table 5.10: Ambient Air Quality Monitoring Stations

Location Code	Location	Area Category	Coordinates	Direction from the Wellsite
AQ-1	Thea Kaw	Residential	18° 42' 00.0" N 95° 04' 47.6" E	South
AQ-2	Ye Twin Hla	Residential	18° 44' 40.5" N 95° 02' 16.6" E	West
AQ-3	Yae Win	Residential	18° 43' 05.1" N 95° 06' 35.2" E	South-East
AQ-4	Swe Taw	Residential	18° 45' 04.9" N 95° 07' 39.3" E	North-East

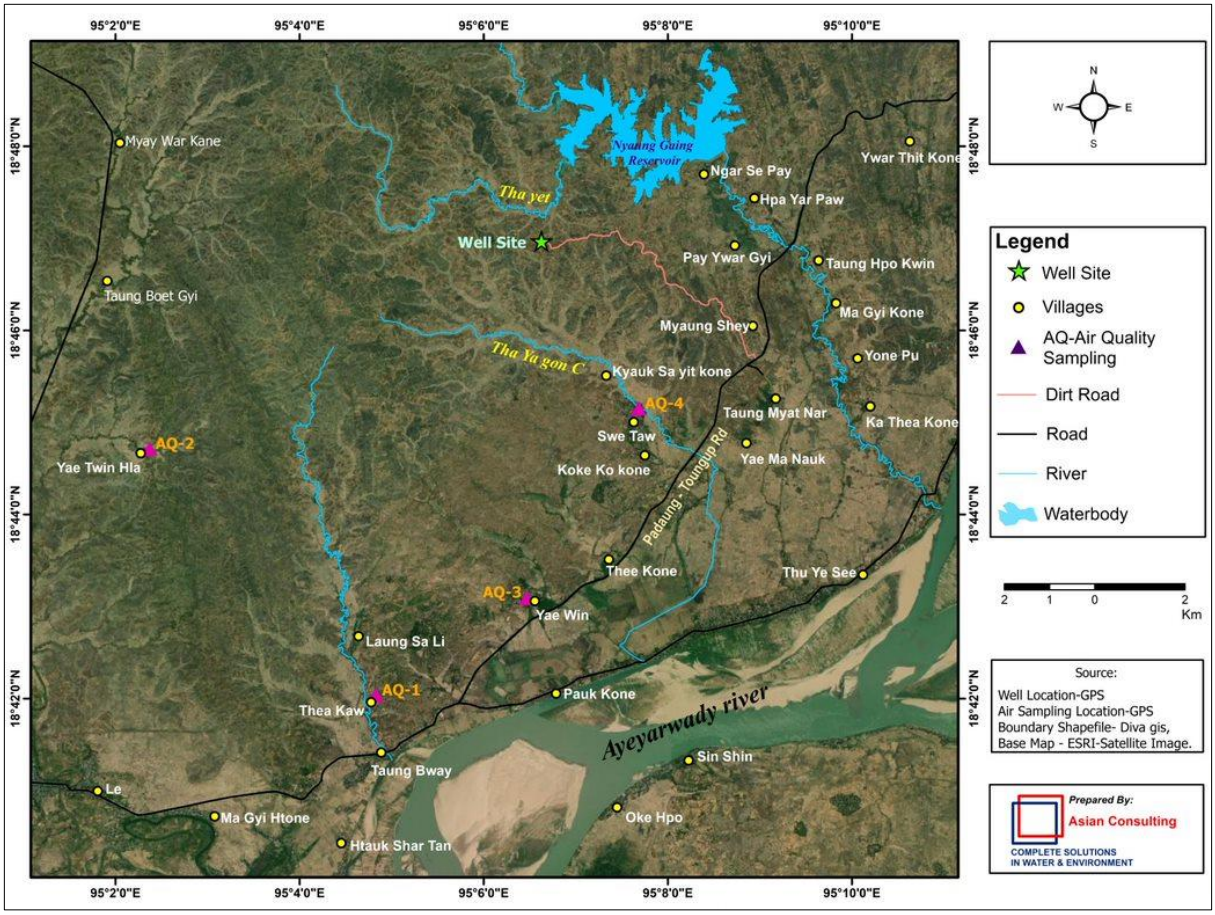


Figure 5.12: Air Quality Monitoring Location Map

Photo Plates 5.3 to **5.6** show the air quality monitoring at four locations in the study area.


Photo Plate 5.3: Air Quality Monitoring at Thea Kaw


Photo Plate 5.4: Air Quality Monitoring at Yae Twin Hla


Photo Plate 5.5: Air Quality Monitoring at Yae Win Village

Photo Plate 5.6: Air Quality Monitoring at Swe Taw

Ambient Air Quality Monitoring Results

The 24-hour PM_{10} and $PM_{2.5}$ levels varied between 39.5µg/m^3 and 53.1µg/m^{3,} and 22.4µg/m^3 and 32.5µg/m^3 respectively. All these values are well within the specified limits as per Myanmar National Environmental Quality (Emission) Guidelines, 2016 except for Ye Twin Hla and Yae Win villages where a slight increase in the values were noted.

The values of SO_2 and NO_2 varied from 6.1 to 7.2 µg/m^3 and 19.6 to 21.2 µg/m^3 respectively. All these values are found to be well within the specified limits as per Myanmar National Environmental Quality (Emission) Guidelines, 2016. The ambient air quality monitoring data is given in **Tables 5.11.**

Table 5.11: Summary of Monitored Air Quality in the Study Area

Location Code	Station Location	24-hourly Results (µg/m^3)			
		PM_{10}	$PM_{2.5}$	SO_2	NO_2
AQ-1	Thea Kaw	39.5	22.4	6.2	20.1
AQ-2	Ye Twin Hla	53.1	32.5	7.2	21.2
AQ-3	Yae Win	50.5	28.4	6.4	20.1
AQ-4	Swe Taw	44.7	25.3	6.1	19.6

5.4.6 Noise Environment

The aim of the baseline noise monitoring is to obtain background noise level data within the study area, especially in the human settlements for future reference. The ambient noise monitoring was conducted at four (04) locations within the study area on a 24-hour basis and in the nearby settlements as given in **Table 5.12** and shown in **Figure 5.13**. Since there are no industries within the study area, the major sources of noise may include road traffic, household gadgets, markets and loudspeakers playing on occasions such as during worships in the temples.

Table 5.12: Noise Quality Monitoring Stations

Location Code	Location	Area Category	Coordinates	Direction from the Wellsite
NQ-1	Thea Kaw	Residential	18° 42' 00.0" N 95° 04' 47.6" E	South
NQ-2	Ye Twin Hla	Residential	18° 44' 36.0" N	West

Location Code	Location	Area Category	Coordinates	Direction from the Wellsite
			95° 02' 24.5" E	
NQ-3	Yae Win	Residential	18° 43' 05.1" N 95° 06' 35.2" E	South-East
NQ-4	Swe Taw	Residential	18° 45' 04.9" N 95° 07' 39.3" E	North-East

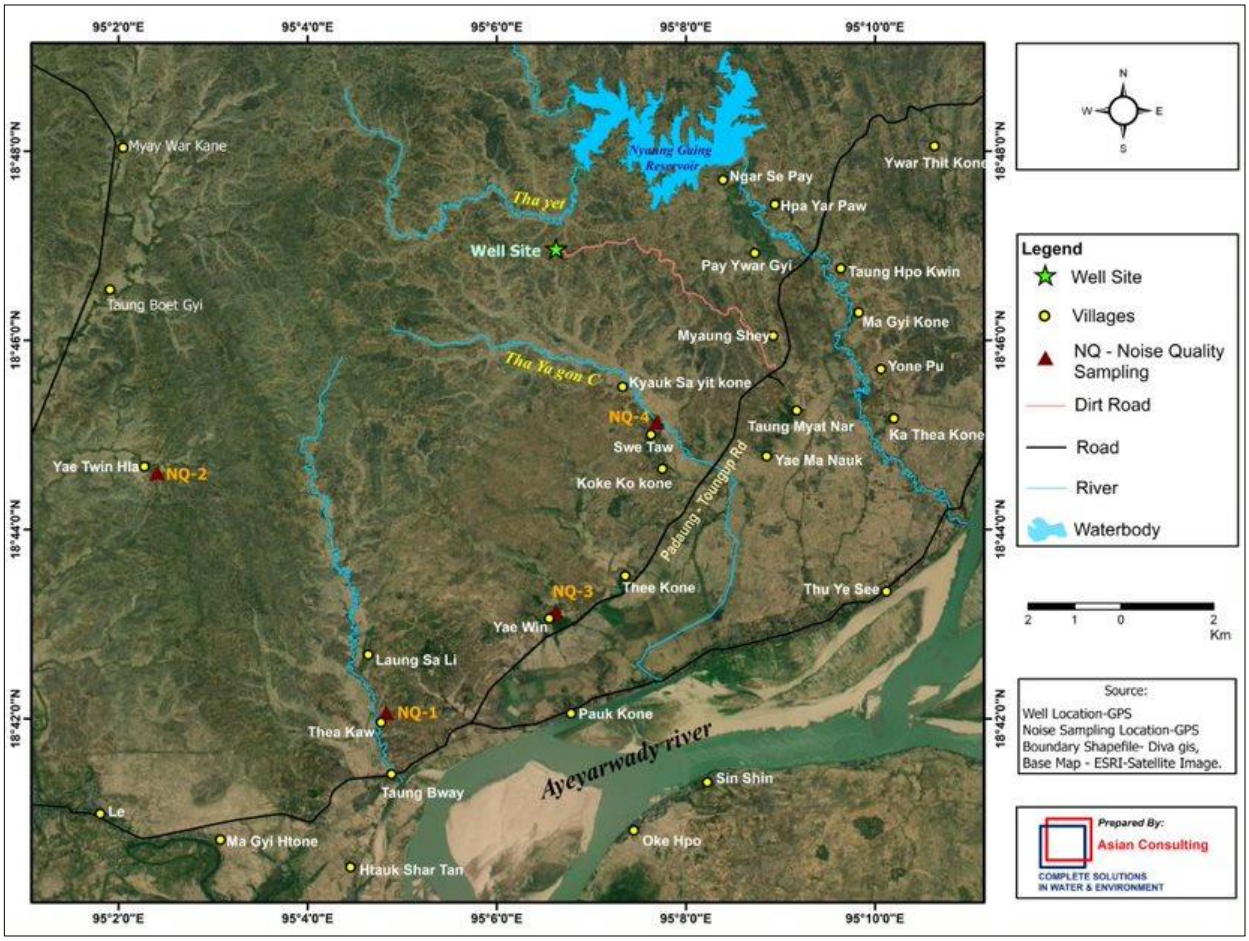


Figure 5.13: Noise Quality Monitoring Location Map

Noise Monitoring Methodology

Ambient noise levels/Sound pressure levels (SPLs) were measured by a portable sound level meter having in-built facilities to read noise level directly in dB (A). A-weighted equivalent continuous sound pressure level (L_{eq}) values were computed from the values of A-weighted SPL measured with the help of noise meter.

Ambient noise level monitoring was carried out in the post-monsoon season of 2017. At each location, noise monitoring was conducted continuously over a period of twenty-four hours to obtain L_{eq} values at uniform time intervals of one (01) hour. **Photo Plate 5.7** shows the noise monitoring results.

Photo Plate 5.7: Noise Monitoring at Thea Kaw and Swe Taw Village

Daytime L_{eq} has been computed from the hourly L_{eq} values between 7 a.m. and 10 p.m. and night-time L_{eq} from the hourly L_{eq} values between 10 p.m. and 7 a.m. using the following formula:

$$L_{eq\,night} = 10 \log \frac{1}{9} \sum_{i=1}^{9} 10^{\frac{L_i}{10}} \qquad L_{eq\,day} = 10 \log \frac{1}{15} \sum_{i=1}^{15} 10^{\frac{L_i}{10}}$$

Where, Li = Leq value of the i^{th} hourly time interval.

Area category: I-Industrial, C-Commercial, R-Residential, S-Silence zone
Daytime: 7.00 a.m. to 10.00 p.m.; Nighttime: 10.00 p.m. to 7.00 a.m.

Noise Monitoring Results

Noise levels during daytime in residential areas were observed in the range of 47.5 dB(A) to 55.5 dB(A) being slightly exceeding the limit at location NQ-1as per National Environmental Quality (Emission) Guidelines, Myanmar, 2015. Noise levels at these locations are attributed to vehicular movements.

Noise levels during night-time were observed in the range of 41.5 dB(A) to 44 dB(A), which are within the standard limit. There are no industries in the study area. Day and night noise levels with their respective locations along with coordinates are given in **Table 5.13** and graphically represented in **Figure 5.14 & 5.15.**

Table 5.13: Summary of Ambient Noise Levels Monitored in the Study Area

Location Code	Location	Area Category	Day		Night	
			Leq	Limit	Leq	Limit
NQ-1	Thea Kaw	Residential	55.5	**55**	44	**45**
NQ -2	Ye Twin Hla	Residential	47.5	**55**	41.5	**45**
NQ -3	Yae Win	Residential	48	**55**	42	**45**
NQ -4	Swe Taw	Residential	51	**55**	43.5	**45**

Note: Limit as per National Environmental Quality (Emission) Guidelines, Myanmar, 2016.

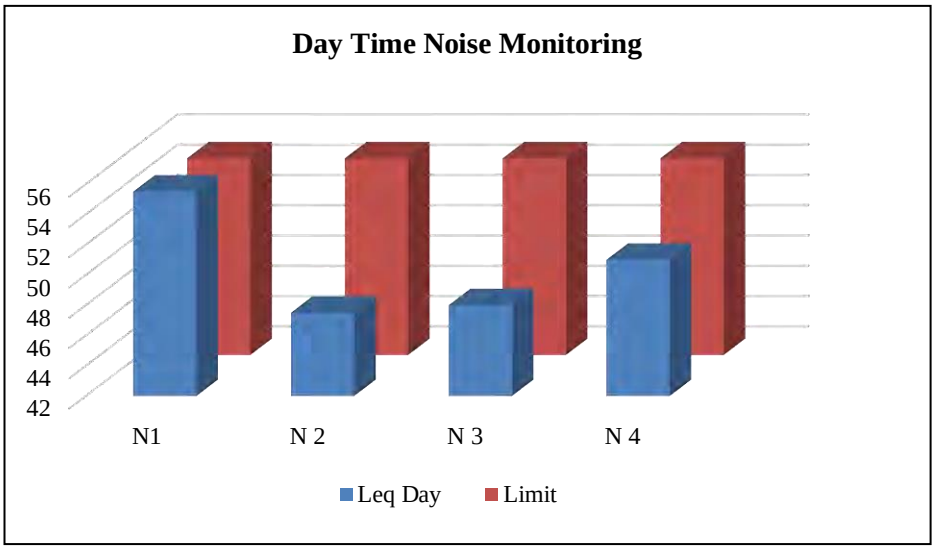


Figure 5.14: Noise Quality Monitoring Results (Leq Day Time)

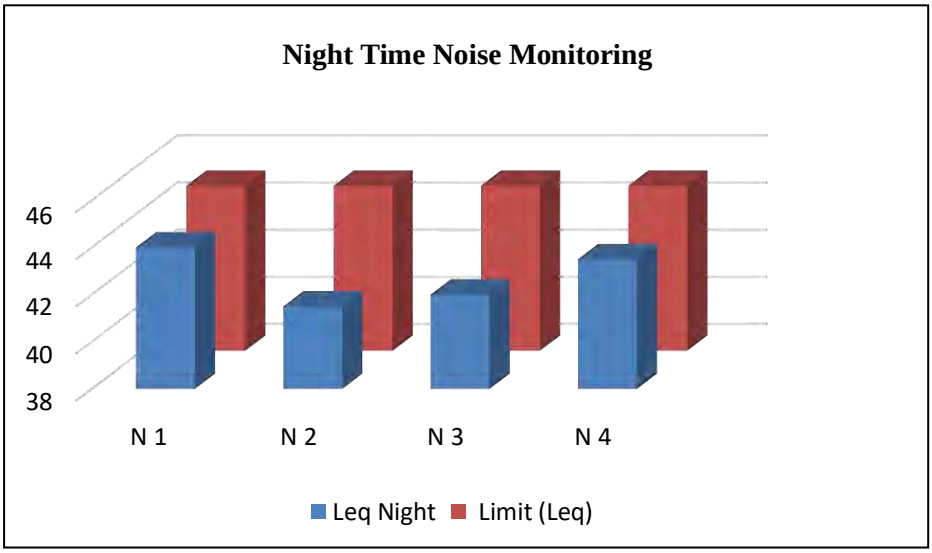


Figure 5.15: Noise Quality Monitoring Results (Leq Night Time)

5.4.7 Water Environment Hydrology and Drainage

The study area is located at the western side of Ayeyarwady River (Length 2170 km; drainage area 413,710 km^2), which is country's largest river. The Ayeyarwady River in Myanmar flows from the Himalayan Mountain Range in the north to the Andaman Sea in the south. The Ayeyarwady River Basin and the Catchment occupy 60% of the country area traversing Chin, Kachin, Shan states, Mandalay, Magwe, Bago, Yangon and Ayeyarwady Divisions. In the study area Ayeyarwady River enters from the North-Eastern part of the Block near Nawaday Bridge and flows through the middle of the Block bordering the Padaung administrative areas and exits from the Southern part near Te Gyi Kone village (**Photo Plate 5.8 & 5.9)**.

The major source of water in the study area is the Ayeyarwady River. Besides, few other small streams also pass through the study area most of which are non-perennial and rain- fed and remain dry during the hot season. At the time of our field survey, non-perennial streams and ponds

Streams were carrying substantial amount of water, i.e during the post-monsoon season. The Drainage Map of the study area is shown as **Figure 5.16.**

Photo Plate 5.8: Ayeyarwady River

Photo Plate 5.9: Pond near Ye Twin Hla

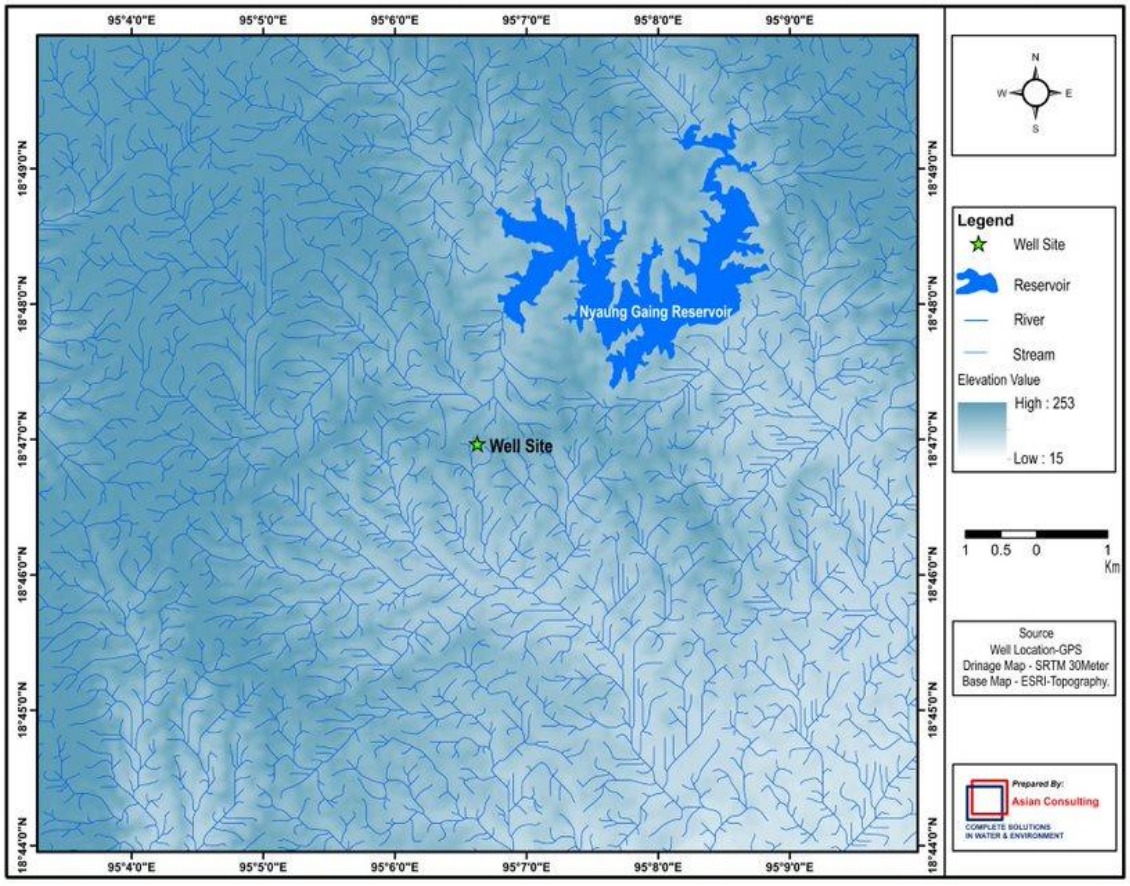


Figure 5.16: Drainage Map of the Study Area Village

Water Quality

To assess the water quality within the study area, surface water and groundwater sampling was carried out during the post-monsoon season. Surface water and groundwater samples were collected at four (04) and six (06) (dug wells) locations respectively **(Photo Plates 5.10 to 5.12)**. Samples were analysed for various physico-chemical parameters to know the present status of the water quality. All precautions and care were taken during the sampling to avoid contamination. Sampling and analysis of the samples was carried out as per established standard methods and procedures prescribed by the WHO, and "Standard Methods for Examination of Water and

Wastewater" published by APHA et al The results of water analysis have been compared with WHO drinking water standards to assess their suitability for the drinking purposes.

Photo Plate 5.10: Ground Water Sampling at Thea Kaw Village

Photo Plate 5.11: Surface Water Sampling at Ayeyarwady River

Photo Plate 5.12: Non-perennial Stream near Village Thea Kaw

Details of the surface water sampling locations are given in the **Table 5.14** and **Figure 5.17.**

Table 5.14: Description of Surface Water Sampling Locations

Station Code	Sampling Location	Coordinates		Direction from the Wellsite
		Latitude	Longitude	
SW1	Thea Kaw	18° 41' 58.0" N	95□ 04' 42.7"E	South
SW2	Ye Twin Hla	18° 44' 35.5" N	95° 02' 24.4" E	West
SW3	At Ayeyarwady River	18° 41' 54.7" N	95° 04' 46.7" E	South-East
SW4	TaungMyat Nar	18° 45' 11.1" N	95° 09' 08.7" E	North-East

On-site Surface Water Quality: Analytical Results

Monitoring locations were determined on basis of the drainage pattern, location of residential areas representing different activities, andareas likely to be impacted, which can represent the

baseline conditions. The temperature, pH and conductivity were analysed on site at the place of sample collection i.e. Ayeyarwady River and non-perennial stream (**Photo Plates 5.13 to 5.15)**.The conductivity level was found to be 0.12mS/cm and 0.38 mS/cm for Ayeyarwady River and non-perennial stream near Thea Kaw village respectively. The pH was in the range of 9.5 for the River water and 9.6 for the stream near village Thea Kaw. The analytical results of collected surface water samples are presented in **Table 5.15.**

Photo Plate 5.13: On-site Water Testing of Non-perennial Stream near Thea Kaw Village

Photo Plate 5.14: On-site Water Testing of Pond near Taung Myat Nar Village

Photo Plate 5.15: On-site Water Testing of Pond near Village Ye Twin Hla

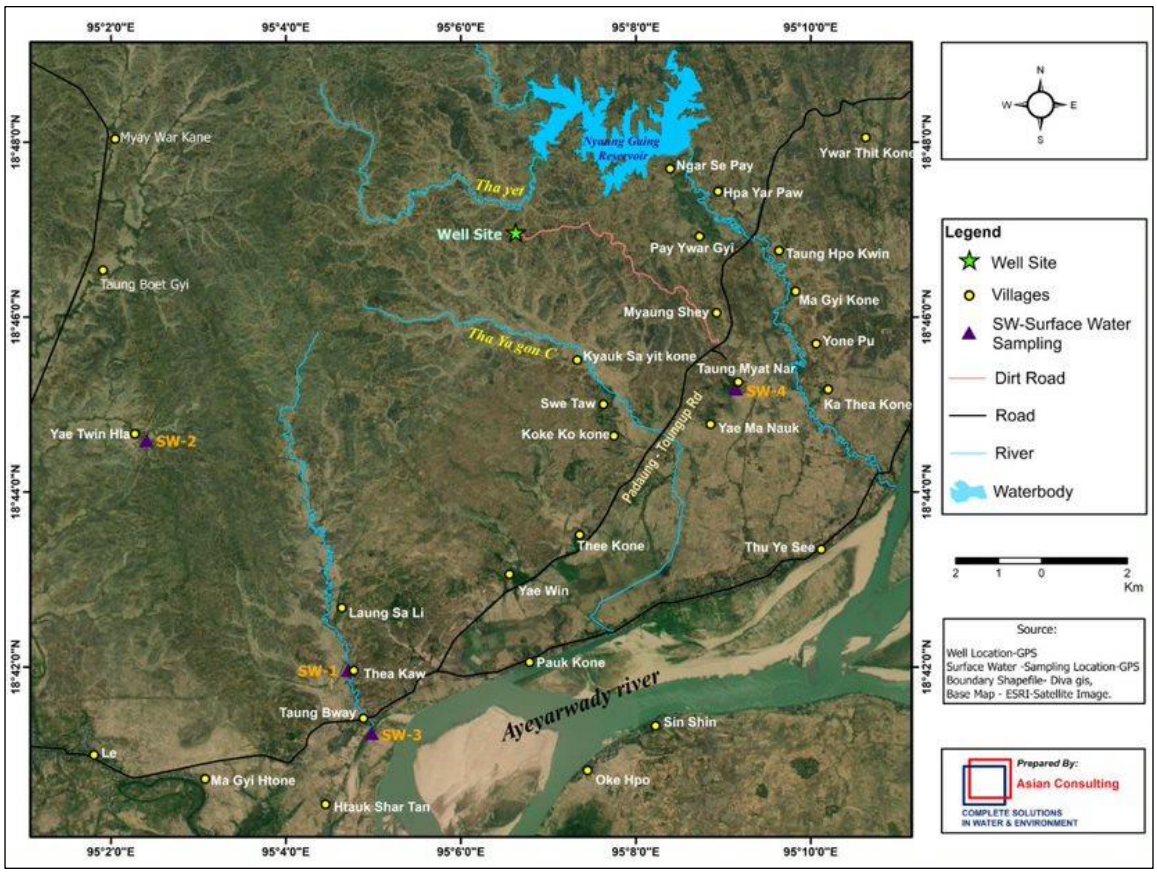


Figure 5.17: Surface Water Quality Monitoring Location Map

Table 5.15: Analytical Results of Surface Water

Sl. No.	Sampling Locations / Parameters	Units	Thea Kaw (Seasonal Stream)	Ye Twin Hla (Pond)	At Ayeyarwady River	Taung Myat Nar (Pond)	Drinking Water Standards – WHO, 2017
	Location Code		**SW 1**	**SW 2**	**SW3**	**SW4**	
1.	pH	-	7.62	7.15	7.4	7.75	6.5 - 8.5
2.	Conductivity	µS/cm	390.5	536.5	212.7	892.1	-
3.	Color		<1.0	<1.0	<1.0	<1.0	-
4.	Turbidity	NTU	15.8	1.5	90.5	0.5	-
5.	DO	(mg/l)	6.1	6.3	6.3	6.2	-
6.	Total Hardness	(mg/l)	136	248	76	132	-
7.	Calcium hardness (as Ca^{2+})	(mg/l)	21.8	39.76	12.18	21.16	-
8.	Magnesium hardness	(mg/l)	19.93	36.21	11.18	19.44	-
9.	Total Solids	(mg/l)	336	400	280	614	
10.	TDS	(mg/l)	246	338	134	562	500
11.	TSS	(mg/l)	26.5	3	188	0.5	
12.	Nitrate	(mg/l)	2.25	0.79	2.86	0.68	50
13.	Nitrite	(mg/l)	<0.01	<0.01	<0.01	<0.01	3
14.	Ammonia Nitrogen	(mg/l)	<0.04	<0.04	<0.04	<0.04	-
15.	Total Alkalinity	(mg/l)	120.6	132.66	100.5	514.56	-
16.	Sulphate	(mg/l)	84.22	154.37	19.87	15.93	500

Sl. No.	Sampling Locations / Parameters	Units	Thea Kaw (Seasonal Stream)	Ye Twin Hla (Pond)	At Ayeyarwady River	Taung Myat Nar (Pond)	Drinking Water Standards – WHO, 2017
	Location Code		SW 1	SW 2	SW3	SW4	
17.	Fluoride	(mg/l)	0.01	0.23	<0.01	0.27	1.5
18.	Sodium	(mg/l)	45.8	47	9.3	25.4	200
19.	Potassium	(mg/l)	3.6	2.9	2.9	1.9	
20.	Iron Dissolved	(mg/l)	0.7	0.2	7	0.1	-
21.	BOD	(mg/l)	20	15	12	15	-
22.	COD	(mg/l)	66.67	44.45	33.34	44.45	-
23.	Mercury	(mg/l)	<0.01	<0.01	<0.01	<0.01	0.001
24.	Lead	(mg/l)	<0.01	<0.01	<0.01	<0.01	0.01
25.	Total Chromium	(mg/l)	<0.01	<0.01	<0.01	<0.01	0.05
26.	Cadmium	(mg/l)	<0.01	<0.01	<0.01	<0.01	0.003
27.	Arsenic	(mg/l)	<0.01	<0.01	<0.01	<0.01	0.01
28.	Faecal Coliform	MPN/ 100ml	Absent	Absent	28	Absent	

Surface Water Quality: Analytical Results

- The pH of analysed surface water samples varied between 7.15 and 7.75 with a slightly alkaline nature at all the locations.
- The total dissolved solids varied from 134 to 562 mg/l while electrical conductivity varied from 212 to 892 µS/cm being maximum at SW4 (pond near Taung Myat Nar village) indicates the accumulation of salts, minerals and nutrients, which may result from surface water entering the ponds and fertilizers runoff.
- Total suspended solids varied from 0.5 to 188 mg/l with maximum value observed at Ayeyarwady River. During the field visits, high flow rate was observed in the river, which may have kept the particles suspended.
- Dissolved Oxygen (DO) values varied from 6.1 to 6.3 showing favorable conditions for the growth and reproduction of normal population of fish and other aquatic organisms in these waterbodies.
- Heavy metals, namely mercury, chromium, lead, cadmium and arsenic were below the detectable range in all the sampling locations.
- Biochemical Oxygen Demand (BOD) levels recorded were in the range of 12 to 20 mg/l, which denote the presence of organic matter in the waterbodies. The maximum BOD value of 20 mg/l was observed at Thea Kaw village (seasonal stream), which was slightly higher than the other locations and it may be due to the discharge of domestic wastewater from nearby settlements and runoff from agricultural lands.
- At Ayeyarwady River, iron content was found to be 7 mg/land presence of faecal coliforms was observed. During the field visits, it was noticed that the river water was being used for drinking purposes and thus, it was recommended to disinfect the water before its direct usage.

Groundwater Quality

The details of the groundwater sampling location are given in **Table 5.16** and **Figure 5.18** whereas the physico-chemical status of ground water is presented in **Table 5.17**.

Table 5.16: Description of Groundwater Sampling Locations

Sl. No.	Sampling Location	Station Code	Coordinates		Direction Within the Block
			Latitude	Longitude	
1.	Thea Kaw	GW1	18° 41' 57.9" N	95° 04' 46.6" E	South
2.	Thee Kone	GW2	18° 43' 34.2" N	95° 07' 23.2" E	South-East
3.	Ye Twin Hla	GW3	18° 44' 36.0" N	95° 02' 24.5" E	West
4.	Swe Taw	GW4	18° 45' 04.9" N	95° 07' 39.3" E	North-East
5.	TaungMyat Nar	GW5	18°45' 11.1" N	95° 09' 08.7" E	North-East
6.	Laung Sa Li	GW6	18° 42' 50.8" N	95° 04' 41.3" E	South

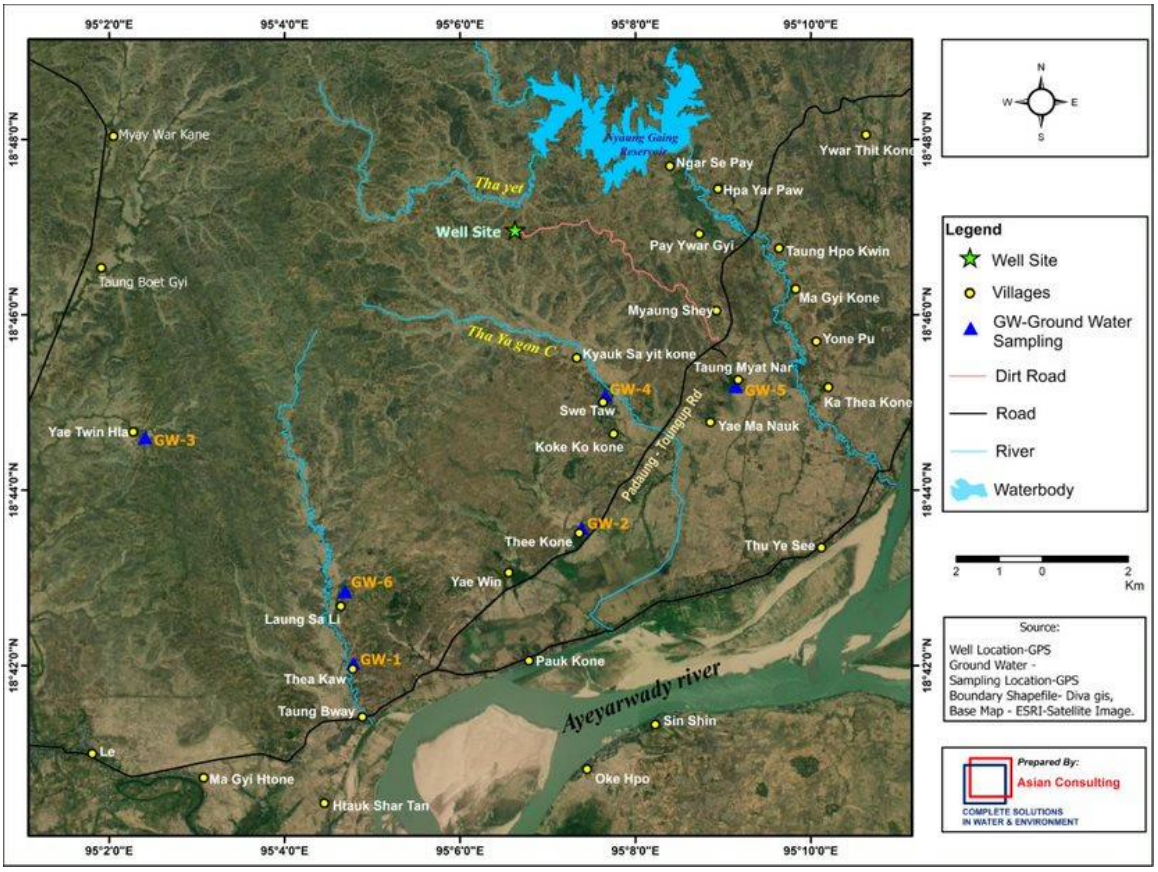


Figure 5.18: Groundwater Quality Monitoring Location Map

Table 5.17: Physico-Chemical Quality of the Ground Water

Sl. No	Sampling Locations / Parameters	Units	Thea Kaw	Thee Kone	Ye Twin Hla	Swe Taw	Taung Myat Nar	Laung Sa Li	WHO Drinking Water Standards
	Location ID		GWI	GW2	GW3	GW4	GW5	GW6	
4.	Total Hardness ($CaCO_3$)	(mg/l)	432	40	688	36	152	24	-
5.	Calcium hardness (as $CaCO_3$)	(mg/l)	140	34	386	22	66	16	-
6.	Magnesium hardness (as $CaCO_3$)	(mg/l)	132	6	302	14	88	8	-

Sl. No	Sampling Locations / Parameters	Units	Thea Kaw	Thee Kone	Ye Twin Hla	Swe Taw	Taung Myat Nar	Laung Sa Li	WHO Drinking Water Standards
	Location ID		GWI	GW2	GW3	GW4	GW5	GW6	
7.	Total Solids	(mg/l)	580	368	1020	156	852	114	-
8.	TDS	(mg/l)	516	274	872	100	678	84	500
9.	TSS	(mg/l)	<1.0	<1.0	1	<1.0	<1.0	<1.0	-
10.	Nitrate (as NO_3)	(mg/l)	0.06	0.03	0.08	0.03	0.06	0.02	50
11.	Nitrite (as NO_2)	(mg/l)	0.05	0.02	<0.01	<0.01	<0.01	<0.01	3
12.	Ammonia Nitrogen (NH_3)	(mg/l)	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	-
13.	Total Alkalinity (as $CaCO_3$)	(mg/l)	213.06	172.86	434.16	40.2	397.98	36.18	-
14.	Sulphate (as SO_4)	(mg/l)	160.78	52.14	243.35	30.21	106.98	28.35	-
15.	Fluoride (F)	(mg/l)	0.42	0.31	0.49	0.19	0.32	0.46	1.5
16.	Sodium (as Na)	(mg/l)	54.4	38.5	68	18.6	60.2	16	-
17.	Potassium (as K)	(mg/l)	2.6	1.9	26.9	1.5	286.2	3.2	-
18.	Iron Dissolved (as Fe)	(mg/l)	0.2	<0.01	0.1	<0.01	<0.01	<0.01	-
19.	Manganese (as Mn)	(mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.4
20.	Total Chromium (as Cr)	(mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.006
21.	Lead (as Pb)	(mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
22.	Mercury (as Hg)	(mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01
23.	Arsenic (as As)	(mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
24.	Cadmium (as Cd)	(mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003

Groundwater Quality: Analytical Results

The quality of the groundwater in the sampled locations is delineated below:

- The pH of groundwater samples varied from 6.36 to 7.41 with a slightly acidic nature at location GW6. The groundwater with low pH may contain the elevated levels of toxic metals and cause aesthetic problems like premature damage to metal pipings, sour taste and staining of laundry.
- The Total Dissolved Solids (TDS) varied from 84 to 872 mg/l while electrical conductivity varied from 133 to 1384µS/cm being maximum at GW3 (Ye Twin Hla village), which is quite high if considered for the drinking purposes. Lowest TDS recorded at GW6, which is a natural spring water flowing to surface from a clean ground water source.
- Total Hardness varied from 24 to 688 mg/l with maximum value recorded at village Ye Twin Hla, which is quite high when considered for drinking purposes while calcium at different monitored locations ranged between 16 and 386 mg/l and magnesium from 8 to 302 mg/l. Thus, the hardness values recorded were found to be in correlation with the calcium and magnesium ions analysed at the respective locations.

- Iron content varied from 0.1 to 0.2 mg/l with maximum value recorded at village Thea Kawand hence, it should not have an unpleasant odor, taste or appearance and will not require treatment. Fluoride contents in the ground water samples were found to be in accordance with the standard limits for drinking water of World Health Organization (WHO).
- The presence of heavy metals like mercury, lead, arsenic, chromium and cadmium in the groundwater samples were found to be below the detectable limit.

From the above analysis results, it can be summed up that all the parameters of the groundwater samples fairly meet the standard limits for drinking water as per World Health Organization (WHO). Moreover, the groundwater quality results do not indicate any industrial pollution.

5.4.8 Biological Environment

Terrestrial Ecology

5.4.9 *Flora*

The study area consists of agricultural land (i.e. paddy fields and crops) and open barren land with some trees resistant to drought. During the field visits, deciduous trees and green bushes were observed. Major agricultural practice carried out in the study area is paddy cultivation. List of important common plant species in and around the Block area are given in **Table 5.18** and common medicinal plants species are tabulated in **Table 5.19.**

Table 5.18: List of Common Plant Species

Sl. No.	Scientific Name	Common English Name in Myanmar
Tree		
1	*Azadirachta sp.*	Margosa, Neem
2	*Eucalyptus microtheca*	Eucalyptus
3	*Mangifera sp.*	Mango
4	*Ficusbengalensis*	Banyan Tree
5	*Aegle marmelos*	-
6	*Artocarpusheterophyllus*	Jackfruit
7	*Ficusreligiosa*	Peepal
8	*Tectonagrandis*	Teak
9	*Anogeissuslatifolia*	Axle Wood Tree
10	*Delonixregia*	Flame Tree, Royal Poinciana
11	*Haldinacordifolia*	Haldu
12	*Psidium guajava*	Guava
13	*Pongamiapinnata*	Pongam Tree
14	*Madhucalatifolia*	-
15	*Ziziphusmauritiana*	Zee-pen, Zizidaw, Desert Apple
16	*Terminalia arjuna*	White Marudah
17	*Tamarindus sp.*	Tamarind
18	*Syzygiumcumini*	Java Plum
19	*Moringa oleifera*	Drumstick Tree
20	*Borassusflabellifer*	Palm Tree
21	*Pyllanthusemblica*	Emblic, Malacca Tree
22	*Callistemon viminalis*	Bottle Brush
23	*Thevetia peruviana*	Bastard Oleander, Be-still Tree
24	*Drypetesroxburghii*	Luck Bean Tree, Wild Olive
25	*Polyalthialongifolia*	Mast Tree, Cemetery Tree, Ashok Tree
26	*Acacia auriculiformis*	Earpod Wattle
27	*Mimusopselengi*	Bulletwood, Spanish Cherry
28	*Cassia roxburghii*	Red Cassia, Ceylon Senna
29	*Ailanthus excelsa*	Tree of heaven

Sl. No.	Scientific Name	Common English Name in Myanmar
30	*Senna siamea*	Ironwood Tree
31	*Cassia fistula*	Golden Shower
32	*Albizialebbeck*	Koko, Frywood, East Indian Walnut
33	*Prosopis glandulosa*	Mesquite, Algarrobe
34	*Carica papaya*	Paw-paw, Tree Melon
Shrub		
1	*Bambusabambos*	Bamboo
2	*Vitex negundo*	Chaste
3	*Calotropisprocera*	Rubber Bush
4	*Datura innoxia*	Dhatura, Horn of Plenty; Downy Thorn Apple
5	*Tabernaemontanadivaricata*	Pinwheel Flower
6	*Mimosa pudica*	Touch-me-not Plant
7	*Hibiscus rosa-sinensis*	China Rose
8	*Ficuspalmata*	
9	*Musa sapientum*	Banana
10	*Citrus limon*	Lemon
11	*Annona squamosa*	Custard Apple
12	*Murrayapaniculata*	Orange Jassamine, Mock Orange, Satinwoodm
13	*Plumeria obtusa*	White Frangipani, Temple tree
14	*Alstoniascholaris*	White Cheese Wood Tree, Blackboard Tree
Herbs		
1	*Lantana camara*	Lantana
2	*Ocimum sp.*	Holy Basil
3	*Cuscutareflexa*	Giant Dodder
4	*Clitoreaternatea*	Butterfly Pea, Blue Pea
5	*Catharanthus Roseus*	Rosy Periwinkle
6	*Vitex negundo*	Chaste Tree
7	*Acacia sp.*	Cactus
8	*Bacopa monnieri (Brahmi sp)*	Brahmi
9	*Parthenium sp.*	Parthenium
10	*Centellaasiatic*	Centella
11	*Canna xgeneralis*	Laphoorit
12	*Mirabilis jalapa*	Beauty-of –the- night
13	*Cyperusalternifolius*	Dwarf Papyrus Grass, Umbrella Sedge
14	*Gladiolus xhortulanus*	Natal Lily
15	*Sansevieriatrifasciata*	Snake Plant
16	*Kalanchoe gastonisbonnieri*	Palm Beachbells
17	*Bougainvillea sp*	Bougainvillea, Paper Flower
18	*Jasminum L. spp.*	Jasmine
19	*Quisqualis sp.*	Burma Creeper
20	*Asparagus officinalis*	Garden Asparagus

Table: 5.19 List of Medicinal Plant Species

S.No.	Scientific Name	Local Burmese Name
1	*AndrographispaniculataNees*	Say khar
2	*Cinnamomumtamala*	Kohe Woo Leave
3	*Acacia concinna DC*	Kin Mungyin
4	*Jatropha podagrica HK*	Tha Pin Shwe

S.No.	Scientific Name	Local Burmese Name
		Htae Rabin Shwet Lee
5	*Tinosporacordifolia*	Sin Tone Manwe
6	*AspragusAcerosusRexb*	Shint Matet
7	*Viola odorata*	Swng May Kher Minkoeher Saymyinkhwar Min Kokar Taw MyinKhwar
8	*Nelumbo nucifera gaertn*	Badonmakyar
9	*Eclipta Alba hassk*	KyeikHman
10	*Ipomoea AquaticaForsk*	Kanyut
11	*Alysicarpus vaginalis*	Semmaneing Kyauk Maneing
12	*Mimosa Pudica*	Tibe Gayone
13	*Heliotropiumindicumlinn*	Sin Hnamaung
14	*Polygonum Tomentosum Wild*	Ma-ha -ga -Kyansit
15	*Piper Longum Linn*	Peik Chin
16	*AmaramthusBlitusDinn*	Hinnu New
17	*DesmotiumTriquetrun DC*	Lautaray Luxiy Lacigetaya
18	*CatharanthusRoseusG.don*	Thin-baw-ma-hnyo
19	*Albizzia Lebbeck*	Koktcoyouh
20	*Lagerstroemia Speciosa (L) Pers*	Pyinma
21	*JussiaeaSuffruticosa Linn*	Taw Lay Nyin
22	*ArtabotrysOdoratissimus*	Tawuyihuay Tassmyinbay
23	*CinnamomumObtusifoliumNees*	NaninGya
24	*Alstoniascholaris*	Taunmayoe Kaungmayoo
25	*Cassia Elongata*	Pwe Kind
26	*GlyeyrihifGlabra*	Nwocho Nwechu
27	*DregeaVolubilisBenth*	Gwaydauk
28	*Azadirachta Indica a. juss*	Tamar
29	*Croton oblongifolius*	Thayingyi
30	*Nyctanthes arbor-tristislinn*	SeikPhalu
31	*Not Available*	TwarPhore Say leave TwerPhomp Say Ymer
32	*Not Available*	Gone Kher
33	*Not Available*	Simee Dauk
34	*Not Available*	Min Lay Par
35	*Not Available*	Taunghtan
36	*Not Available*	Saypalaung pin
37	*Not Available*	Nargiainpat
38	*Not Available*	Patainmanaing
39	*Not Available*	Garmany leave

(Source: observations of site visit and secondary data analsysis.)

Photo Plates 5.16 to **5.19** show local vegetation in the study area.

Photo Plate 5.16: Banana and Coconut Tree in Yae Twin Hla Village

Photo Plate 5.17: Vegetables (pumpkin) Grown in Villages

Photo Plate 5.18: Corn Cultivation within Study Area

Photo Plate 5.19: Teak Plantation within Study Area

Fauna

Assessment of animal species has been done on basis of secondary information collected from different government offices, forest officials of the area and through visual observations during the field surveys. Naturally occurring animal species include animals like Jackals, Foxes, Bats, Squirrels, Hares, Rabbits, mice etc. Common avifauna includes Egrets, House Sparrows, Cuckoos and Pigeon. The list of faunal species found in the study area is given in **Table 5.20.**

Table 5.20: List of Common Naturally Occurring Animals and Birds

Sl. No.	Scientific Name	Common Name
Mammals		
1.	*Presbytis sp.*	Langur
2.	*Canis aureus*	Jackal
3.	*Felis sp.*	Cat
4.	*Lepus sp.*	Hare
5.	*Oryctolagus sp.*	Rabbit
6.	*Apodemussylvaticus*	Common Field Mouse
7.	*Rattus rattus*	House Rat
Reptiles		

Sl. No.	Scientific Name	Common Name
1.	*Calotes versicolor*	Garden Lizard
2.	*Najanaja*	Cobra
Avifauna		
1.	*Acridotherestristis*	Myna
2.	*Columba livia*	Pigeon
3.	*Passer domesticus*	House Sparrow
4.	*Ardea alba*	Egrets
5.	*Cuculusmicropterus*	Cuckoo
6.	*Corvus sp.*	Crow
7.	*Hypsipetes sp.*	Bulbul
8.	*Gracupica contra*	Asian Pied Starling
9.	*Oriolusxanthornus*	Black-hooded Oriole
10.	*Dendrocoposatratus*	Stripe-breasted Woodpecker
11.	*Turdoidesstriata*	Jungle Babbler
12.	*Eudynamysscolopaceus*	Asian Koel
13.	*Pycnonotuscafer*	Red-vented Bulbul
14.	*Bubulcus sp.*	Cattle Egret

Eco Sensitive Area

No ecologically were found sensitive zones in the study area.

Aquatic Ecology

Fisheries

Fish is the most important source of food for the local people, which serves as a source of protein for the villagers. Fish is certainly recognised as second only to rice in the diet of villages within the study area. It was also observed and verified from locals and Department of Fisheries, Pyay that most of the fishing is carried out for self-consumption and extra catch is sold off in the market. The most common species available along the stretch of Ayeyarwady River near the EP-4 Block are Hilsa, Carps and Catfish. **Photo Plate 5.20 below** shows fish species observed in the local fish market in Pyay while the list of freshwater fish species found at Pyay district is given in **Table 5.21.**

Photo Plate 5.20: Common Fish Species Found in Local Fish Market at Pyay

Table 5.21: List of Freshwater Fish Species Found at Pyay District, Bago Region

S.No.	Common Name	Scientific Name
1.	Striped Snakehead	ChannaStriatus
2.	Comon Catfish	ClariasBatrachus
3.	Scorpion Catfish	HeteropneustesFossilis
4.	Sheat Fish	Ompok Bimaculatus
5.	Climbing Perch	Anabus Testudineus
6.	Catla	CatlaCatla
7.	Pool Barb	Puntius Sophore
8.	River Catfish	MytusBlythii
9.	Catio	Osteobrama Cotio Cotio
10.	MolaCarplet	AMblypharyngodonmola
11.	Dwarf Snakehead	Channa Gachua
12.	Spotted Snakehead	Channa Punctata
13.	Gian Catfish	Pangisius Pangisius
14.	-	Silonia Silondia
15.	River Catfish	Aorichlthys Aor
16.	Freshwater Shark	Wallago Attu
17.	Feather Back	Notopterus Notopterus

Source: Department of Fisheries, Pyay.

Fish Food Organisms

The sampling of planktons and benthos helps in assessing the quality of waterbodies. These communities are sensitive to various physico-chemical characteristics of waterbodies such as alkalinity, conductivity, nutrients, BOD etc. and are considered the best indicators to assess the conditions of and changes in the freshwater environment. The sampling locations of planktons and benthos were carried out at Ayeyarwady River is given in **Table 5.22.**

Table 5.22: Sampling Locations of Planktons and Benthos

S.No.	Location	Latitude	Longitude
Plankton			
1.	Downstream of Ayeyarwady River (P 1).	18°41'46.16"N	95° 6'23.78"E
2.	Upstream of Ayeyarwady River (P2) (Near Sinte Village).	18°46'41.41"N	95°12'26.01"E
Benthos			
1.	Downstream of Ayeyarwady River (B1).	18°41'50.53"N	95° 6'20.56"E
2.	Upstream of Ayeyarwady River (B2).	18°46'42.17"N	95°12'20.01"E

There were no phytoplanktons, zooplanktons and benthos reported in the samples collected at these locations. Based on the secondary study, a list of these species found in the Ayeyarwady river is given in **Tables 5.23, 5.24 & 5.25.**

Phytoplanktons

The dominant genus of phytoplanktons are given below in **Table 5.23** (based on secondary research)**.**

Table 5.23: Phytoplankton Species at Ayeyarwady River

Phytoplankton	Phytoplankton Genera
Chlorophyta	*Dictyosphaerium sp.*
	Volvox sp.
	Ulothrix sp.
	Clamydomonas sp.
	Rhizosolenia sp.
Xanthophyta	*Botrydium sp.*
Diatoms (Bacillareophyceae)	*Tabellaria sp.*
	Synedra sp.
Spermatophyta	*Spirodela sp.*
Chrysophyta	*Schizomeris sp.*

Zooplanktons

The reported list of zooplankton species found in the waterbodies is given in **Table 5.24** (based on secondary review).

Table 5.24: Zooplankton Genera at Ayeyarwady River

Zooplankton	Zooplankton Genera
Coelenterates	*Hydra sp.*
	Anthopleura sp.
Rotifers	*Brachionus sp.*
	Philodina sp.
	Euchlanis sp.
	Proales sp.
	Ceratium sp.
	Peridinium sp.
Flagellates	*Dinomonas sp.*
Copepoda	*Diaptomus sp.*
Mysidacea	*Holmesimysia sp.*
Amoeba	*Naegleria sp.*
Cladocera	*Daphnia sp.*

Seven (07) different species of zooplanktons are observed. These were dominated by the Rotifers and followed by Coelenterates, Amoebas, Cladocera etc. as per the secondary research, The dominant genus of Rotifers are Brachionus *sp., Philodina sp.,Euchlanis sp.* etc.

Benthos

The dominant benthic organisms are given below in **Table 5.25** (based on secondary review).

Table 5.25: Benthic Organisms at Ayeyarwady River

Benthos	Benthic Genera
Macrobenthos	*Tonne sp.*
	Amussium sp.
Microbenthos	*Navicula sp.*
	Pleurosigma sp.
Polychaetos	*Nereis lamellose*
Cermaceans	
Decapods	
Amphipods	
Ostrecodes	
Bivalvos	

5.5 SOCIO-ECONOMIC ENVIRONMENT

There are 17 village tracts (village groups) in the Padaung Township. The information on the socio-economic status of the villages falling under the study area was collected through primary data collection (public consultations) and secondary data collection. Locations where stakeholder consultations were carried out, are shown in **Figure 5.19.**

Methodology

The key stakeholders of the proposed project were identified and accordingly the public consultations were carried out in the presence of officials from the Myanma Oil and Gas Enterprise (MOGE), Govt. of Myanmar, respective areas administrative officials and representatives of M/s Bashneft. Feedback from village heads, community representatives and other concerned departmental bodies were noted down.

Public Consultations

The public consultations were carried out to record the views of the village heads, community representatives and other concerned departmental bodies of the project area. The consultations were done in two phases:
i) First Phase - 7th November to 10th November 2017, and
ii) Second Phase- 2nd November to 5$_{th}$ November 2019

Photo plates 5.21 to 5.23 show the public consultations carried out in the study area on 7th November 2017.


Photo Plate 5.21: Public Consultation at Dan Tha Lun Village on 8th November 2017


Photo Plate 5.22: Public Consultation at Phayar Paw Village on 8th November 2017


Photo Plate 5.23: Public Consultation at Taung Bo Kwin Village on 8th November 2017

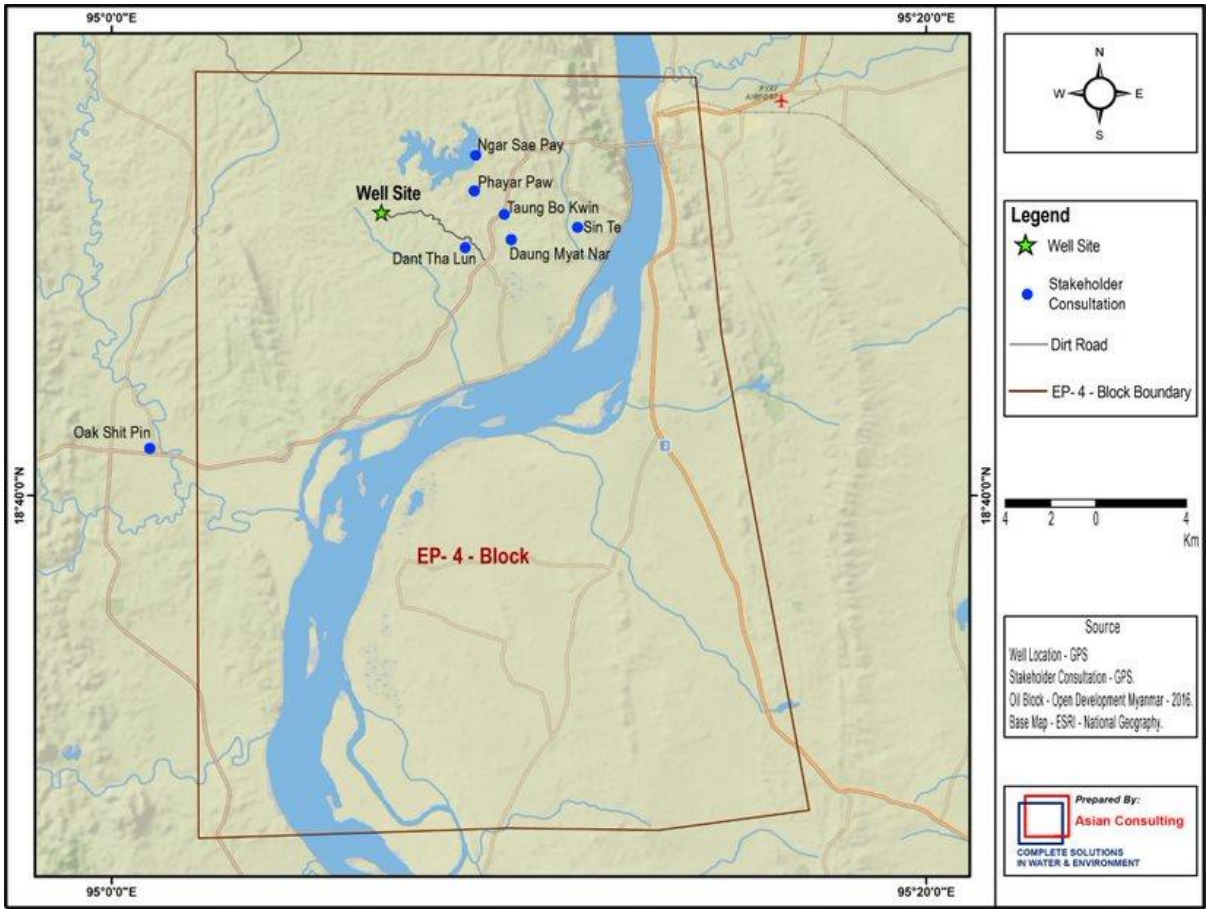


Figure 5.19: Locations of Stakeholder Consultations in the EP-4 Block

Secondary Data Collection

Meetings were conducted with various Government officials in Pyay and Padaung township areas to obtain the approval to conduct the field study, public consultations and to collect available secondary data for the study **(**as shown in **Photo Plates 5.24** to **5.26).** An opening meeting was held at the District Administrative Office, Padaung Township on 7th November 2017, (List of Officials attended the meeting is enclosed as **Annexure – III**) in the presence of departmental officials and village heads, to share the outlines of the monitoring programme and obtain necessary permission from the village administrative bodies for carrying out environmental monitoring and sampling.

Photo Plate 5.24: Meeting with the Officials at District Government Office, Padaung Township on 7th November 2017

Photo Plate 5.25: Consultation with Departmental Officials and Village Heads at Padaung Township Administrative Office on 7th November 2017

Photo Plate 5.26: Discussion with Officials of AOSL at Seismic Activity Camp Site on 7th November 2017

The list of villages for which the Corporate Social Responsibility (CSR) activities are planned is given in the **Table 5.26.**

Table 5.26: List of Villages

S. No	Village Name	S. No	Village Name
1	Nat Mauk	26	Ye Dwin Hla
2	Thigon	27	KineYwar
3	ShweNyiNaung	28	Byu Phet
4	Mewa Gone	29	Say Taw
5	Taung Bo Gyi	30	The Kaw
6	DaungMyat Na	31	ThaeGyi In
7	Taung Bo Gwin	32	NgarMyat Nar
8	Swedaw	33	Gway Gone
9	Talote Pin	34	Mya Sagaing Ywar
10	Laung Zilli	35	Nyaung Kone
11	Dantdaloon	36	Ye Win Lay
12	Kyi Pin	37	Ye Win Gyi
13	Nyaung Phyu	38	KoKo Gone
14	Kyi Inn	39	Ye Min Nauk
15	Yattha West	40	Byu Kone
16	Sinde (YwarThitKon)	41	Myaung Shay
17	Nga Se Pay	42	Nyaung Pin Kone
18	Yattha East	43	Kyauk Sarit Kone
19	Thayat Lane	44	Ngar Sal Pay
20	Kayin Su	45	Oak Pho
21	Kya Khat	46	PhayYwarGyi
22	Winloo + Minyart	47	SannPauk Chaung
23	Si Thar	48	Tamar Kone
24	Myan Gone	49	Inn Wun
25	YwarThit Kone	50	Thayet Lain

Note: *The above is the list of villages for which CSR activities will be planned. However, the number of villages may increase before commencement of the project.*

Methodology of Secondary Data Collection

Meetings were conducted with various Government officials in Pyay and Padaung Township areas to obtain their approval to conduct the field study, public consultations and to collect the available secondary data for the study **(**as shown in **Photo Plate 5.27** to **5.30).**

Photo Plate 5.27: Meeting with Officials at MoECAF, Padaung on 8th November 2017

Photo Plate 5.28: Meeting with Officials at Meteorological Department, Pyay on 9th November 2017

Photo Plate 5.29: Visiting the Fisheries Department at Pyay on 9th November 2017

Photo Plate 5.30: Meeting at the Agriculture Department

As stated above, the second phase public consultations were conducted from 2nd November to 11th November 2019. The list of villages consulted is given in **Table 5.27**. **Figure 5.20** shows the map of the villages consulted.

Table 5.27 List of Villages Consulted

Sl. No.	Name of the Village	Total Area (in acres)	Population		No. of Households
			Male	Female	
1.	Duang Myat Nar	25	249	266	138
2.	Myaung Shea	7	80	70	50
3.	Swe Daw	24	135	132	69
4.	Nga se Pay	28	170	197	89
5.	Nyaung Phyu	20	146	178	71
6.	Dant Da lun	20	98	145	57

The public consultation pictures are shown in **Photo Plate 5.31 to 5.36.**

Photo Plate 5.31 Public Consultation at Daung Myat Nat Village Tract

Photo Plate 5.32 Public Consultation at Myaung Shea Village

Photo Plate 5.33 Public Consultation at Swe Daw Village

Photo Plate 5.34 Public Consultation at Pay Yar Paw- Nga se Pay

Photo Plate 5.35 Public Consultation at Nyaung Phyu Village

Photo Plate 5.36 Public Consultation at Dant Da lun Village

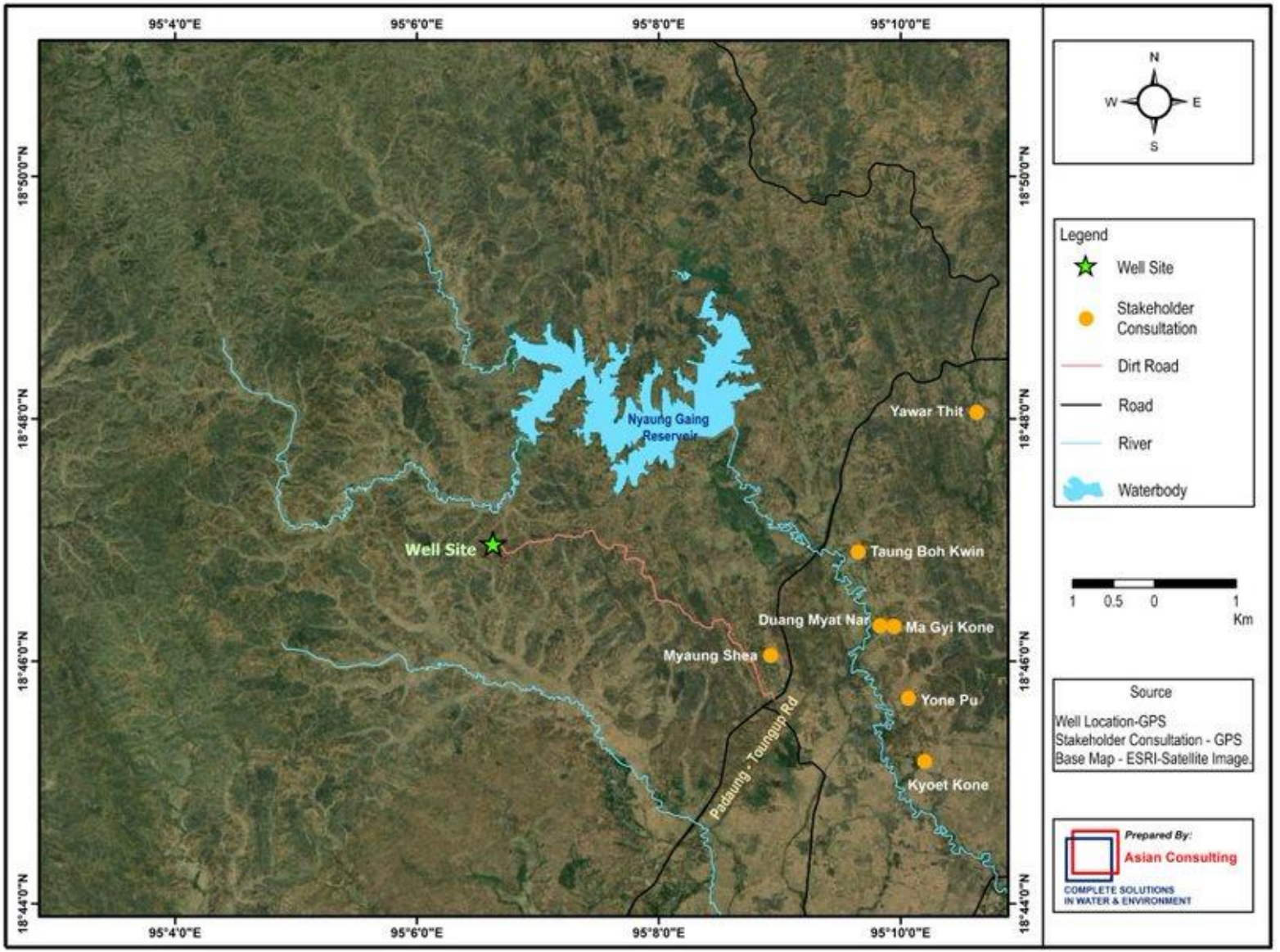


Figure 5.20: Locations of Stakeholder Consultation in the EP-4 Block

Feedback, Suggestions and Recommendations Received from Villagers for the Proposed Project

i. People did not see any social problem arising from this project.
ii. Villagers were of the view that the drilling activities should not pollute the air quality and damage the environment and to ensure this, appropriate prevention methods need to be followed.
iii. Villagers opined that vehicles used for the project purposes must travel at a safe distance without disturbing and harming the animals in the village.
iv. They requested that the current roads need to be upgraded, especially at two locations i.e. i) Myaung Shea, ii) Ywar Thit.
v. They also requested to upgrade the playground which is in front of the primary school.

5.5.1 Demography

The proposed drilling site is located near Padaung Township of Pyay district. The total population of this township is 147,123 as on April 2017. The list of village tracts, villages and the respective population of these areas and/Padaung Township is given in **Table 5.28.** The total number of households in the Padaung area is 37,298 as on April 2017.

Table 5.28: List of Village Tracts and Villages in the Study Area (Padaung Township)

Sl. No.	Name of the Village Tract	Name of the Village	No. of Persons
1.	Dant Da Lun	KyaukHpyar Kone	220
2.		NyaungHpyu	761
3.		Kyar Inn	835
	Sub-total		**1,816**
4.	Daung Ma Nar	YwarThit	157
5.		Daung Ma Nar	445
6.		Kyoet Kone	260
7.		Yone Pu	235
8.		MyaungShey	276
9.		Ma Gyi Kone	211
	Sub-total		**1,584**
10.	Nat Mauk	Yae Win	609
11.		Nyaung Kone	234
12.		Thee Kone	478
13.		Nat Mauk	331
14.		ShweTaung Kone	132
15.		Thar Yar Kone	175
16.		Nyaung Pin Kone	176
17.		ShweKyaung Kone	185
18.		KokeKo Kone	365
	Sub-total		**2,685**
19.	Ngar Se Pay	Kyaung Kone	**77**
20.	Shwe Nyi Naung	ShweNyiNaung	288
21.		Yae Ma Nauk	277
22.		Byu Kone	242
	Sub-Total		**807**
23.	Sin Te	Inn Wun	227
24.		YwarThit Kone	436
	Sub-Total		**663**

Sl. No.	Name of the Village Tract	Name of the Village	No. of Persons
25.	Swei Taw	Nyaung Pin Kone	534
26.		Swei Taw	1255
27.		Kyauk Sa Yit Kone	224
	Sub-total		**2,013**
28.	Ta Loke Pin	Yae Twin Hla	**430**
29.	TaungBoetGyi	Myay War Kone	**781**
30.	TaungBway	Thea Kaw	317
31.		Laung Sa Li	519
	Sub-total		**836**
32.	Tha Yet Lein	Ka Thea Kone	**315**

Source: Data obtained from the Administrative Office, Padaung

5.5.2 Religion and Culture

Around 80% of the people in Myanmar practise Theravada Buddhism. The remaining people follow Christianity, Islam, Hinduism and Animism. In line with the same, this area is mainly dominated by Buddhists with the main of ethnic groups from Bamar. Christianity was also reported to be practised in the study area.

Myanmar language (Burmese) is the widely spoken language in the study area. In Padaung Township area, Chin language is also spoken.

The most important architectural feature in Myanmar is the Buddhist temples known as Pagodas. These Pagodas serve as a religious school, a community center, a guest house, a place where the government and other agencies post information, a site for sports activities, a centre for welfare services for those who are poor and ill, a morgue, and a center for music and dance. Renting of land or homes and provision of loans are the economic services provided to the local people by these Pagodas.

In the study area, the houses are made of bamboo and are about a meter above the ground (**Photo Plate 5.37)**. Walls are made of flattened pieces of bamboo and the roof is made of thatch, which is made from broad leafed grass or palm fronds. The most prevalent structure of family type was the extended family observedduring the site visits.

Photo Plate 5.37: Wooden Houses in the Study Area

Rice is the staple food, which is usually consumed after dawn (breakfast) and before dusk (dinner). Tea is the most consumed beverage in the region, even the dried tea leaves are taken as a snack. Betel chewing and smoking are also common among the local people. The advent

of Burmese New Year is marked with Thingya Water Festival, which is celebrated in mid-April. Another important festival is the Kason in May, which is the celebration of enlightenment of Buddha.

5.5.3 Education

The literacy rate of the Bago region is reported to be 94.7% (Myanmar Population and Housing Census - The Union Report, May 2014). **Photo Plate 5.38** shows a typical village school inside the study area.

Photo Plate 5.38: Typical Junior School in Yae Win Village

There are no colleges in the study area. The nearest institutions for higher education are the Pyay University (PU), Pyay Technological University (PTU) and Government Computer University (GCU), which are located at about 08 km from the North-east end of the EP-4 Block, in Pyay town.

Education Facilities in Consulted Villages

Almost all the consulted villages in the study area had schools. As mentioned above, the nearest university is the Pyay University.

5.5.4 Occupation and Income

The major economic activity of the study area is cultivation. Major crop is paddy and its cultivation mainly takes place during monsoon season (June to December). Seasonal vegetables and fruits are also grown in the cultivated land but mainly forthe self-consumption and its surplus produce is sold in the local market for the consumption of local people only. Villagers also keep domestic animals such as cow, pig, hen, duck for their own consumption. No industrial activity was observed in the study area. Cultivation of corn and vegetables was observed at some places. Grocery shops, blacksmith, carpentry, barber, masonry work, fishing and shopkeeping are the alternative sources of income among the villagers.

A The details about each of the occupation practised in the study area are presented in the following sub-sections.

In general, the unemployment rate of Bago region is 5.1% (for age group 15 to 64 years). Specific information regarding unemployment rate in the Padaung area was not available.

5.5.4.1 Agriculture

Almost all the households are dependent on the agriculture for their income in the study area. Paddy cultivation is the predominant agricultural practice here. The total cultivable area in Padaung Township is 89,098 acres. Area under paddy cultivation amounts to 47,087 acres.

(a) Cultivation Period

In the Padaung region, mostly single season (monsoon) cultivation of rice is practised. The rice cultivation period is from June to December. Below is the view of paddy, bean and gram cultivation in study area as shown in **Photo Plates 5.39 & 5.40.**

Photo Plate 5.39: Bean and Gram Cultivation

Photo Plate 5.40: Paddy Cultivation on the ay to Ye Twin Hla Village

(b) Production Area

The land usage in Padaung Township area is given in **Table 5.29.**

Table 5.29: Area under Cultivation in Padaung Township Area (2009 – 2010)

Sl. No.	Type of Area	Area in Acre
Area Under Cultivation		

Sl. No.	Type of Area	Area in Acre
1.	Total Agricultural Area	89,098
2.	Paddy Field	47,087
3.	Dry Field	28,036
4.	Reserved Forest	315,024
5.	Culturable Waste	37,892
6.	Pastureland	21

(Source: Data Collected from the Department of Agriculture, Padaung)

(c) Production Capacity

The crop production information of Padaung Township areas are given in **Table 5.30**.

Table 5.30: Crop Production in Padaung Township Area

Sl. No.	Type of Crop	Production in Tin/ Acre					
		2011	2012	2013	2014	2015	2016-17
1.	Paddy	63.01	63.03	63.05	63.07	63.08	75.87
Beans							
2.	Rel Zin Ngon	15.40	15.45	15.48	15.50	15.55	
3.	PelTe Sane	16.63	16.65	16.70	16.73	16.75	
Oil Seed							
4.	Groundnut	68.43	68.45	68.48	68.50	68.54	64.88
5.	Sesame	10.42	10.44	10.47	10.50	10.55	11.26

(Source: Data obtained from the Administrative Office, Padaung)
Note: 1 Tin = 26.127 kg.

5.5.4.2 Fishing

Fishing is a predominant activity in those villages that are located near the water resources mainly near the Ayeyarwady River. Fishes are caught by the villagers mostly for self-consumption. If any extra fishes are left, these are sold off. Households, which are involved in the fishing, are also reported to be involved in agriculture. Hence, fishing is not a sole occupation of the people in the proposed area.

As per the information provided by the Deputy Director, Department of Fisheries, major commercial fish found in Ayeyarwady River is Hilsa, locally known as Pyay species. It migrates from sea to the river for breeding in the monsoon months from June to August. After being hatched, the juveniles swim back to the Bay of Bengal. **Photo Plate 5.41** shows fishes found in the local fish market at Pyay.

Ayeyarwady/Chindwin has a total of 227 species of fish with endangered species and 21 vulnerable species whose probable distribution is projected in 481 sub-basins (Hydro Basins level 8) out of 526 sub-basins. There are 19 near-threatened species, 125 least-concern species and 58 data-deficient species. The list of threatened fish species in the Ayeyarwady River Basin is shown in **Table 5.31.**

Photo Plate 5.41: Fishes in Local Market at Pyay

Table 5.31: Threatened Fish Species in the Ayeyarwady River Basin

S. No	Species	Group	Family	Red List Status	No. of Sub-basins Reported
1	*Badis tuivaiei*	Peciformes	Badidae	EN	1
2	*Psilorhynchus microphthalmus*	Cyprniformes	Psilorhynchidae	EN	11
3	*Schistura minutus*	Cyprniformes	Balitoridae	EN	5
4	*Schistura reticulata*	Cyprniformes	Cyprinidae	EN	14
5	*Barilius chatricensis*	Cyprniformes	Cyprinidae	VU	5
6	*Barilius dogarsinghi*	Cyprniformes	Cyprinidae	VU	2
7	*Barilius ngawa*	Cyprniformes	Cyprinidae	VU	5
8	*Danio jaintianensis*	Cyprniformes	Cyprinidae	VU	7
9	*Devario acuticephala*	Cyprniformes	Cyprinidae	VU	1

S. No	Species	Group	Family	Red List Status	No. of Sub-basins Reported
10	*Devario browni*	Cyprniformes	Cyprinidae	VU	26
11	*Devario naganensis*	Cyprniformes	Cyprinidae	VU	31
12	*Devario yuensis*	Cyprniformes	Cyprinidae	VU	13
13	*Garra bispinosa*	Cyprniformes	Cyprinidae	VU	5
14	*Garra compressa*	Cyprniformes	Cyprinidae	VU	5
15	*Garra flavatra*	Cyprniformes	Cyprinidae	VU	7
16	*Garra manipurensis*	Cyprniformes	Cyprinidae	VU	7
17	*Garra nambulica*	Cyprniformes	Cyprinidae	VU	5
18	*Garra paralissorhynchus*	Cyprniformes	Cyprinidae	VU	5
19	*Laubuca khujairokensis*	Cyprniformes	Cyprinidae	VU	1
20	*Pseudecheneis ukhrulensis*	Siluriformes	Sisoridae	VU	11
21	*Rasbora ornata*	Cyprniformes	Balitoridae	VU	16
22	*Schistura khugae*	Cyprniformes	Balitoridae	VU	1
23	*Schistura nagaensis*	Cyprniformes	Balitoridae	VU	11
24	*Schistura prashadi*	Cyprniformes	Balitoridae	VU	5
25	*Yunnanilus brevis*	Cyprniformes	Balitoridae	VU	14

(Source: Data obtained from the Administrative Office, Padaung)

5.5.4.3 Others

The other sources of income reported during the consultations are grocery shops, automobile services/ rental centres, rice mills, carpentry, blacksmith and masonry.
Photo Plate 5.42 shows the grocery shops at Pyay.

Photo Plate 5.42: Grocery Shops at Pyay

5.5.5 Infrastructural Facilities

5.5.5.1 Transportation Network

River

The River Ayeyarwady is the main mode of transportation in the EP-4 Block. All necessary and bulky cargos are being transported through this river only. **Photo Plate 5.43 s**hows the transportation in the Ayeyarwady River through boats. Villages near the riverbanks were noted to use boats for transportation.

Photo Plate 5.43: Boats Used in villages as a Means of River Transportation

Roads

Most of the roads in the study area are unpaved, single track and dusty **(Photo Plates 5.44** to **Photo Plate 5.47)**.

Photo Plate 5.44: Unpaved Road at Dan ThaLun Village

Photo Plate 5.45: Concrete Road at Myaung Shea Village

Photo Plate 5.46: Unpaved Road at Phayar Paw Village

Photo Plate 5.47: Unpaved Road on the way to Swe Taw Village

5.5.5.2 Communications

The only mode of communication in the study area is mobile phones. There are two major telecom operators, namely Telenor and Myanmar Post and Telecommunication (MPT).

5.5.5.3 Drinking Water Availability

Almost 81% of the people residing in the Bago region have access to the drinking water, which is higher than the national average of 69% (The State of Local Governance: Trends in Bago, UNDP Myanmar, 2014). In line with the same, almost all the villages in the proposed study area have access to drinking water.

Ground water is the major source of potable water in the study area. The well depths reported during the consultations and baseline monitoring in the proposed study area are given in **Table 5.32**.

Table 5.32: Depth of Wells in the Study Area

Sl. No.	Name of the Village	Depth of Wells (in feet)
1.	Thea Kaw	47
2.	Laung Sa Li	40

(Source: Data collected during baseline monitoring)

5.5.5.4 Sanitation Facilities

In general, the overall sanitation facility availability in Bago region (77%) is slightly lesser than that of the national average (79%) (The State of Local Governance: Trends in Bago, UNDP Myanmar, 2014). In contrast to that, sanitation facility (toilet) is available in all the villages in the proposed study area. The sewage systems from the toilets are mostly connected to the soak pit/septic tanks. Sanitation facilities in the study area are shown in **Photo Plate 5.48 & 5.49**.

Photo Plate 5.48: Sanitation Facility at Myaung Shea

Photo Plate 5.49: Sanitation Facility in the Study Area

5.5.5.5 Solid Waste Management

There is no solid waste management facility or practice observed in the study area. The solid wastes are generally dumped in the open areas.

5.5.6 Health Care Facilities

There are four (04) health care centres/hospitals in Padaung Township for the local residents in proposed study area. In addition, there are five (05) clinics in township area. However, it was observed that no healthcare centre is present in the villages.

5.5.7 Electricity

Most of the villages in the study area were observed to have no 24x7 electricity connection. Solar lightnings were noted at a few villages though at some villages, car batteries were seen to be used as a temporary source of electricity. Village monasteries were seen to be using diesel generators for lightning. (**Photo Plates 5.50 & 5.51)**

Photo Plate 5.50: Solar Panels and Car Batteries Used as A Source of Electricity

Photo Plate 5.51: Diesel Generator Set at Monastery in Yae Win Village

5.6 CULTURAL STATEMENT

Cultural, Religious Buildings & Pagodas

Pagodas are spread all over the proposed study area. The major tourist destination near the study area is Shwe Bon Thar Muni Pagoda located at Padaung (as shown in **Photo Plates 5.52 and 5.55**).

Photo Plate 5.52: Monastry in Swe Daw

Photo Plate 5.53: Pay Yar Paw Monastry in Nga Se Pay

Photo Plate 5.54: Shwe Bon Thar Muni Pagoda in Padaung

Photo Plate 5.55: Shwesandaw Pagoda in Pyay

In the study area, there are small pagodas in and around some of the villages of the Block area. As mentioned earlier, the survey area is dotted with several pagodas and monasteries.

6

IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

6 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

6.1 INTRODUCTION

This chapter also presents the likely impacts identified and its appropriate mitigation measures based on:

- Project information provided by Bashneft (described in Chapter 4).
- Existing environmental condition of the study area (described in Chapter 5).
- ACE's past experience in similar projects; and
- Standard international environmental protection and management practices in Oil and Gas sector.

Actual and foreseeable events, including operational events and typical events, are discussed in this section. Processes that may create risks to the natural environment are considered first and are analyzed in terms of key potential environmental impacts. Mitigation measures and management techniques, which will minimize the identified impacts, are also proposed.

The impact analysis performed is intended to cover only the activities relating to exploratory drilling and associated activities. Bashneft's primary purpose and need for the proposed prospecting and appraisal well drilling is to determine the presence of hydrocarbon reservoir and quantity of such reserves in addition to, establish its economic feasibility.

The anticipated qualitative potential impacts related to the proposed project activities and its consequential effects on the surrounding environment based on the environmental sensitivities/ resources available in the study area, i.e. 5 km radial distance from the well site is provided in interactive matrices.

The activities involved in drilling operation are very important for the economy of Myanmar, as these will promote discovery of new oil and gas field in the country, which will substantially increase Oil and Gas Production and will provide additional revenues to Myanmar besides providing additional impetus to the local economy. But the different stages of drilling operations are associated with many risks which should be rectified parallelly along with drilling operation to avoid any discrepancy in the drilling operation.

The various risks associated at different stages of drilling operations along with its precautionary measures are explained below in further sections of the chapter.

6.2 METHODOLOGY OF IMPACT ASSESSMENT

The potential impacts anticipated during the Bashneft's proposed prospecting and appraisal well drilling in Block EP-4 will be identified by using Interaction Matrix. At this stage the interactions are not quantified, but only identified for further assessment. The principal impact assessment steps are summarized in **Figure 6.1** and comprise of:

- **Impact Prediction:** to determine what could potentially happen to resources/ environmental receptors because of the project activities.
- **Impact Evaluation:** to evaluate the significance of predicted impacts by considering their magnitude or likelihood of occurrence and the sensitivity, value and/or importance of the affected receptor/resource.
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

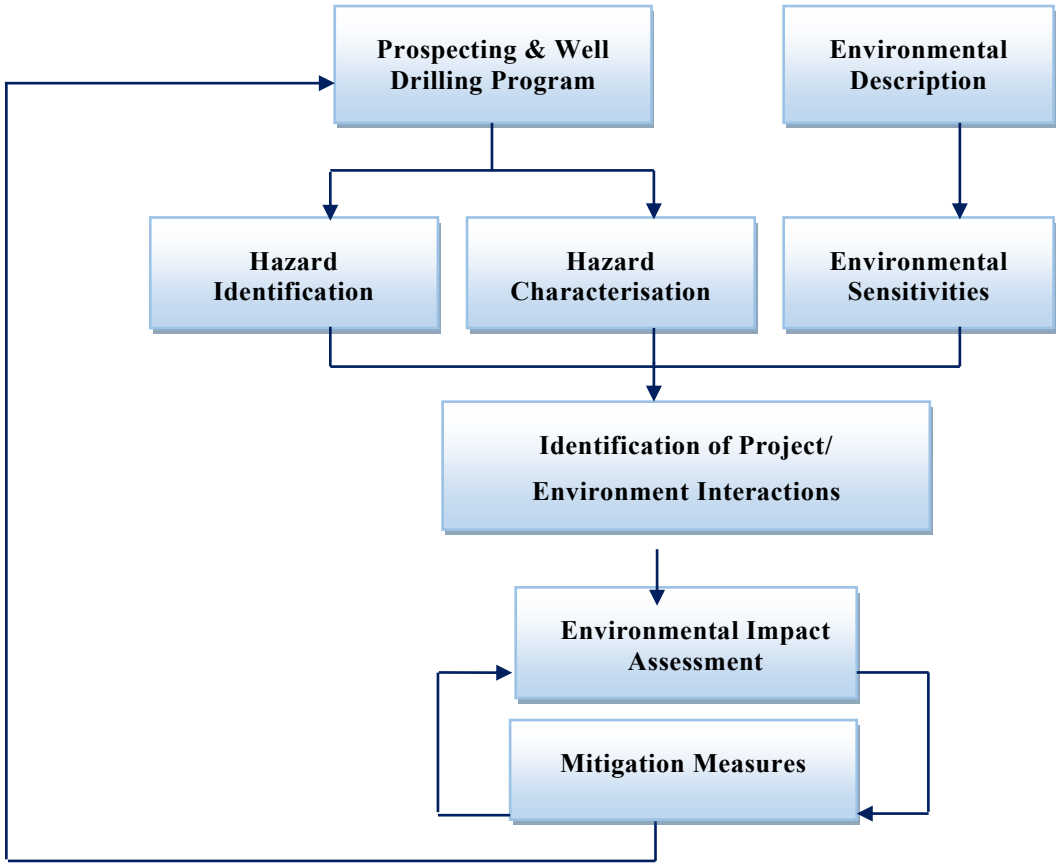


Figure 6.1: Methodology for Environmental Impact Assessment

6.2.1 Prediction of Impact: Prediction of impacts is an objective exercise to determine what could happen to the sensitive environmental receptor/component as a consequence of the project activities. From these potential interactions, the potential impacts to various environmental receptors are identified and elaborated, to the extent possible.

6.2.2 Impact Evaluation: Once the prediction of impacts is complete, each impact is described in terms of its relevant characteristics (such as type, scale, duration, extent, etc). The process for impact evaluation is shown in **Figure 6.2**.

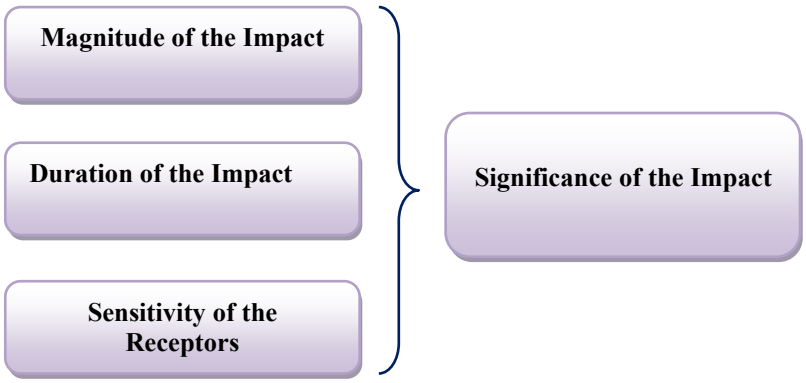


Figure 6.2: Process for Impact Evaluation

- ***Intensity:*** The impact intensity shows the relative significance of consequences attributable to the observed alteration of an environmental component. It compiles the social and ecosystem value of the component along with the anticipated disturbance degree of this component.
- ***Extent:*** The impact extent stands for the range or the spatial coverage of the effects generated by the intervention on the site. This concept refers either a distance or a surface over which the observed modifications felt by a component or else by the proportion of population being touched by these modifications.
- ***Duration:*** The impact duration indicates its time extent, defined as being the period of time during which the imposed modifications will be felt by a component.
- ***Sensitivity of the receptors:*** The impact sensitivity of receptors stands for the receptor's susceptibility towards the modified component.

Evaluation of impacts signifies the potential impact in terms of its likelihood nature as per the following criteria:

a. The impacts are further classified based on their spatial distribution, i.e. *local,* when impacting an area of approximately one km radius from the project area, *moderately spread,* when impacting an area of one to two km radial area and *regional,* when it is beyond two km;
b. The impacts are classified as *short term, moderate term* and *long term* with respect to their existence in temporal scale. Impacts less than one-year existence as *short term,* while those with one to three years as *moderate term* and more than three years as *long term*;
c. The negative impacts are termed as *adverse impacts* while positive impacts as *beneficial.*

The significance of environmental impacts of various involved activities is evaluated based on the criteria outlined in **Table 6.2**

Table 6.1: Impact Significance Criteria

Impact Significance	Criteria
Significantly Adverse	When the impact is of high intensity with high spread and longer duration or of high intensity with moderately spread and of medium duration.
Moderately Adverse	When the impact is of medium intensity with high spread and longer duration or of high intensity with low/ moderately spread and of low duration.
Slightly Adverse	When the impact is of low intensity but with moderately spread and for moderate duration or of moderate intensity with low spread and shorter duration.
Insignificantly Adverse	When the impact is of low intensity low spread and shorter duration.
Beneficial	When the impacts are positive.

6.2.3 Identification of Mitigation Measures: The assessment process is intended to identify impacts and benefits associated with the project activities and ways of dealing it during the planning and design stage of the Project. Planned mitigation measures will be described, and additional measures will be recommended that will be altogether incorporated to develop an Environmental Management Plan (EMP).

6.2.4 Residual Impact Evaluation: Once mitigation and enhancement measures are declared, the residual impact significance is identified, if any.

6.3 DRILLING OPERATIONS

6.3.1 Potential Impacts

The key potential environmental aspects associated with the drilling operation include the following:

- **Pre-Drilling Activities**
  - Site Selection and land acquisition.
  - Site Clearance and topsoil removal.
  - Well site and access road construction.
  - Transportation of materials, drilling rig and ancillaries.
  - Storage and handling of construction debris.
  - Operation of D.G. sets.
  - Workforce engagement and camp site.
  - Generation of wastes – solid wastes, wastewater and their disposal.
  - Surface run off.

- **Well Drilling and Testing**
  - Operation of D.G. sets and machinery.
  - Operation of drilling rig.
  - Storage and disposal of drill cuttings and mud.
  - Generation of process and domestic wastewater and discharge.

- Flaring.
- Blowouts.
- Spills – Chemical and/or Oil.

- **Rehabilitation and Site Restoration**
  - Dismantling of rig and associated facilities.
  - Transportation of drilling rig and ancillaries.
  - Removal of construction materials and disposal.

Based on the proposed project activities the impacts will be analyzed, the template of the activities and impact interaction matrix is given as **Table 6.2**:
Based upon the above interaction matrices following potential impacts will be identified after the planned drilling operation:

I. Physical Impact

- Air Quality,
- Noise,
- Local Drainage and Water Resources,
- Land use Pattern,
- Surface Water Quality,
- Groundwater Quality and,
- Soil and Sediment Quality.

II. Biological

- Vegetation/Agriculture,
- Terrestrial Wildlife/Livestock.

III. Socio-economic

- Occupational Exposure & General Safety,
- Community Health & Safety,
- Increased Traffic,
- Population Influx,
- Local Economy,
- Cultural Heritage and archaeological monuments and
- Aesthetic value.

Appropriate mitigation measures will be integrated even before the commencement of the project i.e., during design and planning phase, thereby, minimizing these anticipated adverse impacts. The potential impacts and its appropriate mitigation measures are discussed below.

Table 6.2: Activities – Impacts/Risks Interaction

Environmental and Social Components																					
Impacts/ Risks / Project Activities	Physical							Biological				Socio-economic									
	Air Quality	*Noise*	*Local Drainage and Water Resources*	*Surface Water Quality*	*Groundwater Quality*	*Soil & Sediment Quality*	*Land use Pattern*	*Vegetation/Agriculture*	*Terrestrial Wildlife/ Livestock*	*Threatened and Endangered Species*	*Aquatic Flora and Fauna*	*Occupational Health & Safety*	*Community Health & Safety*	*Cultural & Historical Resources*	*Loss of livelihood*	*Increased Traffic*	*Common Property Resources*	*Population Influx*	*Tourism/Leisure/Aesthetics*	*Local Economy*	*Displacement of local/tribal/ethnic group*
Prior to drilling operation																					
Site selection & land acquisition							■														
Site clearance & topsoil removal	■	■	■			■	■	■	■					■	■						■
Well site and access road construction	■	■	■									■	■			■		■	■	■	
Transportation of drilling rig & ancillaries	■	■										■	■			■					
Storage & handling of construction debris	■											■							■		
Operation of D.G. sets	■	■										■									
Workforce engagement and camp site													■					■		■	■
Generation of solid wastes and their disposal				■	■	■							■								
Wastewater from camps				■	■								■								
Surface run off from project site			■	■	■	■															
Well Drilling and Testing																					

Environmental and Social Components																					
Impacts/ Risks / Project Activities	Physical							Biological				Socio-economic									
	Air Quality	*Noise*	*Local Drainage and Water Resources*	*Surface Water Quality*	*Groundwater Quality*	*Soil & Sediment Quality*	*Land use Pattern*	*Vegetation/Agriculture*	*Terrestrial Wildlife/ Livestock*	*Threatened and Endangered Species*	*Aquatic Flora and Fauna*	*Occupational Health & Safety*	*Community Health & Safety*	*Cultural & Historical Resources*	*Loss of livelihood*	*Increased Traffic*	*Common Property Resources*	*Population Influx*	*Tourism/Leisure/Aesthetics*	*Local Economy*	*Displacement of local/tribal/ethnic group*
Operation of D.G. sets and machinery	▪	▪							▪			▪	▪						▪		
Operation of drilling rig		▪							▪	▪		▪							▪		
Storage and disposal of drill cuttings and mud				▪	▪	▪													▪		
Generation of process wastewater and discharges				▪	▪			▪			▪		▪								
Flaring	▪	▪								▪		▪	▪								
Blowouts	▪			▪	▪	▪		▪	▪	▪		▪	▪								▪
Spills – Chemicals and/or Oil				▪	▪	▪		▪	▪	▪	▪	▪	▪						▪	▪	▪
Rehabilitation and Site Restoration																					
Dismantling of rig and associated facilities	▪	▪										▪	▪						▪		
Transportation of drilling rig and ancillaries	▪	▪											▪			▪					
Removal of construction materials and disposal	▪	▪	▪																▪		

Note: ▪ *denotes likely impact*

6.4 POTENTIAL IMPACTS AND MITIGATION MEASURES

The probable impacts during various phases of the project life cycle on environmental and socio-economic components have been identified for both construction and operation phase. The potential impacts that could adversely affect the environment can be reduced by implementing the proposed mitigation measures for these project activities by selecting the most appropriate measure based on the reduction in significance achieved and sensibleness in implementation. These are discussed in further in details.

6.4.1 Air Environment

There are activities involved in the drilling operations which will have an adverse impact on the air quality. As well site is located far-off from settlement, the anticipated impact due to fugitive emission during construction and operation phase can be considerably reduced by implementing appropriate mitigation measures.

Impacts on Air Quality

Adverse impacts on air quality are mainly due to the emission from construction phase and operation phase. Fugitive emission from the construction phase includes initial site preparation, emissions from vehicles for transportation of construction materials and final restoration phase whereas, emission during operation phase are from diesel generator (DG) sets, vehicular emission and flaring. Since the proposed project will be carried out within a confined area for a short duration, adverse impacts can be minimized considerably by implementing appropriate mitigation measures. Following are the point source of air emissions which will affect air quality.

i. D.G. sets

These may remain in operation for almost 24 hours a day. Gases such as CO_2, NOx, suspended particles, water vapor etc., from D.G. sets may impact local air quality. The concentration of SO_2 emission will depend on the type of fuel. In the camp site, emission due to operation of generators may impact local ambient air quality.

ii. Vehicular Emission

Exhaust gases and dust generation due to movement of machineries and transportation of materials can also affect local air quality.

iii. Flaring

Flaring of gases during well testing will contribute to additional pollution due to incomplete combustion of hydrocarbons. However, flaring will be a temporary activity and therefore, there will not be significant impact on ambient air quality of the study area.

Mitigation Measures

- Low Sulphur content diesel must be used.
- Proper maintenance of equipment. Periodic washing of equipment and vehicles to avoid dust accumulation.
- Advanced Flare system will be selected to minimize emission.
- Water spraying will be carried out to minimize dust, whenever required.

- Engine and exhaust systems of all vehicles will be maintained.
- Providing adequate PPEs to the on-site workers, e.g. dust mask.
- Regular monitoring of SPM, RPM, NOx, CO, SOx emission to ensure compliance with applicable regulatory guidelines including those of the government of Myanmar.

6.4.2 Noise and Vibrations

Proposed drilling operations and related activities will lead to generation of noise during the construction and operational phase. The noise generated from drilling, rotating equipment pumping, diesel generator sets, flaring and transportation will have potential impact on surrounding communities.

Impacts on Noise Quality

i. ***Noise from Drilling Rigs***

Drilling of rigs and operation of D.G. sets on site may generate elevated noise levels. Drilling rig may generate noise in the range of 60 – 65 dB. However, as habitations are far (more than 500 m from well drilling site), it can be anticipated that it will not impact communities by large.

ii. Noise generated from Machinery

Noise may be generated from heavy machineries and traffic movement as well. The drilling platform can be also attributed to be a potential source of noise emission. The average noise levels in 1 km radius from the drilling site would be around 40 - 45 dB depending upon vegetation, air absorption and other environmental attenuation.

Mitigation Measures

The mitigation measures for above mentioned potential impacts are listed below:

- Regular maintenance of DG sets, construction & drilling equipment's and related machineries will be carried out.
- Operation of vehicles will be restricted in the nighttime.
- On-site workers will be provided with Personnel Protective Equipment's (PPE's) such as earmuffs/plugs.
- Selecting equipment with lower sound power levels will be encouraged. Proper maintenance of vehicles will be undertaken to reduce noise levels.
- Acoustic barriers will be provided wherever necessary.
- Noise monitoring programs should be designed and conducted by trained specialists.

6.4.3 Water Environment

There are number of activities within proposed project which has the potential to impact the surface and ground water source such as discharge from drill cuttings, drilling mud, accidental spillage of chemicals, oil & lubricants etc. The major River Ayeyarwady is located more than 5 km from the well site and did not fall within the study area. However, there are some small non-perennial streams and ponds within the study area. With the implementation of proper management practices, the anticipated impacts on water environment can be considerably minimized.

6.4.4 Impacts on surface water quality

Impact on surface water quality of natural drainage channels and community water usage may arise from discharge of contaminated surface run off, process water and sewage from camp site during various project activities.

- Increase of sediment load in surface run off due to removal of vegetation and loose topsoil. This may also increase soil erosion potential in project area.
- Contamination may be caused from surface run off due to generation of drill wastes, hazardous waste (used oil, waste oil, etc.) and chemical storage and may pollute nearby streams, ponds, etc.
- Storm water may get mixed with spilled oils or chemicals in absence of adequate drainage mechanism. This contaminated storm water upon mixing with nearby surface water bodies can pollute them.
- Domestic wastewater generated from camp site and effluents generated from drill site comprising of drain out from rig, equipment washing and other sources, if not treated and disposed adequately, may contaminate nearby water bodies, especially during heavy rainfall.

Mitigation Measures

Suitable mitigation measures for the anticipated potential impacts on water environment are presented as follows:

- Drill cuttings will be dried to maximum extent using suitable equipment and final disposal will be done after testing.
- Drill cutting wash water and wastewater from drilling operation shall be collected in a pit lined with HDPE sheets and will be disposed off only after appropriate treatment to ensure that they comply with the effluent discharge standards prescribed by regulatory bodies in Myanmar.
- Activities such as stripping, excavation, etc. will be restricted during monsoon season as far as possible.
- Domestic wastewater including grey water will be discharged into soak pit/septic tank provided at the site.
- Proper drainage and sediment control systems at the drill site will be designed.
- Proper bunds will be made around the drill site and near chemical storage areas so that contaminated run-off cannot escape into the storm-water drainage system.
- Hazardous wastes such as chemicals/system oil will be collected in a separate HDPE lined pit and later will be sold to authorized recycler.
- An environment-friendly Water-Based Mud (WBM) system will be used for drilling of the proposed wells in order to maintain hydrostatic pressure control in the well and to lubricate the drill bit. It may be noted that a typical WBM may contain nearly 80% water and 20% clay as well as chemicals by weight. This will have minimum impact on the water environment.

6.4.5 Impacts on Groundwater quality

The water requirement for drilling activities will be less and it is a temporary activity. The anticipated adverse impact on groundwater is considered to be insignificant. However, there is a possibility of contamination of subsurface water through infiltration from accidental spillage

of fuel, site drainage, chemical spill from storage areas and improper casing and cementing of well.

Mitigation Measures

- Best engineering techniques will be employed during cementing and installation of casing to protect groundwater and shallow aquifers from contamination.
- There shall be provision of on-site or off-site biological or physical treatment of drilling fluids to render the fluid and cuttings non-hazardous prior to final disposal, so that there is no contamination of groundwater resources.
- The drilling mud collection and recirculation pond will be lined with impervious layer in order to prevent the seepage of drilling chemicals and mud into aquifer.
- Appropriate spill control techniques will be employed to avoid any spillage within the project area and prevent infiltration.

6.4.6 Land Environment

The entire drilling operation requires site preparation and approach roads which will involve clearing of ground vegetation. Thus, there will be likely changes in the land use pattern during this entire drilling activity occur. However, there will be insignificant and temporary impacts. The land will be restored to its original condition if there is no indicative of economically feasible hydrocarbon.

Impacts on Land

- The land use of drill site will be affected due to the preparation of drilling site and associated drilling activities like installation of rigs and machineries, storage of oil and chemicals, domestic waste etc.
- During drilling activities, due to the movement of trucks with drilling rigs, laborer's and machineries, there may be alteration in the soil property. This can lead to land subsidence.
- Drill cuttings from drilling operations and sewage and domestic waste from camp site may contaminate land resources.
- Excavation and paving of site during construction phase will have negligible impact on land use.

Mitigation Measures

- The drill cuttings generated will be disposed-off in accordance with IFC EHS Onshore Oil and Gas Development Guidelines. In addition to that, domestic waste generated at drill site will segregated into biodegradable and non-biodegradable components. Bio-degradable wastes will be disposed-off into a pit, while non-biodegradable wastes will be sent to authorized recyclers for further safe disposal.
- Project operation and its related activities will be restricted within the drilling site including the storage of oil and chemicals.
- The existing roads can be strengthened and utilized so that land use change by road construction can be minimized. Movement of project related vehicles will be restricted during night-time to the maximum extent possible.
- Topsoil removed during the site clearance will be stored and used later for restoration purposes.
- Proper sanitation facilities and separate collection bins will be provided at the drilling locations for the collection of operation and domestic waste.

- The movement of trucks with drillings and machineries will be restricted to the paved areas only.
- Solid waste will be sent to authorized recyclers and sewage waste generated from the camp will be sent to soak pit/septic tank.
- Preparation of contingency plans for spillages, leakage of oil and chemical, etc.

6.4.7 Biological Environment

The impact due to drilling activities on biological environment is insignificant as the well site and its surrounding region is devoid of eco-sensitive and protected area. The drilling operations will incorporate adequate precaution to avoid any disturbance to natural habitats including cutting of trees. The northern part of north survey grid falls under Pangabin forest area which is sparsely vegetated forest. However, as already mentioned the study area does not involve eco-sensitive, protected or forest area.

Impacts on terrestrial flora and fauna

- Due to ground clearance, there may be loss of endemic and threatened plant species.
- The noise produced from the drilling and vehicular movement is likely to affect the terrestrial animals near the project site, steering them to move away from immediate project location.
- Generation of dust can impact growth of plants in the study area.
- Introduction of alien species may occur.
- There can be incidents of animal kill during increased traffic in drilling phase.
- The night lighting may attract some wildlife and birds which will have an impact on their behavior and physiology.
- Animals may fall into open unprotected pits used for storing drill waste or oil.
- There is a possibility for non-target killing of wildlife from effluent discharges, accidental spills, fire, explosion, etc.

Mitigation Measures

- Acoustic enclosure will be provided to D.G. set to reduce the noise intensity during the drilling activities. Moreover, drilling activities will be conducted for 3-4 months and this temporary impact will not cause permanent shifting of fauna.
- Vehicles and machinery that have been used in other areas outside the project site should be cleaned properly before commencement of work.
- Drilling activities will incorporate adequate precautions to avoid any disturbance to natural habitats including cutting of trees. If necessary, prior intimation to concerned authorities for their approval, advice and involvement would be undertaken.
- Any open drill pit will be fenced and protected to avoid wildlife falling and getting entrapped in them.
- Implementation of erosion and sediment controls to direct runoff from site through silt fences and sediment traps to decrease sedimentation in streams.
- Flaring towards any vegetations or trees should be avoided and if unavoidable, a suitable barrier will be erected to prevent vegetations from direct heat radiation. Flare testing will be for a short period and the impact will be temporary nature with no residual impacts.

6.4.8 Socio-Economic Environment

There are no major adverse social impacts due to present project activities as the well site is located far away from human settlements. However, it is anticipated that drilling operations

might have some direct and indirect impacts on socio-economic environment which are discussed below.

Impacts

Critically analyzing the existing status of socio-economic profile vis-à-vis its scenario with proposed project, the impacts could be of varying nature.

- Movement of heavy machines and vehicles can damage the unpaved village roads within study area.
- Land acquisition may lead to loss of valuable agricultural lands. This may cause stress over loss of employment. This will also affect animal grazing and livestock.
- Influx of population during drilling operation will lead to sharing of common resources like water, roads, etc. among communities, which may impact the net availability of resources and may give rise to conflict over allocation. However, as human settlements are located far away from the well site, probability of such occurrences is negligible.
- There will a temporary job creation for local youth within study area.
- Problems such as drug abuse, alcoholism, etc. may rise due to migration of population.

Impact on health due to noise and emission from drilling operations has been assessed to be negligible as the wellsite is located far away from the settlements.

Mitigation Measure

- Implementation of the Stakeholder Engagement Plan to manage relationships with potentially impacted and interested stakeholders.
- Communication with water agencies, local authorities and communities is recommended in order to better understand their concerns regarding the project activities.
- Cultural induction training will be provided to all construction personnel and contractors workers as well as visitors.
- There will be a prohibition on drugs and alcohol at all its facilities within the activity area, including in the accommodation camps.
- Preferential recruitment of unskilled and low-skilled labour from the local population will be encouraged.
- Public access control should be applied to avoid accidents and any other health & safety hazard.
- Implementation of adequate CSR Policy by the project proponent within study area.

6.4 IMPACT EVALUATION

Based on **Table 6.1** the significance criteria, that will be assessed after obtaining the actual project related informations, the potential environmental and social impacts due to drilling operations and associated activities, with or without mitigation measures will be given. The template of the same is given in **Table 6.3 and Table 6.4** respectively.

Table 6.3: Potential Environmental and Social Impacts of Proposed Exploratory Drilling (Without Mitigation Measures)

Environmental Sensitivities	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Air Quality		□		□			□			□			□		
Noise			□		□		□			□				□	
Local Drainage and Water Resources		□		□			□			□			□		
Surface Water Resources & Quality		□			□		□			□			□		
Groundwater Resources & Quality		□			□		□			□			□		
Soil & Sediment Quality		□			□			□		□				□	
Land use Pattern		□		□				□		□			□		
Vegetation/Agriculture		□		□				□		□			□		
Terrestrial Wildlife/ Livestock		□		□			□			□			□		
Threatened and Endangered Species															
Aquatic Flora and Fauna															
Occupational Health & Safety		□		□			□			□		□			
Community Health & Safety	□			□			□			□		□			
Cultural & Historical Resources															
Loss of livelihood															
Increased Traffic		□			□		□			□			□		
Common Property Resources															
Population Influx	□			□			□			□		□			
Tourism/Leisure/Aesthetics															
Local Economy	□				□		□				□		□		
Displacement of local/tribal/ethnic group															

Note: For colour coding refer **Table 6.1**

Table 6.4: Potential Environmental Impacts of Proposed Drilling Activities (With Mitigation Measures)

Environmental Sensitivities	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Air Quality		□		□			□						□		
Noise		□		□			□						□		
Local Drainage and Water Resources	□			□			□					□			

Environmental Sensitivities	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Surface Water Resources & Quality	□				□		□						□		
Groundwater Resources & Quality	□				□		□						□		
Soil & Sediment Quality	□				□			□					□		
Land use Pattern	□			□				□					□		
Vegetation/Agriculture	□			□				□					□		
Terrestrial Wildlife/ Livestock	□			□			□					□			
Threatened and Endangered Species															
Aquatic Flora and Fauna															
Occupational Health & Safety	□			□			□					□			
Community Health & Safety	□			□			□					□			
Cultural & Historical Resources															
Loss of livelihood															
Increased Traffic	□				□		□						□		
Common Property Resources															
Population Influx	□			□			□					□			
Tourism/Leisure/Aesthetics															
Local Economy	□				□		□				□		□		
Displacement of local/tribal/ethnic group															

Note: For co*lour coding refer* **Table 6.1**

6.5 RISK ASSESSMENT

The risks at different stages of the drilling operation has been identified along with its suitable elimination/mitigation measures.

6.5.1 Risks & their prevention methods in course of Well Construction

The Drilling project for exploration well involves the construction of the 2,000m vertical well. The design of sting was proposed in such a manner which can eliminates maximum possible predicted risks during the construction. But this design will not be able to eliminate all the possible complications of well bore passage and cementing operations as it is suitable for mining and rock beddings operations.

The preventive measures to eliminate all the expected or possible complications during the process of drilling are given in **Table 6.5.**

Table 6.5: Main Measures for Risk Reduction During Drilling

Interval		Expected complications	Prevention and elimination measures
From	To		
0	50	Circulation losses, slides and collapses.	1. Capacity of drilling pumps over 30 l/s shall not be exceeded; 2. Maintenance of density and specific viscosity within program values; 3. In case of circulation loss occurrence, a high viscosity bentonitic pill with filler shall be installed in the circulation loss zone.
50	150	Circulation losses	1. Excess of flush water density over 1.15 g/m3 shall be excluded 2. Minimum value of rheological characteristics of the drill mud shall be maintained. 3. Capacity of drilling pumps over 30 l/s shall not be exceeded; 4. Recommended round trip operations speeds shall be observed (hydraulic calculation); 5. High-viscosity pills with selected content of various fractional filler shall be used upon partial mud loss; 6. Running of a rotor BHA shall be performed upon full losses; 7. The loss circulation control algorithm shall be followed it.7.5.
150	280	Packings	1. Observe the bottom hole flushing modes, exclude formation of a momentary packing as a result of plugging of annular space; 2. Observe concentration of a detergent and lubricant in the drill mud; 3. In case of packing formation during drilling it is required to perform intense reciprocating of the BHA and tools
300	400	Oil, gas and water shows	1. Observation of compliance with parameters and density of the drill mud including upon occurrence of circulation losses (control of static level); 2. Avoidance of creation of pressure drawdown due to swabbing or upon violation of filling-up during BHA and tool lifting; 3. Control of pf, mf, pm parameters 4. Control of well makeup during tool lifting; 5. Periodic solution makeup in tools upon BHA running; 6. Upon GOWI the drill mud shall be weighted by stages according to circulation, do not allow formation of weighted pills in the well bore upon circulation
550	650		
800	900		
400	500	Circulation losses	1. Maintenance of density within program values; 2. Do not allow increase of rheological characteristic above the program values;

Interval		Expected complications	Prevention and elimination measures
From	To		
700	800		3. Recommended drilling practice and round-trip speed shall be observed (hydraulic calculation); 4. Drill mud reserve in volume of 40-50 m3 with reduced density shall be available; 5. High-viscosity pills with selected content of various fractional calcium carbonate shall be used upon partial mud loss; 6. Upon full no return it is recommended to change the BHA to the rotor one, to work per the special plan for loss circulation control; 7. The loss circulation control algorithm shall be followed it.
900	959		
400	500	Differential pressure sticking	1. Drill mud density control, filtration reduction; 2. Maintenance of program values of concentration of a lubricant and detergent; 3. Various fractional calcium carbonate shall be used during drill mud preparation and treatment; 4. Do not allow leaving BHA and tools idle in the open hole for more than 3 minutes; 5. Upon impossibility of drill bit separation from the bottom-hole upon tension over 10t of drill tool weight the following should be done: ▪ create load on the bottom-hole to 10-15t more than load during drilling; ▪ then create tension to weight which was during drilling; ▪ then try to rotate the tool using a rotor with control of rotation torque and prevention of its excess over ratings of the weakest element in the assembly. 6. If the tool is not released then repeat the operation 2–3 times with load increase to 5t (as compared to the previous load) each time, with further weight reduction to dead load. 7. The following should be done upon loss of tool mobility when a drill bit is above the bottom-hole: ▪ try to rotate the string upon dead weight; ▪ if attempts to rotate the strings for 7–10 minutes fail then begin spudding up and down; ▪ in case of absence of positive result – begin installation of a fluid patch (add. work plan).
700	800		
900	959		
300	959	Packings	1. Observe the bottom hole flushing modes, exclude formation of a momentary packing as a result of plugging of annular space; 2. Observe concentration of a detergent and lubricant in the drill mud; 3. In case of packing formation during drilling it is required to perform intense reciprocating of the BHA and tools

Interval		Expected complications	Prevention and elimination measures
From	To		
970	1050	Oil, gas and water shows	1. Observation of compliance with parameters and density of the drill mud including upon occurrence of circulation losses (control of static level); 2. Avoidance of creation of pressure drawdown due to swabbing or incompliance of makeup during BHA and tool lifting; 3. Control of pf, mf, pm parameters 4. Control of well makeup during tool lifting; 5. Periodic solution makeup in tools upon BHA running; 6. Upon GOWI the drill mud shall be weighted by stages according to circulation, do not allow formation of weighted pills in the well bore upon circulation
1250	1350		
1050	1200	Tectonic fault (zone of possible collapses, locking, circulation losses or GOWI, due to HC accumulations)	1. Observance of drill mud parameters according to program values; 2. Observance of well drilling practices; 3. Observance of pulling-and-running operations speed; 4. Quality control of gas shows by GES specialists during well drilling; 5. Control of availability of slide cuttings on mud screens, in case of instability signs, gradual weighting of the drill mud is possible; 6. Elimination of GOWI and circulation losses per the additional work plan.
1050	1200	Differential pressure sticking	1. Drill mud density control, filtration reduction; 2. Maintenance of program values of concentration of a lubricant and detergent; 3. Various fractional calcium carbonate shall be used during drill mud preparation and treatment; 4. Do not allow leaving BHA and tools idle in the open hole for more than 3 minutes; 5. Upon impossibility of drill bit separation from the bottom-hole upon tension over 10t of drill tool weight the following should be done: ▪ create load on the bottom-hole to 10–15t more than load during drilling; ▪ then create tension to weight which was during drilling; ▪ then try to rotate the tool using a rotor with control of rotation torque and prevention of its excess over ratings of the weakest element in the assembly. 6. If the tool is not released then repeat the operation 2–3 times with load increase to 5t (as compared to the previous load) each time, with further weight reduction to dead load. 7. The following should be done upon loss of tool mobility when a drill bit is above the bottom-hole: ▪ try to rotate the string upon dead weight; ▪ if attempts to rotate the strings for 7–10 minutes fail

Interval		Expected complications	Prevention and elimination measures
From	To		
			then begin spudding up and down; ▪ in case of absence of positive result – begin installation of a fluid patch (add. work plan).
1500	1600	Circulation losses	1. Maintenance of density within program values; 2. Do not allow increase of rheological characteristic above the program values; 3. Recommended drilling practice and round-trip speed shall be observed (hydraulic calculation); 4. Drill mud reserve in volume of 40–50 m^3 with reduced density shall be available; 5. High-viscosity pills with selected content of various fractional calcium carbonate shall be used upon partial mud loss; 6. Upon full no return it is recommended to change the BHA to the rotor one, to perform works per the special plan for loss circulation control; 7. The loss circulation control algorithm shall be followed it.
1600	1700	Tectonic fault (zone of possible collapses, locking, circulation losses or GOWI, due to HC accumulations)	1. Observance of drill mud parameters according to program values; 2. Observance of well drilling practices; 3. Observance of pulling-and-running operations speed; 4. Quality control of gas shows by GES specialists during well drilling; 5. Control of availability of slide cuttings on mud screens, in case of instability signs, gradual weighting of the drill mud is possible; 6. Elimination of GOWI and circulation losses per the additional work plan.
1725	1825	Oil, gas and water shows	1. Observation of compliance with parameters and density of the drill mud including upon occurrence of circulation losses (control of static level); 2. Avoidance of creation of pressure drawdown due to swabbing or incompliance of makeup during BHA and tool lifting; 3. Control of pf, mf, pm parameters 4. Control of well makeup during tool lifting; 5. Periodic solution makeup in tools upon BHA running; 6. Upon GOWI the drill mud shall be weighted by stages according to circulation, do not allow formation of weighted pills in the well bore upon circulation
1850	1950	Circulation	1. Maintenance of density within program values; 2. Do not allow increase of rheological characteristic above the program values; 3. Recommended drilling practice and round-trip speed shall be observed (hydraulic calculation); 4. Drill mud reserve in volume of 40–50 m^3 with reduced

Interval		Expected complications	Prevention and elimination measures
From	To		
			density shall be available; 5. High-viscosity pills with selected content of various fractional calcium carbonate shall be used upon partial mud loss; 6. Upon full no return it is recommended to change the BHA to the rotor one, to perform works per the special plan for loss circulation control; 7. The loss circulation control algorithm shall be followed it.

6.5.2 Risks and their prevention methods for Lost Circulation during well construction

Tectonic deformations (faults) can result in losses and cracks at any bed type. Under the action of excess of hydraulic pressure, the natural cracks can expand, following which they act as induced fractures. Occurrence of Induced fractures can cause the drilling mud losses in in deep or long wells because of mechanical cracks formation due to the following reasons:

- maximum drilling mud density during circulation;
- insufficient cleaning of a well bore, due to high mechanical drilling speed upon low rheological characteristics of the flush water;
- formation of a momentary packing as the result of violation of drilling practices and well bore flushing.
- in all cases when operating pressures exceed the formation fracturing gradient.

Lost Circulation can be prevented by the following methods:

- Drilling mud should be of maximum density close to pore pressure without violating safety margin;
- Drilling pump capacity should be optimized for the well bore cleaning;
- circulation restoration should be performed with maximum low capacity of drilling pumps for destructing drilling mud structure;
- narrowing of the annular space can be eliminated by reviewing bore cleaning possibility;
- periodical pumping of various fractional colmatants & plugging materials (LCM);
- Check speed rate of drilling and casing strings that should run according to hydraulic calculation;
- under condition of overflow absence at the rotor funnel speed of pulling-and-running operations should be observed for geophysical studies during drilling.
- Additional Calculation of the allowable pulling-and-running operations speed should be done in case of deviation from the actual rheologic characteristics of the fresh water.

6.5.3 Risks and prevention methods for oil and gas shows

Destabilization of the hydrodynamic equilibrium in the formation-well system is the cause of shows of oil-gas and water (GOWI) in the deep wells. Formation fluid enters the well due to capillary crossflows, osmosis, through the drilled and collapsed rocks, gravitational substitution and gas diffusion due to long stoppages of drilling work.

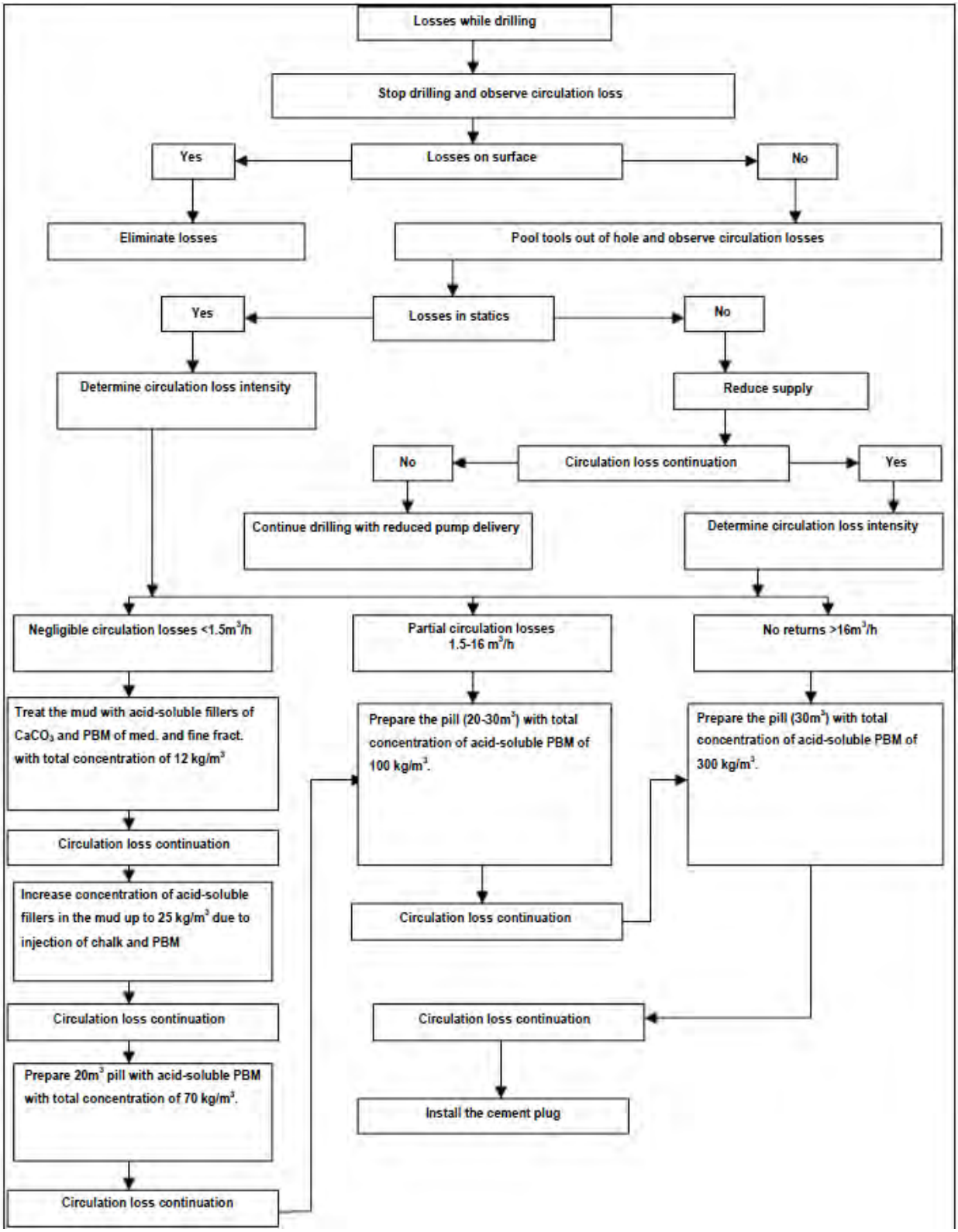


Figure 6.3: Circulation Loss Elimination Algorithm

The following measures shall be envisaged to prevent shows of oil-gas and water:

- preparation of the emergency response plan (ERP);
- the continuous control should be conducted for quantity of the drilling mud pumped into the well and going out from the well, and various other tasks relate pressure change etc.

- the circulation system shall be equipped with mechanisms and alarm.
- Every hour drilling mud density measurements along with other parameters shall be measured with records in a drilling mud log;
- Checking of the drilling mud level in the well due to operational shutdowns and long-term downtime;
- Prohibit the entry of drop of hydrostatic pressure on the bed due to drilling mud density reduction regarding the design documentation;
- Prohibit the entry of less density liquids entry of liquids in the circulating drilling mud;
- Drilling mud level should not be decrease in the well;
- operations of blow out preventive equipment should be reliable & uninterrupted for drilling mud cleaning systems;
- drilling rig should have drilling mud reserve in good volume along with chemical reserve for quick preparation of second volume before opening of gas-oil-water drive beds
- Check speed rate of drilling and casing strings that should run according to hydraulic calculation;
- under condition of overflow absence at the rotor funnel speed of pulling-and-running operations should be observed for geophysical studies during drilling.
- Additional Calculation of the allowable pulling-and-running operations speed should be done in case of deviation from the actual rheologic characteristics of the fresh water.

6.5.4 Risks and prevention methods for sticking of drill string and BHA

Main measures for sticking prevention are:

- optimal fractional composition of carbonate colmatant should be selected;
- drilling mud should be maintained with selected concentration & in minimum solid phase content for its effective cleaning from drilled solids;
- clay cake should be injected with optimum quantity of lubricants;
- Mud density should exclude the occurrence of excess pressure on the bed & include the minimum fluid loss indicator;
- Assurance of effective well hole cleaning from drilled cuttings;
- drilling mud pills with increased lubricating properties should be installed before the casing running and execution of geographical work;
- If leaving of string is necessary in the open hole, then it should be done by taking all measures to keep the bottom hole flushing with string rotation continues.
- Drilling rates should be restricted after the opening of the productive top horizon;
- Perform smooth flushing process stabilization.

6.5.5 Risks & preventive methods during cementing process

Spring formation occurs during the drilling operation for the surface casing due to unsatisfactory support of the conductor casing. To prevent spring formation under the conductor casing shoe it is recommended to provide a drive pipe in the structure.

During the cementing process, cementing slurry surface casings with gas-generating additives should be provided to prevent the breakthrough on cement slurry hardening. Sometimes design lifting of cementing slurry was not achieved during the surface casings and conductor casings as result cementing slurry with colmation additives should be used as preventive measure.

7

CUMULATIVE IMPACT ASSESMENT

7 CUMULATIVE IMPACT ASSESMENT

7.1 INTRODUCTION

Cumulative impacts, as defined by International Finance Corporation (IFC) are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones. Practically, cumulative impact assessment is significant for such scenarios with affected communities and scientific concerns. **Figure 7.1** illustrates Cumulative Impact Assessment (CIA) schematically.

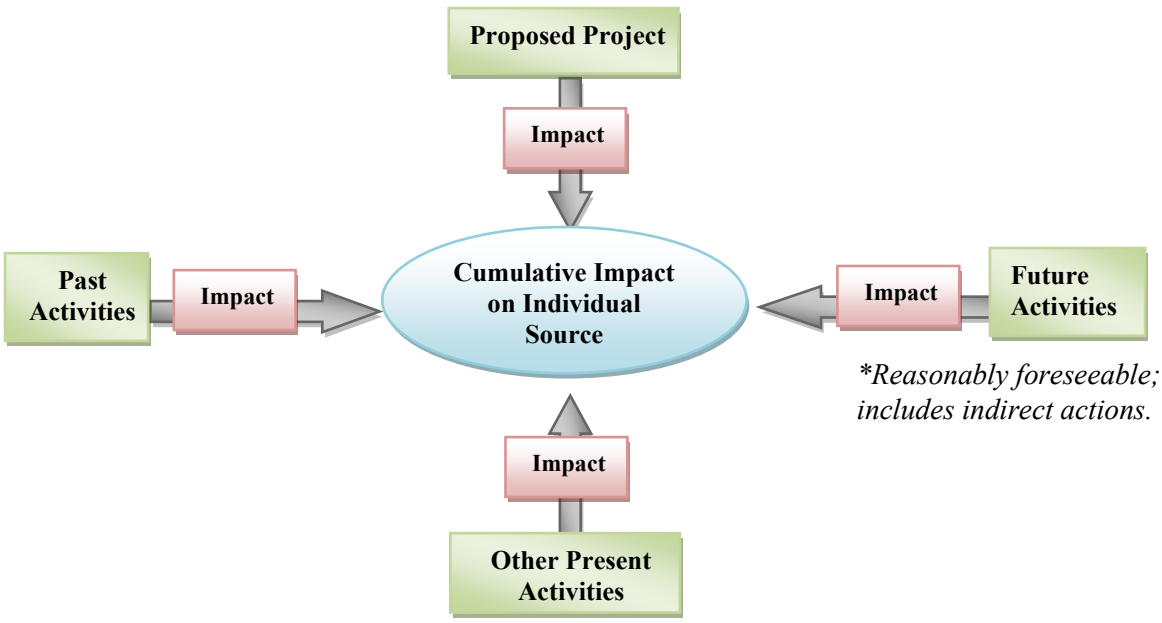


Figure 7.1: Cumulative Impact Assessment

Existing developments with or without proposed developments may be the cause of multiple and successive environmental and social impacts and may lead to cumulative impact which otherwise would not be expected from an individual project development.

7.2 CUMULATIVE IMPACT ASSESSMENT (CIA)

The CIA is effective in supporting good overall environmental and social impact management. It is important to note that not every environmental and social aspect comes under the ambit of cumulative impact assessment. In addition, the focus of assessment and management is given on the Valued Environmental and Social Components (VEC's).

The EIA study includes, socio-economic impact assessment as well, but is considered to be project-centric while cumulative impact assessment, on the other hand, is more of specific to valued environmental and social components (VECs). The VECs considered significant in the CIA assessment are given below:

i. Air Quality
ii. Noise Quality
iii. Local Drainage, Water Resources and water quality
iv. Groundwater Resources & Quality
v. Soil & Sediment Quality
vi. Land use Pattern
vii. Vegetation/Agriculture
viii. Wildlife/ Livestock

The Project location map is given in **Figure 7.2.**

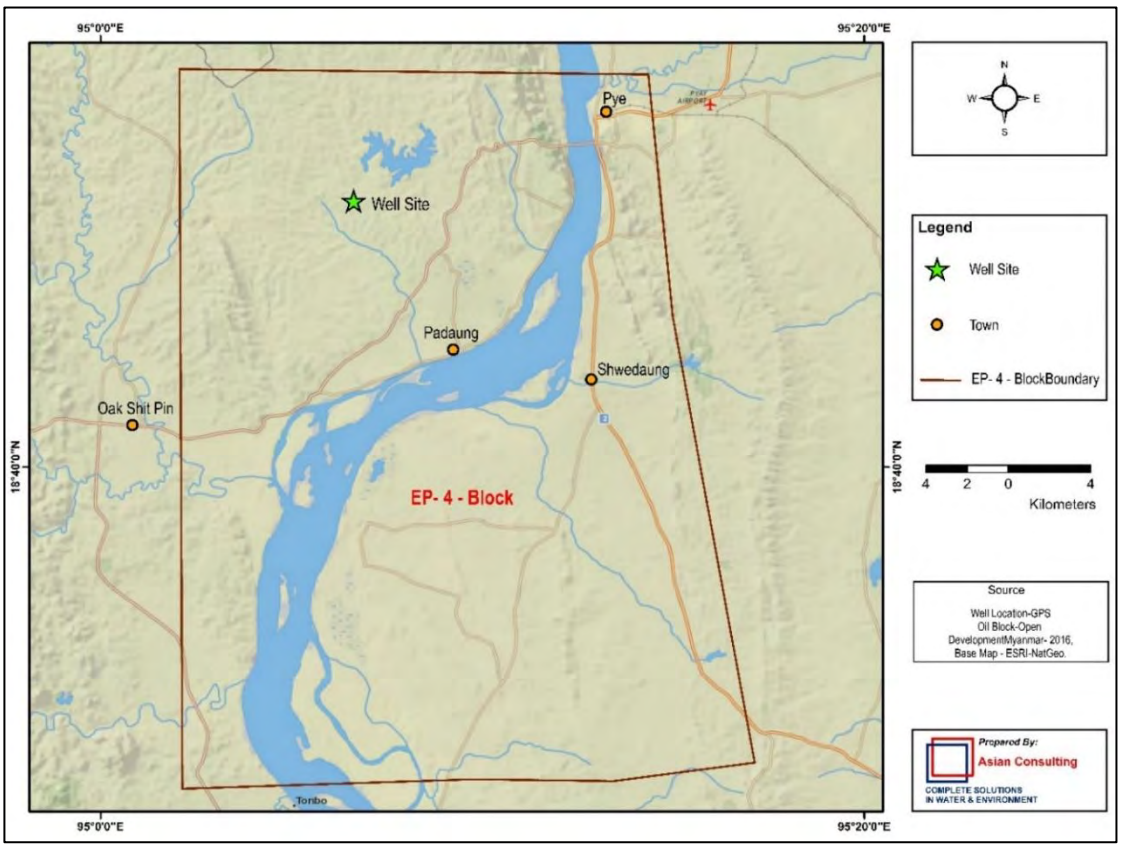


Figure 7.2: Proposed Well Site within North Grid of EP-4 Block

Within the EP-4 Block, no other existing or proposed developmental projects other than the proposed drilling project were found. However, the EP-4 Block area is surrounded by other potential oil and gas wells as shown in **Figure 7.3.**

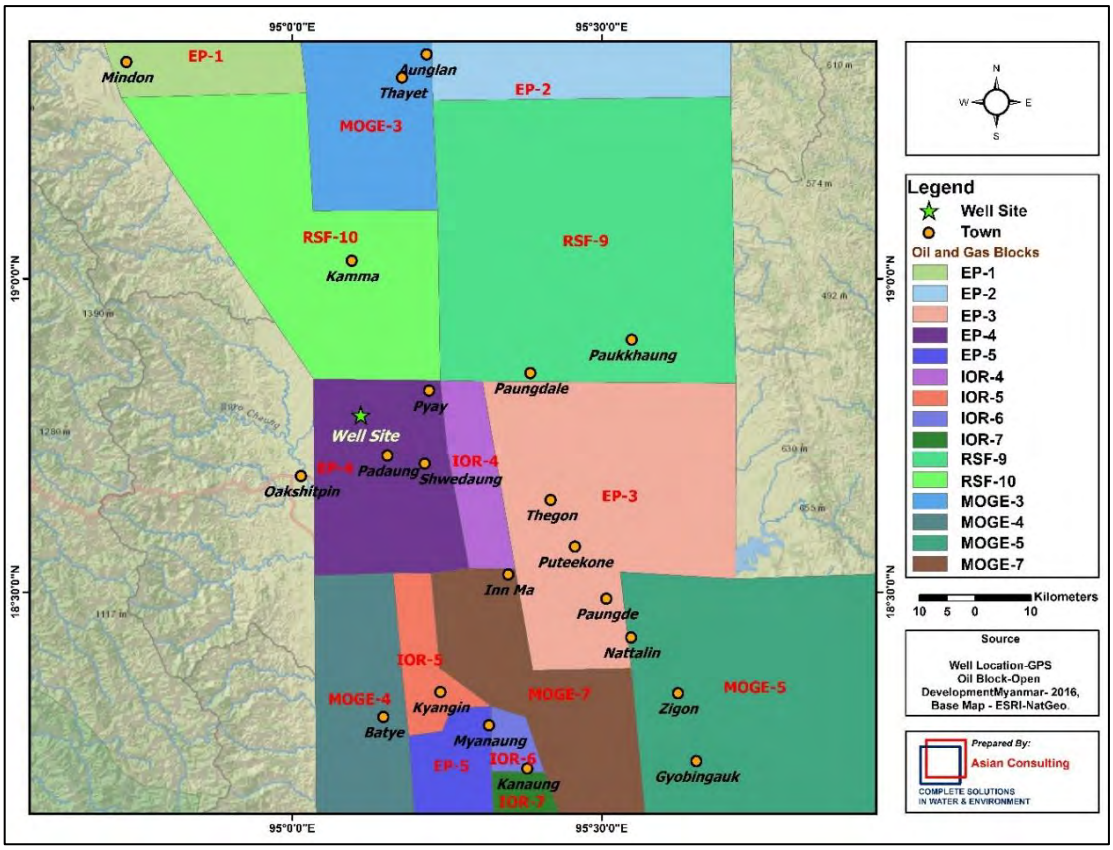


Figure 7.3: Surrounding Oil and Gas Wells of EP-4 Block

There are plans to extract oil and gas from these blocks in near future. The surrounding blocks of EP-4 with respective extractor are given in **Table 7.1.** The tentative schedule of these oil drilling is to complete ESIA study and seismic activity between 2015- 2017 and drilling from 2016 to 2019.[1]

Table 7.1: Oil and Gas Blocks Surrounding EP-4

S. No	Blocks	Extractor
1.	EP-3	ONGC Videsh Ltd.
2.	MOGE-4	CAOG.
3.	IOR 4	MPRL.
4.	IOR 5	Petronas Carigali.
5.	IOR 6	MPRL E&P Pte. Ltd.
6.	IOR 7	Petronas Carigali.

(Source: Oil Block Open Development Myanmar-2016)

For the present study, eight components are prioritized during the construction phase and seven for operation phase as valued environmental and social components (VECs) based on impact significance in accordance with Chapter 6. All the components with minor and moderate impact significance have been prioritized for CIA. The extraction of oil in near future from all these surrounding blocks can cumulatively have a significant negative impact on prioritized VECs. The induced cumulative impacts on these prioritized VECs are given below in **Table 7.2.**

[1]Hlaing Myint (Michael) 2016, Oil and Gas Services Industry in Myanmar, Schlumberger.

Table 7.2: Induced Cumulative Impact of Oil and Gas Extraction

Sl. N	Prioritized VECs	Activities	Cumulative Impact
Construction Phase:			
1.	Air Quality	Site preparation, Emissions from vehicles, restoration	Fugitive and exhaust gas emission can deteriorate the air quality.
2.	Noise	Noise from machineries and vehicular movement	If the construction activities are carried out in same time in different blocks, the cumulative noise levels can have adverse impact to nearby living communities.
3.	Local Drainage, Water Resources and quality	Site preparation and clearance, spillages from machineries	Sediment deposition in the water sources and water quality degradation, impact on aquatic life, stress on local water supply.
4.	Groundwater Resources & Quality	Infiltration of accidental spillage of fuel, site drainage, chemical spill from storage area, cementing of well, wastewater discharges.	Groundwater pollution.
5.	Soil & Sediment Quality	Accidental spillage, Vehicle and machinery movement, storage of oil and chemicals, domestic wastes.	Soil contamination, soil compaction, loss of soil productivity, impact on productivity of land.
6.	Land use Pattern	Acquisition of land, site clearance, preparation of drill site.	Change in Land use pattern, loss of agriculture and livestock grazing land.
7.	Vegetation/Agriculture	Site preparation and top soil removal.	Loss of vegetation and agricultural crops.
8.	Wildlife/ Livestock	Sediment deposition, vehicles movement, site preparation.	Impact on aquatic fauna due to water pollution, disturbances to the wildlife and avifauna due to increased noise levels and air pollution.
Operation Phase:			
1.	Air Quality	Diesel generator (DG) sets vehicular emission and flaring.	Emission of CO_2, NOx, suspended particles, water vapor, methane and VOC, etc. on the air for a longer period will deteriorate the air quality.
2.	Noise	Operation of D.G. sets and machineries.	Increase in noise level in the area.
3.	Local Drainage, water resources and quality	Leakage from storage area, disposal of drill cuttings and mud, domestic wastewater and discharge, flaring. Runoff water from the drilling area dissolved with inorganic or organic compounds.	Sediment deposition, surface water quality deterioration.
4.	Groundwater Resources & Quality	Accidental leakages from drill area to aquifer, contamination due to trade and domestic effluents.	Groundwater pollution.
5.	Soil Quality	Operation of drilling rig, Storage and disposal of drill cuttings and mud, Generation of process and domestic wastewater and discharge, Spills – Chemical and/or Oil.	Deterioration in soil quality and loss of soil productivity.
6.	Vegetation/Agriculture	Diesel generator (DG) sets vehicular emission and flaring, spillage, loss of soil productivity.	Loss of vegetation/agricultural production due to unproductive soil, introduction of invasive species,
7.	Wildlife/Livestock	Sediment deposition, surface water quality deterioration.	Loss of aquatic fauna, loss of native vegetative may affect the fauna of the area.

The cumulative impact significance of each of prioritized VECs is given below in **Table 7.3** and **Table 7.4**. It is based on the impact significance criteria given in Chapter 6 (Table 6.1).

Table 7.3: Potential Environmental and Social Cumulative Impacts - Construction Phase

Prioritized VECs	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Air Quality		□			□			□		□				□	
Noise		□		□				□		□				□	
Local Drainage, water resources and quality		□			□			□		□				□	
Groundwater Resources & Quality		□		□				□		□				□	
Soil & Sediment Quality		□			□			□		□				□	
Land use Pattern		□			□			□		□				□	
Vegetation/Agriculture		□			□			□		□				□	
Terrestrial Wildlife/ Livestock		□			□			□		□				□	

Table 7.4: Potential Environmental and Social Cumulative Impacts: Operation Phase

Prioritized VECs.	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Air Quality		□			□				□	□				□	
Noise	□			□				□		□			□		
Local Drainage, water resources and quality		□			□				□	□				□	
Groundwater Resources & Quality		□		□					□	□				□	

Prioritized VECs.	Nature of Likely Impacts											Impact Significance			
	Low Intensity	*Moderate Intensity*	*High Intensity*	*Local*	*Moderate Spread*	*Regional*	*Short Term*	*Moderate Term*	*Long Term*	*Adverse*	*Beneficial*	*Insignificant*	*Minor*	*Moderate*	*Major*
Soil & Sediment Quality		□			□				□	□				□	
Land use Pattern		□			□				□	□				□	
Vegetation/Agriculture		□			□				□	□				□	
Fauna		□			□				□	□				□	

While oil extraction from each of the blocks, the comprehensive Environmental Management Plan (EMP) with special emphasis on valued environmental and social components should be prepared. All the measures recommended in the EMP should be properly followed to reduce the impact on the environment. The impacts assessed after incorporation of mitigation measures are found to be insignificant (Chapter 6) and will be of no consequence after implementation of the EMP.

Some specific actions are recommended for the project proponent of different oil drilling companies, to be considered in the near future, depending on temporal circumstances.

7.3 MITIGATION MEASURES

Mitigation measures/actions that are recommended to efficiently manage cumulative impacts are given in **Table 7.5**.

Table 7.5: Mitigation Actions/ Measures to Manage Cumulative Impacts

S. No.	Mitigation Action	Responsibility
1.	The drilling operation timing, locations and technology used may be worked upon to avoid cumulative impacts.	Project Proponent.
2.	The mitigation, management and monitoring plans designed for the proposed project must be thoroughly implemented and even be modified to adapt to given circumstances/ conditions to help curb any cumulative impact.	Project Proponent.
3.	Other projects (not under control of the proponent) must implement best available technologies (BATs) and should adopt adequate mitigation, management and monitoring plans to further minimize impacts on the valued environmental and social components.	Other project proponents to address their contribution to cumulative impacts
4.	Protection and enhancement of regional areas to preserve biodiversity by collaborative efforts among various stakeholders.	Collaborative engagement with other stakeholders, including project proponents, government agencies, affected communities, conservation groups, and expert groups.
5.	Other regional cumulative impact management strategies through collaborative associations.	
6.	To keep a regular watch on cumulative impacts through monitoring of various environmental and social components to realize the efficiency of management efforts and further scopes for improvement.	

8

ENVIRONMENTAL MANAGEMENT PLAN

8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 INTRODUCTION

This chapter provides Environmental management and monitoring plan to address the adverse environmental impact of a project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project activities. The EMP is prepared considering International and Myanmar environmental regulations and standards for Oil and Gas sector projects and the Bashneft's HSE policy.

8.2 PURPOSE AND OBJECTIVE OF THE ENVIRONMENTAL MANAGEMENT PLAN

An Environmental Management Plan (EMP) provides a Delivery Mechanism to address the Adverse Environmental Impact of a project during its execution, to enhance project benefits, and to introduce standards of good practice to be adopted for all project works.

The primary objectives of the EMP are to:

i. Facilitate the implementation of the mitigation measures for the identified Adverse Impacts;

ii. Define the responsibilities of the Project Proponents and Contractors in order to effectively implement the Environmental Management Plan;

iii. Define a Monitoring Mechanism and identify Monitoring Parameters in order to:

   a. Ensure the complete implementation of all Mitigation Measures;

   b. Ensure the effectiveness of the Mitigation Measure;

   c. Provide a mechanism for taking timely action in the face of Unanticipated Environmental Situations;

iv. Identify training requirements at various levels.

HSE Policy of Block operator

The Block operator will continue to conduct its activities in a professional and responsible manner. The Block operator, not only will comply with the laid down legislation requirements but when found inadequate will promote creative measures and internal standards for the protection of Health, Safety & Environment of the highest order for all who may directly or indirectly be affected by any of the activities.

The Block operator will continue to take a proactive approach towards creating safe work environment for all employees and will be concerned for promoting continued safety education and training for all employees, assigning responsibility for all aspects of the program, continuously reviewing the program to identify potential areas of improvement, and ensuring a thorough evaluation of all incidents.

Block operator will continue to address the Environmental and Health impact of its operations by reducing Waste, Emissions, discharges and by using energy efficiently.

Organizational Structure and Responsibilities

This section provides an organizational structure for Environmental Protection and Management during the proposed operations and defines the roles and responsibilities of the various entities for the duration of the project.

Management Approach

The organizational roles and responsibilities of various agencies involved in this process are summarized below:

Block operator (Bashneft):The overall responsibility of implementation of the Environmental Management Plan rests on them.

Contractors:The Contractors (Civil, Drilling and Others) will carry out field activities as part of the drilling project. The contractors will be subject to certain liabilities under the environmental laws of the country, and under their contract with Block Operator.

A certain degree of redundancy is inevitable across all management levels, but this is crosschecked in order to ensure compliance with the Environmental Management Plan (EMP).

Other essential features of the EMP are:

i. Bashneft will nominate a field based HSE Coordinator to oversee HSE compliance throughout the duration of the project operations.
ii. Bashneft will ensure that all contracts comply with the requirements given in the Environmental Management Plan;
iii. Bashneft will cooperate with regulatory agencies, MOGE, MoNREC (earlier known as –MOECAF) and other stakeholders.

Organizational Responsibilities

The salient features of the organisational responsibilities are described below:

Primary Responsibilities:

i. The primary responsibilities for the environmental performance of the project will be owned up by the Block Operator and the contractors.
ii. Block Operator's HSE coordinator will be responsible for the company's compliance with the EMP throughout the project.
iii. The contractors will assume the main responsibility for all environmental matters pertaining to their work.
iv. Block Operator will coordinate with relevant government departments and other stakeholders through its Environmental Engineer.

Field Management and Quality Control:

i. Conducting drilling activities in an environmentally sound manner will be the responsibility of the drilling contractor/ Block operator.

ii. HSE Coordinator will be responsible for the overall environmental soundness of all the field operations.

On-the-Job Supervision and Monitoring:

i. Block Operator has HSE coordinator, who is responsible for ensuring compliance with the EMP during the drilling operation. He is also responsible for communicating with and training the Drilling Crews in all aspects of the EMP.
ii. Bashneft will appoint HSE Coordinator, who will be responsible for all environmental issues and for the implementation of the EMP in the field.
iii. If any monitoring team from the government departments or from NGOs visit the field during the drilling operation, HSE Coordinator of Bashneftand the contractor will be responsible for coordinating their visits.

8.3 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

The EMP describes the appropriate mitigation measures to be carried out during the entire project period. Block operator and the contractor are responsible for ensuring the compliance with EMP. It lists all the potential effects of the project and their associated mitigation measures identified in the EIA report. For each Impact/Hazard, the following information is presented in the Plan:

- A comprehensive listing of mitigation measures.
- Actions required to mitigate adverse impact.

The management plan for the drilling operation is been established to carry out the proposed project in an environmentally safe manner by understanding the potential impacts and accordingly implementing the most suitable mitigation measure.The Management plan for the activities proposed are presented in **Table 8.1** (prior to drilling phase) and **Table 8.2** (during drilling phase).

Table 8.1: Environmental Management Plan -Prior to Drilling Phase

Hazard & Effects(s)	Proposed Mitigation	Required Action
Land Acquisition Since there is no settlement within/near the project location the proposed project does not require land acquisition. Necessary approval will be obtained from the government departments before commencement of the project for construction and operation.	• Ensure that all necessary protocols and legal requirements are implemented. • Acquiring necessary approvals from the regional governmentin a timely manner.	• Block Operator to initiate interaction with the concerned officials of regional government, prior to release of actual location to identify necessary permits and the approval mechanism. • Preliminary site survey to be carried out by block operator's civil works consultants to mark the road & site requirement on ground. • Block Operator's Team to meet the regional government to apprise them of the plan and to identify and apply for necessary permissions prior to drilling phase.

Table 8.2: Environnemental Management Plan - During Drilling Phase

Hazard &Effects(s)	Proposed Mitigation	Required Action
Waste and Effluent Management Poor planning and execution might pose a threat to environment. Even though the project area receives scanty rainfall, the possibility of contamination of rain/storm water run-off with rig wash water & waste mud is unavoidable.	• Block Operator to identify different type of waste anticipated during operations, work out estimated quantities, lay down procedures for collection, handling, treatment and disposal of each type of waste. • Waste Management Plan to be implemented during operation phase. • Detailed drainage design will be developed as a part of the site design. It will be ensured that mud and associated drainage system is isolated from the rain/ storm water drainage system.	• Waste Management Plan (given in this section) to be implemented during drilling and to be made available for inspection at site to all the concerned government officials. • Block Operator in association with Civil Workscontractors to develop detailed drainage system addressing concerns outlined here. • Block Operator to work out required pit volumes based on maximum case scenario including rainwater.
Wastewater & cuttings may contain trace amounts of drill fluid and residual chemicals.	• All wastewater, which will be generated from washings & spent mud will be contained in high density polyethylene sheetlinedpits and will be treated before disposing off. • Cuttings will be dried to maximum extent possible using suitable equipment and will be contained in separate pits before final disposal as per direction from Regulatory Authority.	• Site design will include adequately sized pits to contain wastewater and appropriate treatment plant. • Block Operator will use drier system to treat the cuttings coming from the shakers to achieve fairly Dry Cuttings. • Checklist of all drums and containers located within

Hazard &Effects(s)	Proposed Mitigation	Required Action
Fuels, Lubricants and Chemicals Management pose threat of major, moderate & minor spills.	• Keeping all fuels, lubricants and chemicals in well-designed storage facility with regular inventory checking.	footprint of the storage area will be prepared. • Training and awareness program to be developed among all workers associated along with mock exercises.
Contamination by way of fuel oil/lubricant spill and leaching.	• Used and unused chemicals will be stored in a lined & bunded area. • Executing delivery of fuel to drilling site under strict supervision and carrying out refueling operations in an area with impervious flooring and surface drainage with oil interceptor. • Use of suitable delivery trucks. • Impervious liners in place for fuel, lubricants storage area. Fuel/Lubricant Containment & Generator area to have drains with Oil Entrapment Provision. • Fuel/Lubricant storage area: Effective bunds capable of containing 110% of the volume of the largest container within and enclosing all potentially contaminating materials.	• The lined & bunded area for the fuel storage tank will have extra space to contain used and unused lubricants in drums. • Keeping an inventory of all fueling and refueling operations. • Check all delivery trucks for suitability & ensure that they meet safety requirements. • Impervious liners to be installed in the fuel & lubricant storage area. Fuel/lubricant storage area & generator area to have drains with oil entrapment mechanism. • Site design to incorporate bund requirement for the fuel/lubricant storage area.
Noise and Vibration	• Checklist of all machineries with record of date of procurement, installation and age. • Regular maintenance of all equipments. • Implement good working practices to minimize noise. • Wearing of ear protector when appropriate.	• Maintenance Logbook for all machineries to be prepared. • No machinery will be operated when not required. • Block Operator to distribute noise protection equipment and ensure utilization by the work force. • Proper planning will be made to restrict vehicular movements during night time.
Air Emissions	• Operate all equipment within specified design parameters. • Minimize emissions during well testing (flaring). • Watering of unpavedroads if required to control dust generation.	• Ensure proper Equipment maintenance. • Enhanced/Advanced Flare system will be selected to deliver efficient combustion during flaring to minimize emissions. • Ensure absence of stockpiles or open containers of

Hazard &Effects(s)	Proposed Mitigation	Required Action
		dusty materials. • Low Sulphur content diesel must be used.
Solid Wastes Wastes will include organic wastes, scrap metal, waste oil & chemicals, sacks, medical wastes, etc.	• Ensure proper documentation of all wastes generated. • Litter and debris not to be discarded at site and to be segregated at segregation pit on the well site. • Non-Toxic Biodegradable Waste to be buried during operations and de-commissioning, ensuring that local water resources are not contaminated in any way. • Bulk supply of materials to be preferred for minimization of packaging wastes. Unused materials to be returned to Supplier. • Material such as scrap metal, waste oil will be disposed of in a controlled manner through authorized waste contractors. • Draw up Emergency Response Plan (ERP), Well Control Plan, and keep them updated. • Maintain state of readiness for quick response including plan awareness, training and regular mock exercises. • Risk of loss of well control to be minimized through: i) Proper well design, which will ensure that the hydrostatic weight of mud will overcome formation pressure. ii) Proper drilling program design to ensure selection of properly rated BOP equipment. iii) Ensure that the Block Operator's supervision team & Rig Contractor's relevant operating personnel are trained to handle well control situations and hold relevant Well Control Training Certificates.	• Pre-operation inspections to ensure waste disposal facilities are in place. • A segregation pit to have waste types segregated into separate drums at the well site. • Block Operator to arrange for proper disposal and waste recycling contractors. • Block Operator to monitor strict compliance with the provisions of ERP & Well Control Plan. • Records of interaction between the management and the work force. Records of training and drills. • Ensure all available offset data is examined for proper design parameters and ERP (Emergency response plan) to be in place. • Same as above • Well monitoring equipment to detect influx from reservoir. Pressure detection service provided through Mud-logging. • Blowout preventers (BOP) to be tested regularly during and after its installation. • To ensure key personnel to have International recognized certificates.
Non-routine/ accidental events (Well kicks, blow out)	• To detect well kicks immediately to prevent blowouts. • Ensure advanced detection system is in place and BOP equipment is well maintained.	Advance instrumentation system and Mud Logging unit should be available.

Hazard &Effects(s)	Proposed Mitigation	Required Action
Socio-Economic Impacts	• Undertake social welfare projects for the local communities through well thought out CSR strategy. • Few unskilled manual labours may be engaged temporarily from local.	• Implement proposed Waste Management Plan and undertake water quality monitoring before, during and after the operations. • Implement social welfare schemes as per Company's CSR policy.

8.3.1 Waste Management Plan

To facilitate field level implementation, a Waste Management Plan is proposed, which will be subject to fine tuning before the start of the operations. The Waste Management plan is presented below in **Table 8.3**.

Table 8.3: Waste Management Plan

Category	Waste Type	Proposed Action	Responsibility	What needs to be Reported?	Monitoring
Domestic Waste	Sewage (Black Water)	The domestic wastewater (sewage and sullage) generated will be send to septic tank provided at the project site. All Sewage to be channelized into septic tanks and soak pits.	HSE Officer cum coordinator	Dimensions of pits, Integrity & maintenance of the pits, level of sewage in the pits.	Block Operator (Bashneft)
	Wastewater from Kitchen (Grey Water)	The disposal of the overflow from the septic tank will be done into a soak pit provided at the drilling site. All gray water to be channelized into soak pits. Excess waste water will be sprinkled on the project access road	HSE Officer cum coordinator	Dimensions of pits, Integrity & maintenance of the pits, Level of gray water in the Pits. Check availability of grease collection pit and frequent collection of grease, regular checking of wastewater level in the pit.	Block Operator (Bashneft)
	Food Waste	To be properly segregated (no plastics, metal, glass in it) and brought to the segregation pit. Dig two small humus pits depending on the amount of waste generated per day within the camp site area away from common use by rig crewmembers. The humus pits are to be covered with soil on daily	HSE Officer cum coordinator	Construction of pits, daily disposal of organic waste and covering it with soil.	Block Operator (Bashneft)

Category	Waste Type	Proposed Action	Responsibility	What needs to be Reported?	Monitoring
		basis to avoid any odour nuisance due to purification and check any contact with the flies or insects.			
	Combustible Waste (Paper, Rags, Packing material etc.).	To be properly segregated (no plastics, metal, glass in it) and brought to the segregation pit. Sent to recycling contractor.	HSE Officer cum coordinator	Ensure daily bringing of the waste to the pit. Periodic sending of waste to Recycling Contractor.	Block Operator (Bashneft)
Bio-Medical Waste	Medical waste (waste generated from First Aid Centre).	To ensure the availability of specified boxes, use of syringe cutters. Waste to be properly separated and stored temporarily at site separately from other wastes. Medical waste to be transported to the hospital capable of handling waste.	Medical Doctor	Segregation and transportation of waste to recycling contractor.	Block Operator (Bashneft)
Recyclable Waste	Tin packs, plastic and glass bottles and other metallic materials.	To be properly segregated and temporary storage at segregation pit at well site. Deliver to approved Recycling Contractor.	HSE Officer cum coordinator	Segregation and storing of waste at the site. Sending of waste Recycling Contractor.	Block Operator (Bashneft)
Drilling Wastes	Drill Cuttings	To be stored in HDPE lined pits on the well site. At the close of operations, if leachate analysis performed on properly washed and reasonably dried drill cuttings show that it is non-hazardous in nature, then it can be disposed of as inert material either into a cuttings pit onsite or offsite or taken for beneficial use in construction of roads or spreading on land in the local area or land filling. If found hazardous, disposal can be done onsite or offsite as per the approval from the local government bodies or to dispose it in some existing secured landfill operating in the region.	HSE Officer cum coordinator	Verify that volume of pit is adequate for storage of cuttings from the drilling site. Leachate analysis to be done on completion of the well from a recognized Lab.	Block Operator (Bashneft)
	Un-used Drilling	The un-used drilling mud will be stored in HDPE	HSE Officer cum	Check integrity of the HDPE	Block Operator

Category	Waste Type	Proposed Action	Responsibility	What needs to be Reported?	Monitoring
	Mud.	lined pit on site and allowed to dry. Once it is dried, it will be disposed-off after testing.	coordinator	lined pit. Testing for stipulated standards from recognized Labs before deciding final disposal.	(Bashneft)
	Drilling & Wash Wastewater.	All wastewater, which will be generated from washings & spent mud will be contained in HDPE lined pits and final disposal will be done only after treatment.	HSE Officer cum coordinator	Check integrity of the HDPE lined pit. Volume (cum) of wash wastewater generated.	Block Operator (Bashneft)
	Chemical Sludge (generated as a result of wastewater treatment).	The treatment of the sludge so generated can be for pH correction, if any, followed by dewatering either in centrifuge and or solar evaporation. The treatment is to be ensured in a pit properly lined with impervious HDPE liner of 1.0 mm. Disposal is dependent on establishing non-hazardous or hazardous nature after the end of operations.	HSE Officer cum coordinator	Check integrity of the HDPE lined pit. Volume (cum) of the sludge generated. Testing for stipulated standards from recognized Labs before deciding final disposal.	Block Operator (Bashneft)
Oily Waste	Used Oil	Oil changing activity is allowed only at the rig site. Oil to be collected in designated containers at the Rig site. Ensure that the used oil drums are safely transported to the approved recycling contractor to the certified workshop.	HSE Officer cum coordinator	Collection and storage of oil. Used oil drums safely transported and sent to approved recyclers.	Block Operator (Bashneft)

For the proposed drilling, it is expected that the drill cuttings will be free from oil and may not be rendered as hazardous. The sludge from the proposed drilling operations may be rendered as free from oil by providing suitable pre-treatment measures. However, any chemical sludge generated from wastewater treatment is considered as hazardous. Therefore, the chemical sludge from the wastewater treatment at the proposed Exploratory Drilling can be rendered as hazardous. The Drilling Mud and Other Drilling Wastes also considered as hazardous. However, based on sampling and analysis carried out through a recognized laboratory after the end of the drilling phase, if it is proved that the drilling mud and other drilling wastes do not contain any of the hazardous constituents therein, the wastes may not be treated as hazardous. Block Operator would require prior authorization from the regional government for storage, transportation and disposal of any hazardous waste generated at site during drilling operations.

8.3.2 Labour Management Plan

A broad labor camp management plan is provided which must be further refined by the Contractor dealing with labor management with respect to the site of labor camp and number of labors to be accommodated.

In order to identify and quantify potential for local employment, the project developer through contractor shall identify potential skills, local sub-contractors, and suppliers and obtain information on their capability to comply with the performance requirements of the project.

The project developer shall also implement skill development programs for local community to improve their employability. The project developer shall engage with local government, industry and other organizations to determine opportunities for targeted training. This will reduce influx of labors from other regions and provide employment opportunities to project affected persons.

8.3.3 Labour Contractor's Management Plan

The construction activity of the proposed project will be outsourced to contractor, and the Block operator shall monitor the contractor's activities and adherence to the environmental management plans. All the policies/ agreements related to labor and workers shall be formulated based on the applicable National and International guidelines.

The project developer should ensure a contractual commitment on the part of all contractors and subcontractors to comply with all relevant national labor law, including those related but not limited to ensuring legal protection on form and frequency of pay, working hours etc.

The agreements signed with various contractors should require them to:

i. Commit to provide a copy of employment registers and records including details of hours/ overtime worked, wages paid and the employment status of workers, both those employed directly and indirectly.
ii. Commit to recruit workers locally based on availability and skills.
iii. Assume primary responsibility for day-to-day monitoring of the implementation of labour standards and thereby designate a manager who is responsible for ensuring labour and health and safety legislation is complied with, both in the direct and indirectly-employed workforce (namely, sub-contracted labour);

iv. Provide or ensure that training is carried out on health and safety issues with regard to all workers, direct and indirectly employed;
v. Put in place a mechanism for checking the age of workers;
vi. Put in place a worker grievance mechanism and details of any complaints lodged under the procedure in the last year;
vii. Undertake to inform the project proponent of all serious accidents that take place.

8.3.4 Labor Camp Management Plan

No major labour influx is anticipated as mostly local people will be employed during the construction phase. But, in case of a distant labourers/ worker, a general labour camp management plan is proposed in this section, which, if required, should be developed further by the Contractor based on the site of the labour camp and number of labourers to be accommodated.

The involvement of labour population is likely to put pressure on the surrounding environment due to increase in discharge of sewage, quantity of solid wastes generated and other pollutants (burning of wood for cooking).

Measures to manage potential effects of the labour influx shall be put in place through a combination of public consultations, policies and planning. These measures may include:

i. A hiring policy giving preference to employment of local people with the best qualifications for a given position. In case of equal qualifications among many candidates, preference should be given to local residents. Therefore, skill mapping is recommended;
ii. A procurement policy that gives preference to locally produced goods and services;
iii. Accommodation of non-local workers in a dedicated construction camp with independent sewage and waste management facilities;
iv. Control of spontaneous settlements in the project vicinity;
v. Establishing a project-sponsored commercial area near the construction site;
vi. A code of conduct for labours that establishes rules for interaction between the project developer, workers and the local community;
vii. Developing a workforce HIV/AIDS management and awareness program;
viii. Sewage Treatment and Sanitation Facilities: The wastewater generated from the labour camps shall not be allowed to flow into the river water or any other natural drainage system of the area. The wastewater shall be collected and treated in septic tanks.
ix. An adequate number of toilets must be provided for workers i.e., One toilet for every 10 men and one toilet for every 10 women shall be provided.
x. All contractors shall ensure that illegal cutting of trees for fuel wood is prohibited. Therefore, an adequate supply of fuel (LPG cylinders) shall be provided in the labour camps and canteens.
xi. Medical facilities: Workers shall be provided with primary health care and basic first aid at the project site during the entire project period.

8.3.5 Occupational Health and Safety

Occupational Health and Safety issues are prevalent in all occupations, irrespective of the type of occupation. Preventive and protective measures should be introduced according to the following order of priority:

i. Controlling the hazard at its source through use of engineering controls. Examples include use of acoustic enclosure in DG sets to reduce noise level, exhaust ventilation in storage areas etc.;

ii. Minimising the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation (shift in working hours), training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.

iii. Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

The Occupational Health and Safety (OHS) issues should be considered not only for those who are directly employed by the Block operator, but also those who are employed by the contractors (including subcontractors).

8.4 EMERGENCY PLAN

To combat the emergencies caused by major accidents, planning response strategies are termed as Emergency Plan**.** Emergency Plan cannot be considered in isolation or act as a substitute for maintaining good safety standards at the operation. The best way to protect against major accident occurrence is by maintaining very high levels of safety standards.

Generally, the following five phases are involved in an emergency:

i. **Discovery and Notification:** An event with an imminent threat of turning into an accident must first be discovered and the discoverer shall quickly notify the same to the plant HSE coordinator on site.

ii. **Evaluation and Accident Control Initiation:** Based on the evaluation of available information, the HSE coordinator makes a rapid assessment of the severity of the likely accident and initiates the best course of action.

iii. **Containment and Counter Measures:** Action is first taken to contain and control the accident by eliminating the causes which may lead to the spread of accident. Measures are also taken to minimize the damage to personnel, property and environment.

iv. **Cleanup and Disposal:** After the accident is effectively contained and controlled, the cleanup of the site of the accident and safe disposal of waste generated due to the accident are undertaken.

v. **Documentation:** All aspects of accidents, including the way it started and progressed as well as the steps taken to contain and the extent of the damage and injury, must be documented for subsequent analysis of accident for prevention in future, damage estimation, insurance recovery and compensation payment. It may be noted that some aspects of documentation, such as, photographs of the site of accident and main objects involved in the accident, survey for damage estimation, etc. may have to be carried out before the cleanup and disposal phase. However, the effort in all cases is to recommence the operations as soon as possible.

8.4.1 Methodology of Emergency Plan Preparation

Emergency Plan is usually prepared in two parts: On-site and Off-site. The On-site Emergency Plan is to be administered by Bashneft. Bashneft management may seek the assistance of other agencies, namely, District authorities and fire brigade, police and health

authorities, if considered necessary. The off-site Emergency Plan is normally administered by the statutory authorities / District Magistrate with the assistance of other relevant authorities.

Following are the key elements of Emergency Plan:

a. Cause of the Emergency;
b. Accident prevention procedures/measures;
c. Accident/emergency response planning procedures;
d. Recovery procedure; and
e. On site and off site Crisis management, communication, contact information etc.

8.4.2 Causes of the Emergency

An industrial emergency / disaster during the drilling Operations may include one or a combination of more than one of the following:

(a) Natural Calamities

- Flood
- Wind Storm/Dust Storm
- Earthquake

(b) Man Made Disaster

- Major Fire
- Accidental spillage of Fuel and Chemicals
- Missing Person
- Serious Injury, Illness, Fatality
- Collapsing of equipments/machineries and vehicles (project vehicles, drilling rig etc.)
- External factors like Riots, Sabotage, and Extremist threats, Threat of War or War Itself.

8.4.3 Accident Prevention Procedures/ Measures

Personal Protective Equipment (PPE)

PPE is a fundamental requirement to be used during the entire drilling operation. The PPE for the operations should include helmets, hearing protection, safety shoes etc. Activity wise PPE requirements are provided in **Table 8.4**.

Table 8.4: Activity wise PPE Requirements

Activity	PPE Requirements
Site Survey	• Safety shoes and protective glasses shall be worn wherever necessary during the survey. • All persons traveling in vehicles must wear seat belts.
Drilling Operation	• Protective gloves shall be worn wherever applicable. • Safety shoes and protective glasses shall be worn during the operations, wherever applicable. • Proper marking of the area with warnings, if required. • Safety harness and helmets shall be used, wherever required.

Activity	PPE Requirements
	• No employee to be allowed to move around the machinery without protective gear. • Hearing protection gear, wherever applicable shall be used during the operation.
Fuel Storage and Handling	• Appropriate fire extinguishers should be available at the storage site. • Adequate ventilation shall be provided at the place of storage. • All protective gears as applicable shall be worn while handling flammable liquids.

Emergency Management Interface

The following details identify the interface between the Incident Response Team (Site) and Emergency Response Group (ERG).

Incident Response Team (IRT) – Operational Response

It is the Incident Response Team's responsibility to deal with the respective location or asset's incidents / emergencies of minor nature requiring no external assistance and which can be controlled with local resources. For emergencies where external assistance is required the Incident Controller at site must notify Emergency Response Group Leader for action.

Emergency Response Group (ERG) – Tactical Response

It is the Emergency Response Group's responsibility to respond and provide assistance to control the response to all major emergencies that occur.

Emergency Reporting

i. When witnessing or receiving notification of an emergency, as much information as possible should be taken and/or conveyed to the relevant emergency activation authority. Where possible, all information should be logged in written form with time and date included and provided to the Incident Controller.

ii. When an emergency occurs, an appropriate and prompt response is required, providing precise action to control, correct and return the site to a safe condition. Timely action is also required to protect the people, the environment and property from harm/ damage.

iii. Reporting Forms for actions to be considered, when witnessing an emergency or receiving a report of an emergency.

8.4.4 Emergency Response Strategies

This plan has been prepared based on the Trigger Mechanism. The Trigger Mechanism envisages that on receiving signals of a disaster happening or likely to happen, all activities required for the mitigation process are energized and activated simultaneously without loss of any time. The primary objective of this mechanism is to undertake immediate rescue and relief operations and stabilize the mitigation process as quickly as possible.

The main parameters of such a response plan include:

i. Signal/Warning Mechanism.

ii. Activities and their Levels.
iii. Sub-Activities.
iv. Command and Control Structure.
v. Individual roles and responsibilities of each specified authority to achieve the activation as per response time.
vi. Response teams for each specified authority.
vii. Emergency procedures.
viii. Alternate plans and contingency measures.

I. Declaration of Emergency

To enable the appropriate level of response to be implemented, emergency incidents are to be categorized according to three levels as follows:

Tier 1

- The incident can be effectively and safely managed and contained within the drilling operation area by operations staff.
- The incident has no effect outside the project site.
- There is unlikely to be serious danger to life, the environment or to company assets or reputation.

Tier 2

- The incident cannot be effectively and safely managed and contained at the drilling operation by operational staff and some form of additional assistance is required.
- The incident may be "on project site", have some effect beyond the "project site" and an external emergency services will be involved.
- There is likely to be danger to life, to the environment or to company assets or reputation.

Tier 3

- The incident has ESCALATED to a level where it begins, or has the potential to begin, to adversely affect the Company, its Joint Venture Partners, or the public on a broad front.
- The incident will have technical, press, public affairs and personnel implications, which require immediate assistance.
- There will be one or combination of the following:
  - Death and/or serious injury,
  - Potential for significant pollution or environment damage,
  - Substantial damage or property.

Emergencies will initially be under the control of the Incident Controller whose main tasks are to locate the source and nature of the incident, to inform the Emergency Response Group (ERG) Leader and activate the Drilling Site Security and Emergency Services.

During normal working hours the Incident Controller will keep the ERG Leader informed and jointly decide whether it's a Tier 1, Tier 2 or Tier 3 emergency. For a major emergency appropriate Emergency Control Centers will be set up, the site Emergency Support Team summoned and the ERG activated as required.

II. Preparation for Emergencies

Command by Competent Persons

Effective command and control starts with a clear definition of the overall command and control structure, and description of the duties of key personnel with specific responsibilities for emergency response.

Number of Persons for Emergency Duties

The command/control of emergencies must identify the minimum number of persons required to provide an adequate response to emergencies. This includes having staff trained and competent to fulfill the roles of other members of staff if they are not available.

List of Persons for Emergency Duties

A list of the staff in the field having emergency duties is displayed in the Control Room. It is the responsibility of the Incident Controller to ensure that these lists are kept up to date.

Control of Emergencies

The major systems for controlling emergencies and preventing escalation are detailed in this plan, which gives the emergency procedures to be followed in case of an impending/ occurring disaster. It should be noted that during any emergency during Drilling Operations in the block EP-4, this document would be referred. This would result in the most efficient emergency response strategy to combat the impending/occurring disaster.

Assembly Procedures

When personnel arrive on site, they are assigned to an assembly station.

- Assembly Areas
  - Non-essential personnel assemble within the accommodation.
  - Fire Team at the Alert Team Station.
  - Emergency Response Team in the office of Incident Controller.
- Lists
  - Assembly lists should be kept up to date and are produced by a senior person. Copies are displayed at each Assembly Station.
- Accounting for Personnel
  - The person in charge at each Assembly Station checks the personnel according to the assembly list and relays the information to the site HSE Support and the Incident Controller. The HSE Support person conducts the final headcount and notifies the Incident Controller of the results and discrepancies if any.
- Co-ordination
  - The senior person in the Control Room is charged with coordinating the information/response measures from the various Assembly Stations and ensuring that all personnel are accounted for. He/ She must refer to the HSE Support or the

Incident Controller if any personnel are not accounted for or if there are impediments to carry out the response strategy.

III. Post Emergency

The post emergency phase is an important event in the long-term emergency response strategy for Bashneft.

It is absolutely necessary for the Emergency Response Team (ERT) members (Incident Response Team, IRT) to review the emergency plan and the incident response events and provide their inputs for response improvements or emergency plan updates. All personnel involved in the emergency response actions during an incident will be debriefed by their superior officer.

It will be the responsibility of the designated ERT members to prepare a complete incident report collating incident reports/logs from the respondents and forward the same to higher authorities as appropriate or send notifications to the Government authorities as the case may be. It will be the responsibility of the ERG leader to develop a post emergency action plan with the assistance of Incident Controller.

8.4.5 Emergency Response Organization

Incident Response

The Incident Controller (IC) is responsible for coordinating the on-site tactical response to any emergencies arising out of the Drilling Operations at project site and will activate and direct emergency response personnel as appropriate to the emergency. The Incident Controller will notify and correspond with the IRT Leader.

If required, the following personnel or teams are available to be activated at the site:

Incident Controller	HSE Support
Site Medical Centre	Site Contractor Management (as appropriate)
Fire Team Leader	Technical Support
Control Room	Scribe

Emergency Response Group

The Emergency Response Group (ERG) is responsible for coordinating the strategic response relative to any Tier 2 emergency arising out of the Drilling Operations. The ERG is activated and directed by the ERG Leader, and will assemble in the Emergency Coordination Centre (ECC).

If additional support is required for the Bashneft response, the following personnel should be mobilized as required:

Operation and Technical Coordinator	HSE Coordinator
Human Resources and Services Coordinator	Public Affairs Coordinator
Logistics Coordinator	
Security Coordinator	

8.4.6 Accident / Emergency Response Procedures

In order to deal with an emergency, a complete emergency procedure document will be prepared, which identifies the key personnel involved with their specific duties and responsibilities.

This emergency plan will include all requirements for dealing with such a situation, so that all the equipments and personnel can be mobilized in the shortest possible time.

- **Basic Features**

In the development of emergency procedures, following factors will be kept in view:

- Identification of situations i.e. what can happen and how it can happen.
- Identification of problem/ priority areas i.e. where it can happen.
- Identification of individuals i.e. who is to take action.
- Duties of individuals.
- System or equipment to be used and when to use it.
- Procedures for operating the system or equipment.

- **Basic Actions**

The basic actions required to handle any emergency are as follows:

- Operation of emergency shutdown of machineries and equipments.
- Maintenance of telephonic communication.
- Persons to be nominated for evacuation.
- Effective internal communication by public address system and walkie-talkie sets.

The purpose of this section is to provide “all Hazards” emergency response procedures to previously identified hazards and threats to Bashneft areas of operations and activities in the Block.

8.4.7 Emergency Control Centre

The establishment of a 'focal point' or 'EMERGENCY CONTROL CENTRE' to co-ordinate emergency response activities within a relevant area is essential. The emergency control centre will be sited in an area of minimum risk and will have easy and fast access to all major hazardous installations.

Emergency control centers will be equipped with the following:

- An adequate number of external telephones.
- An adequate number of internal telephones (if required).
- Notepads, pens and pencils.
- A list of external agencies likes Fire Brigade, Police, Hospitals, neighbouring Industries, Telephone no. etc.
- Source of safety and fire equipment.
- A nominal role of employees.
- First-aid kits.
- A list of KEY PERSONNEL with addresses, telephone numbers, etc. with their roles and responsibilities.

8.4.8 Recovery Procedure

Following an accident at project site, there shall be a full recovery procedure as part of the Emergency Plan. The recovery procedure shall deal with two distinct situations described below.

Emergency Plan: Onsite Crisis

Identification of Personnel and Assessment of Responsibilities on specific functions of Coordinating Authority: In order to effectively deal with onsite emergencies, following coordinators are required to co-ordinate for various activities during the emergency:

Incident Controller (IC)	Incident Controller (IC)
Operations Coordinator (IC)	Drilling Manager
Fire Fighting and Safety Coordinator (IC)	Fire and Safety In charge
Medical Officer / Paramedic Communications Coordinator	Medical In charge
Services Coordinator	Maintenance In charge
Logistics Coordinator	Administrative In charge

Role of Incident Controller

He/ She shall be the main guiding force in directing the emergency operations and will be in-charge of overall control of the disaster/emergencies. The actions include:

- On hearing the fire siren or on receiving information about the disaster, he will immediately take charge of the emergency control centre.
- To declare the category of the emergency after discussing with other team members.
- To instruct all the team members/ coordinators to make necessary arrangements.
- To inform mutual aid partners about the disaster.
- Instruct the safe shut down of system in consultation with emergency site in charge and key personnel.
- If necessary, arrange for evacuation of population in the neighbouring villages.
- Carry out search for causalities within the affected area and arrange for first aid/hospitalization of victims, if required.
- Ensure not to operate the plant/system unless it is declared safe by the competent person.
- Provide local authorities, media and Govt. adequate factual information through in-company modalities.

Emergency Plan: Offsite Crisis

Bashneft's responsibilities towards generation of the Offsite Emergency Plan:

- To provide basic information on Environmental and Social Impact Assessment to the Local Administration Authority, Police, Fire Brigade, Doctors, surrounding Industries and the Public and to appraise them on the consequences and the protection/prevention measures and control plans and seek their help to manage the emergency.
- To assist the District Authorities in preparing the Off-site Emergency Plan.

An off-site emergency plan organization has essentially two parts:

- Formation of the Local Crisis Group: This Group will be responsible for the management of any emergency confined to the local area.

Since, the actual offsite plan requires the participation of outside agencies, this report does not dwell further on the issue.

8.4.9 Communication Systems Network

An efficient and reliable communication system is required for the success of the emergency plan. The efficient communication system is required to alert:

- Emergency Authorities and Services.
- Neighbouring area and public in the vulnerable zone.

The communication system requires the following:

- Communication between Control Room and Emergency Services, Meteorological Station and the mutual aid members.
- Mobile Communication with the Control Room for alerting the employees.
- Telephone lines.

A communication flow chart is to be prepared and kept in the Control Room. An up-to-date Telephone Directory of key personnel concerned with the emergency should be available at all times. These matters should be documented and kept within the Emergency Plan manual.

The Emergency Plan Manual is required to maintain a record of police stations, hospitals and fire brigade stations in the area to seek assistance in dealing with emergency situations. The emergency team of Bashneft should liaise with these agencies and with District officials and furnish them information on the possible hazards, extent of damage and actions to be taken by them during such emergencies.

8.4.10 Role of External Services

Police

The Police should assist in cordoning off the accident site, organize evacuation and moving any seriously injured people to hospitals. They shall divert traffic as and when necessary.

Fire Brigade

The fire brigade shall organize to fight fires and provide assistance, as and when required.

Hospitals and Doctors

Hospitals and doctors should treat any injury, which may primarily be burn injury.

8.4.11 Mutual Aid from Neighbouring Installations

Bashneft may also depend on the facilities of the other industries in the locality for handling emergencies. They will have to arrange with the local administration for providing services, such as fire fighting and medical needs during incidents particularly in the nearby regions.

Telephone links with neighboring industries and customer facility control rooms should be established.

8.4.12 Public Information System

During a crisis following an incident, the people of the area and a large number of media representatives would like to know about the situation from time to time and the response of the District Authority to the crisis. It is important to give timely information to the public in order to prevent panic and rumors. The emergency public information could be carried out in three phases.

Before the Crisis

This will include the safety procedure to be followed during an emergency through posters, talks and mass media in different languages including local language. Leaflets containing do's/don'ts will be circulated to educate the people in the vicinity time to time.

During the Crisis

Dissemination of information about the nature of the incidents, actions taken and instructions to the public about protective measures to be taken, evacuation etc. are the important steps during this phase.

After the Crisis

Attention should be focused on information concerning restoration of essential services, travel restrictions, etc.

8.4.13 Fire Fighting System

Accidental Release of fuel/chemical, short circuit and other operational activities can lead to fire. In order to deal with such possible situations, there is a need for constant preparedness to mobilize fire fighting and control resources in minimum time. There should be control of all fire fighting resources in the affected areas under the Fire and Safety Officer. The operational response will be coordinated from the Central Control Room. The planning for firefighting should be as follows:

Before the Crisis

- Proper road and means of escape should be identified.
- Considering the possible hazards, there must be adequate water supply.
- Training of the fire fighting personnel.
- Provision of adequate availability of fire fighting facilities is important.

During the Crisis

Immediate response to an incident should be coordinated by the Control Room by matching all the resources. In a major incident having wide off-site implications, large area of drilling site may be affected, necessitating concurrent fire fighting operations at a number of places. In this case, the whole area may be divided in different fire zones.

8.4.14 Relief to the Victims

Post-incident activities include the relief to the victims by the owner, who has control over Drilling Operations, to pay specified amounts to the victims as interim relief. After proper assessment of the incident, he/she may invite applications for relief, conduct an enquiry of the claims and arrange for payments of the relief amounts to the victims.

8.4.15 Checklist For Capability Assessment

The checklist will help in assessing the preparedness, prevention and response resources capabilities. The points included in the checklist are only indicative and there is a need to closely examine the local requirements while preparing the checklist.

For good control and management of an incident, there are three important requisites.

- Defined Organization;
- Effective means; and
- Trained people.

The organization must be properly structured for routine as well as emergency purposes with clear understanding of duties and responsibilities. The structure has to consider an execution and speedy implementation of the response plans; while at the same time, it should be flexible enough to tune itself to the fast changing situations. All plans and procedures for emergency handling should be established.

Means include equipment and materials, transport and communication. Identification, storage and upkeep of these means are essential for speedy implementation of the response plans. People form the vital element in emergency response. Experience, education and training should help make this vital element effective. In general, the duties, responsibilities and competence of the individual team are defined by the description of the function.

A broad outline of responsibilities and duties of different managers concerning the emergency management plan are given below in **Table 8.5**.

Table 8.5: Roles and Responsibilities of Various Emergency Response Team Members

Role	Responsibility
Incident Controller (IC)	• Responsible for overall control of emergency. • Liaise with external agencies for any additional help. • Reports to statutory agencies about the emergency.
Operations Coordinator (OC)	• Responsible for control of emergency at site. • Liaise with fire and safety coordinator in effective control of emergency.
Fire and Safety Coordinator	• Responsible for carrying out fire fighting and rescue work at the incident site. • Co-ordinate with IC and other teams for effective control in minimum possible type.
Services Coordinator	• Responsible for upkeep of equipments and facilities. • Provides necessary support for identifying and rectifying the faults and bring the systems online.
Communication Coordinator (CC)	• Ensure proper working of the communication facilities during an emergency. • Responsible for internal and external communication as instructed by CC. • Log the sequence of events and actions taken.
Logistics Coordinator	• Responsible for providing support for the transportation of men, material, food etc. • Liaise with chief coordinator for mobilizing external emergency services.

Role	Responsibility
Medical In charge	• Responsible for treatment of casualties involved in the incident during emergency control operation. • Liaise with hospitals for future treatment.

8.4.16 Warning System

In an off-site emergency plan, one of the most important prerequisites is a good 'Warning System'. Efficient warning system will save lives, prevent injuries and reduce losses. The Emergency Coordinator - Onsite in consultation with Emergency Coordinator Offsite will decide the appropriate warning system and implement it.

The warning systems are of the following types:

- Disaster Warning (Maximum Credible Loss Scenario) High pitched continuous wailing siren.
- Fire/Toxic Release.
- All Clear.

Depending upon the nature of hazards and the area affected, other methods of warning may be used as follows:

- Out-door warning sirens.
- Public address system with police.
- Telephone contact with schools and other organizations/public institutions.
- Information to be provided at common gathering places such as village canteens, shops, etc.

8.4.17 Services Support System

A major off-site incident may affect Drilling Operations and the surrounding areas. Hence in addition to the communication, warning, public information, fire fighting system, following additional service support will be required:

- Health and medical services.
- Transportation services.
- Security and police.
- Mutual aid services.

A telephone directory containing the contact numbers of all these support services should be documented and be part of the offsite emergency plan.

8.5 ENVIRONMENTAL MONITORING PLAN

An environmental monitoring plan is recommended to monitor environmental parameters during drilling and Post Drilling Phase of the project. An environmental monitoring plan is recommended to monitor environmental parameters during drilling and Post Drilling Phase of the project. The monitoring plan is given in **Table 8.6** and **8.7**.

Table 8.6: Recommended Environmental Monitoring/Audit Protocol - Drilling Operation

Receptor	Location	Monitoring Mechanism	Monitoring & Reporting Frequency
Natural Resource	At Project site	Inventory of each type of material (including water consumption) and fuel (used for power) quantity	Daily during drilling phase
Ambient Air Quality	At project Location	Monitoring of PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOCs and HC.	Once in a month
Noise & Vibration	At Rig Site, near DG sets and drilling pumps.	Noise level monitoring	Once in a month
Drilling wastes	At drilling site	Quantification and characterization of drill cuttings	• Quantity of wastes to be recorded on daily basis. • Characterization of the waste to be done every month.
Wastewater Generation	At Project Site	Waste water generation rate	Quantity to be recorded every day.
Oil wastes	At Drilling Site	Spent oil from engines.	A logbook should be maintained daily during drilling phase. If no spent oil is produced, the same should be noted in the logbook.

Table 8.7: Recommended Environmental Monitoring Protocol - Post Drilling

Receptor	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
Drilling waste	At project Location	Quantification of drill cuttings and safe disposal as per norms.	At the end of the drilling operation.

The post operational monitoring programme will be carried out under the supervision of Block operator (Bashneft).

8.6 ENVIRONMENTAL TRAINING

Environmental training will help to ensure that the requirements of the EMP are clearly understood and followed by all project personnel throughout the project period. The primary responsibility for providing training to all project personnel will be that of the HSE Officer.

The HSE Officer will train the site staff, drilling contractor and other staff engaged by block operator for the project. Training will cover all staff levels, ranging from the

management and supervisory to the skilled and unskilled categories. The scope of the training will cover the proposed mitigation measures, EMP and its implementation, with special emphasis on sensitizing the project staff to environmental, social and ethnic context of the area.

The Environmental Engineer will conduct on-job live risk assessment trainings for the block operator's staff (including HSE coordinator & Company personnel) and the contractor staff to better address environmental risks and their mitigation measures. Block operator has a well-defined Health, Safety and Environment Policy, which explains health and safety measures and need to be taken during entire course of work and in general work practice.

8.7 RESTORATION AND REHABILITATION

Well Abandonment

After well testing and evaluation, a decision on whether to abandon or develop the well, will be taken. If no indications of a commercial quantity of gas are encountered either before or after testing, the well will be declared dry, accordingly plugged and abandoned, and the site restored in line with local regulations and good industry practice.As a minimum, the following steps will be undertaken to restore and rehabilitate the area:

- The well mouth will be capped at ground level;
- All concrete structures will be broken up, and the debris disposed off as per the regulatory requirements;
- All other waste products, solid and liquid, will be disposed of in accordance with the requirements of the EIA and will be treated to render them harmless;
- All fencing and access gates will be removed;
- All pits whose contents would show regulatory compliance for on-site disposal, at the time of site closure, will be backfilled and closed out as per the legal requirements;
- Waste products,solid and liquid, will be disposed of in accordance with the waste management plan.

Well Suspension

After well testing and evaluation, if it is decided that the block is to be developed, the well site and the approach road will be maintained. The site will not be restored to its original condition until a decision is taken on the environmental assessment of the field development. Until then, the fencing will be left intact and the site sealed and protected. The road will be maintained but barriers installed at suitable locations will control access to it.

8.8 BUDGET FOR ENVIRONMENTAL POLLUTION CONTROL MEASURES

The budget of environmental pollution control measures is given below **Table 8.8.**

Table 8.8 Pollution Control Measures Budget

Sl. No.	Pollution Control Measures	Total Cost (in USD/Kyat) *
1.	**Wastewater and effluent Management** Septic Tank	USD 800 (Kyat1,217,600).
2.	**Fuel, Lubricant and Chemical Management**	As per actual cost

Sl. No.	Pollution Control Measures	Total Cost (in USD/Kyat) *
3.	**Noise and Vibration Mitigation** • Acoustic Enclosure and Personal Protective Equipments • Noise Monitoring • Maintenance cost of equipments	• As per Actual cost. • USD 400 (Kyat 608,800) per location. • USD 150 (Kyat 228,300)
4.	**Solid Waste Management**	• As per actual cost
5.	**Air emission mitigation** • Maintenance of D.G. sets • Air monitoring	• USD 11000 (Kyat 16,742,000) per DG set. • USD 2500 (Kyat 3,805,000) per location.
6.	**Training to Staff**	• USD 750 (Kyat 1,141,500) per location.

**Note: 1 USD = 1522 Kyat.*

The number of locations shall be envisaged during drilling operation.

9

PUBLIC/STAKEHOLDER CONSULTATION AND DISCLOSURE

9 PUBLIC/STAKEHOLDER CONSULTATION AND DISCLOSURE

9.1 PUBLIC CONSULTATION AND DISCLOSURE

The proposed well site lies in the Block EP-4 area in Pyay District of Bago Region in Myanmar. As part of the EIA for the proposed project activity, Public Consultations were carried out at 4 locations within the study area. In addition to that, public view of village heads and other administrative & community representatives was also captured through meeting in the Administrative office in Padaung Township.

The Public Consultations were carried out by ACE Team in November 2017 and 2019, in the presence of officials from the Myanma Oil and Gas Enterprise (MOGE), Govt. of Myanmar, Officials from the respective Administrative Office (Padaung) and representatives of Bashneft.

The objectives of the Public Consultations were as follows:

- Inform citizens, groups and organizations about the proposed project.
- Record the apprehensions of the public, if any.
- Ensure all views are considered in planning and decision making for the proposed project.
- Create joint visions that consider multiple interests and concerns.
- Initiate action to resolve issues and problems, if any.

The detailed information about the consultations conducted and the outcome of the same are given below in subsequent sections.

9.1.1 Meeting at Government Administrative Office, Padaung

On 7th November 2017, ACE team conducted a meeting with administrative officials, village heads and community representatives in Padaung Township, and their perception on the proposed drilling activity in the study area was discussed and recorded. Stakeholder Consultations were conducted in three villages of block EP-4 area. The outcomes of the public consultation are discussed in **Table 9.1** below.

Table 9.1: Outcomes of Public Consultation at Padaung Township

Component	Public Opinion
Employment	The representatives who had participated in the discussions were found to be hopeful that the proposed project activity will generate employment opportunities for the people living near to the project site.

Component	Public Opinion
Natural Resources	It was noted that all the participants were of the opinion that there will be no damage to the natural resources in the area due to the proposed project activity.
Environmental Pollution	Some of the community representatives expressed their concern over increase in pollution levels in their area due to elevated noise levels, heat energy, water contamination, solid wastes, etc. caused by the project activities. However, majority of the people who participated in the meeting opined that there may not be much adverse impact on local environment.
Local Economy	Local economy is expected to get a boost with the initiation of proposed project. This is what local people in the surrounding villages of the study area feel.
Increased Traffic	Most of the representative had informed that they don't expect a lot of traffic movement leading to road congestion in the study area due to proposed drilling activities.
Community Health & Safety	Some of the participants had expressed their concern over the health and safety of the community living in the study area. However, by large, it was observed that community members feel that there will not be much threat to health and safety of local population while the project is in operation.
Overall impact of project activities	The overall opinion of community members was that the project will be good for local people.

9.1.2 Meeting at Department of Agriculture, Paudaung

On 5th November 2019, ACE team visited Department of Agriculture in Paudaung region. Following information obtained from the meeting:

1. The main crops are paddy, green gram, black gram and beans,
2. Duang Myat Nar, Nga Se Pay and Swe Daw village have 1475, 618 and 1492 acres of land respectively, for paddy cultivation,
3. The people have record of their agricultural land, farmland and fallow land.
4. The department conduct soil sampling as well.

9.1.3 Meeting at District Fisheries Department, Pyay

On 5th November 2019, ACE team visited District Fisheries Department, Pyay. Following information obtained from the meeting:

1. The main fishes in the region are Rohtee, Rohu, Mrigal etc.,
2. Fish breeding seasons are May, June and July, and fishing seasons are November and February.
3. The Fisheries department do not have any authorization on fishermen who are fishing in Dan area.
4. According to the fisheries department, fishing in Dan area is not allowed.

9.1.4 Public Consultations in Paudaung Township

The public consultation was done to record the views of village heads, community representatives and other concerned departmental bodies of project area. The consultations were done in two phases:

i) First Phase – from 7th to 10th November 2017 in Dant tha Lu, Phayar Paw & Taung Kwin Bo village and,
ii) Second Phase- from 2nd to 5th Nov 2019 (in Duang Myat Nar, Ywar Thit, Kyoet Kone, Taung Boh Kwin, Myaung Shea and Yone Pu village).

Observations of Stakeholder Consultations in village tracts near study area:

The observations of the Public consultation held in the above listed village**s** are given below:

Components	Observations
Houses	In most of the villages, houses are made up of bamboo, timber and brick.
Occupation	The villagers are found to be mostly farmers growing paddy, corns, beans and some vegetables. Almost every household is noted to have livestock animals e.g. pigs, goat, hen, cows, duck, etc. Some people in Phayar Paw village are also carrying out fishing activities; however, they are used for domestic use only.
Religion and Festivals	Major religion is the study area is Buddhism. There are few places of worships called *'pagodas'*; for the villagers in these tracts. There is also a small minority of people who follow Christianity. Churches are noted to be present only in **Dant tha Lu** village. The important festival in the region is Myanmar Traditional Festival, along with Chin Traditional Festival and Christmas at some places.
Vegetation	Natural vegetation of the villages where consultation was carried out was similar. Villages in **Dant Tha Lu** mostly comprise mango and papaya trees, small sized teak plantation and grasses. At **Phayar Paw** village, Tamarind, Banana and Palm trees were found along with grasses. All the villages were noted to have some medicinal plants as well.
Languages Spoken	Major language spoken in the study area is Burmese and Chin. Chin is also an ethnic group living in all the three villages where consultations were conducted.
Source of Drinking Water	The main drinking water source in the study area is groundwater. However, some people are also dependent on rainwater. Local villagers were found to dispose off their domestic effluent through septic tanks.
Basic Amenities	• The villages are lacking basic facilities like healthcare centers, post offices, continuous electric supply, etc. It was noted that at few locations, local people have installed solar panels for generation of electricity. • Healthcare facilities were only found in Dant Tha Lu village. • The road conditions in the villages are poor. They are un-paved and narrow. • Telephone connectivity is unpredictable. However, some cellular networks such as MPT and Telenor are known to provide services in the villages. • It was noted that local people were expecting job creation and better living standards once the proposed drilling activities start. They wanted that project proponents help local villagers in providing electricity and improved roads for better connectivity with the nearby towns and cities. Most villagers anticipate that there won't be much negative impact on the native environment.

Photo Plate 9.1 to 9.6 shows the nearby villages.

Photo Plate 9.1: A roadside shop near Dant Tha Lu village

Photo Plate 9.2: Location of Consultation at Phayar Paw

Photo Plate 9.3: Women in the household in the study area

Photo Plate 9.4: Poultry carried to nearest market

Photo Plate 9.5: A Village monastery in Yae Win

Photo Plate 9.6: View of Phayar Paw village