

ENVIRONMENTAL IMPACT ASSESSMENT

FOR

**THE PROPOSED 3D SEISMIC SURVEY IN BLOCK 10BB BY
TULLOW KENYA B.V.**



Prepared by
Earthview Geoconsultants Limited
P.O. BOX 10366-00100, Nairobi, Kenya
Tel: 254-20-2496208
Email: earthview@geologist.com

December 2012



PROJECT REPORT

FOR

**ENVIRONMENTAL IMPACT ASSESSMENT OF THE PROPOSED 3D SEISMIC
SURVEY IN BLOCK 10BB BY TULLOW KENYA B.V.**

December 2012

Prepared By:

EarthviewGeoconsultants Ltd.,
Utumishi Co-operative House,
6th Floor Mamlaka Road,
P.O BOX 10366-00100,
Nairobi, Kenya.
Email: earthview@geologist.com

For:

Tullow Kenya B.V.,
Westlands Office Park,
Waiyaki Way,
P.O BOX 63298-00619,
Nairobi, Kenya.

Submitted by
Position
Signed
Date 21/1/13

We the undersigned, confirm that the contents of this report are a true representation of the Environmental Impact Assessment Project Report for the proposed 3D Seismic Survey in Block 10BB by Tullow Kenya B.V.

Prof. Norbert Opiyo-Akech
(Team Leader and Director)

Sign.....
Date..... 21/1/13

Dr. Daniel Olago
(Lead Expert and Director)

Sign.....
Date..... 21/1/13

EXECUTIVE SUMMARY

This EIA has been prepared by Earthview Geoconsultants (K) Ltd for Tullow Kenya B.V (herein after referred to as "Tullow"), the project proponent. The EIA report provides a critical examination of issues considered important in the fulfilling the requirements of a clean, sustained and healthy environment. This report is primarily aimed at establishing the impacts of the proposed 3D seismic survey project to be conducted in Block 10BB, Turkana South and Turkana East Districts in Northern Kenya by Tullow. The methodology used includes review of available literature, meetings and consultations with local stakeholders and government officials, interviews and public consultation with the local residents.

Seismic surveys are the primary tool utilized during the exploration of hydrocarbons in both onshore and offshore areas. A seismic survey is conducted by creating an energy wave commonly referred to as a 'seismic wave' on the surface of the ground along a predetermined line, using an energy source. This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones are used to detect the waves and recorded for analysis. In this case, the seismic waves were induced by vibrating truck-mounted heavy plates on the ground. The specialized trucks are known as "Vibroseis". By analyzing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface, formations can be mapped and potential oil or gas deposits identified.

Environmental impact assessment is used to: facilitate management and control of environmental degradation during the seismic survey; assess compliance with relevant statutory and regulatory requirements and raise awareness of and commitment to environmental policy by project staff, the community and other concerned parties through public meetings. The environmental parameters assessed during the present EIA include physiography, geology and geological setting, soils and soil characteristics, climatology and air quality, surface and ground water potential and quality, flora and fauna, land resources, visual aesthetics, noise and vibrations, solid wastes and effluents, socio-economic and health and safety issues.

The report consists of suggested Environment management and monitoring plan that should be followed and the proponent should strive to set high environmental standards at all times for the purpose of fulfilling the requirements for a clean, sustained and healthy environment. Thus from an environmental point of view, it is therefore objective to conclude that the project is viable and will not adversely affect the environment and the stated recommendations in the project report should be considered during development and implementation of the 3D seismic survey operations.

TABLE OF CONTENTS

LIST OF FIGURES	VIII
LIST OF PLATES	VIII
LIST OF TABLES	VIII
ABBREVIATIONS.....	X
NON TECHNICAL SUMMARY	XI
1. INTRODUCTION.....	1
1.1 INTRODUCTION.....	1
1.2 DEVELOPER IDENTIFICATION	1
1.3 ACTIVITIES OF TULLOW OIL PLC: AN OVERVIEW	1
1.4 BRIEF SITE DESCRIPTION.....	1
1.5 PROJECT BACKGROUND, OVERVIEW, JUSTIFICATION AND OBJECTIVES.....	3
1.5.1 Project Background.....	3
1.5.2 Overview of the Project	3
1.5.3 Project Justification.....	3
1.6 PURPOSE OF THE EIA	5
1.6.1 The Mandate of NEMA	5
1.6.2 Requirements and Scope of Work for the EIA.....	5
1.6.3 The EIA Review and Approval Process	6
1.7 THE EIA TEAM.....	6
1.8 OBJECTIVES OF THE EIA PROJECT REPORT	7
1.9 TERMS OF REFERENCE (TOR)	8
2. PLANNING, POLICY AND LEGISLATIVE FRAMEWORK	9
2.1 THE CONSTITUTION OF KENYA, 2010	9
2.2 THE POLICY FRAMEWORK	9
2.2.1 Environment and Development Policy.....	9
2.2.2 National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999)	11
2.2.3 energy Policy (Sessional Paper No.4 of 2004)	11
2.2.4 Land Policy (Sessional Paper No. 3 of 2009)	12
2.2.5 Mining Policy 19451	12
2.2.6 Health Policy.....	12
2.2.7 Economic Recovery for Wealth and Employment Creation Strategy.....	13
2.2.8 Kenya Vision 2030	13
2.3 THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY.....	14

2.3.1	The Environmental Management and Co-ordination Act, 1999	14
2.3.2	The EIA Guidelines and Administrative Procedures.....	15
2.4	KENYA LEGISLATION, REGULATIONS, STANDARDS AND INTERNATIONAL CONVENTIONS.....	15
2.5	INTERNATIONAL PRACTICES AND CONVENTIONS.....	33
2.5.1	International Best Practices	33
2.5.2	International Conventions	34
2.6	TULLOW OIL POLICIES	37
3.	PROJECT DESCRIPTION	41
3.1	INTRODUCTION.....	41
3.2	PROJECT LOCATION	41
3.3	OVERVIEW OF 3D SEIMIC SURVEY PROGRAMME.....	41
3.3.1	Principles of Seismic Surveys.....	41
3.4	THE PROPOSED SEISMIC SURVEY	43
3.4.1	Seismic Survey Objectives	43
3.4.2	Seismic Survey Scale and Extent.....	43
3.4.3	Seismic Survey Logistics	46
3.4.4	Data Acquisition Methods and Equipment.....	47
3.4.5	personnel and facilities	48
3.4.6	Occupational Health and Safety.....	48
3.5	WATER SUPPLY.....	49
3.6	EMISSION AND WASTE MANAGEMENT	49
3.6.1	Emissions.....	49
3.6.2	Wastes	50
3.7	DECOMMISSIONING/ABANDONMENT	54
3.7.1	General activities.....	54
4.	PERMITS	56
5.	ENVIRONMENTAL AND SOCIAL IMPACT ASSSSMENT PROCESS AND METHODOLOGY.....	57
5.1	the ESIA PROCESS.....	57
5.2	ENVIRONMENTAL AND SOCIAL PARAMETERS ASSESSED	58
5.3	COLLECTION OF BASELINE DATA.....	60
5.3.1	Overview of Methods.....	60
5.3.2	Physiography and Geology	60
5.3.3	Soils.....	60
5.3.4	Climate.....	60
5.3.5	Air Quality.....	61

5.3.6	Surface and Ground Water Resources	61
5.3.7	Terrestrial Environment	61
5.3.8	Land Resources and Parks.....	61
5.3.9	Visual Aesthetics	61
5.3.10	Noise and Vibrations	62
5.3.11	Solid and Liquid Wastes.....	62
5.3.12	Public Consultations and Socio-Economics.....	62
5.3.13	Health and Public Safety	63
5.3.14	Key informant interviews	64
6.	ENVIRONMENTAL AND SOCIAL BASELINE	65
6.1	Physiography and Geology	65
6.2	Soil	65
6.3	Climate.....	65
6.4	Air Quality.....	65
6.5	Surface and Ground Water Resources.....	66
6.6	Terrestrial Environment	66
6.7	Land Resources	66
6.8	Visual Aesthetics	66
6.9	Noise and Vibrations	66
6.10	Solid and Liquid Wastes	67
6.11	Socio-Economics baseline	67
7.	AREA OF INTEREST BASELINE	69
7.1	Climate.....	69
7.1.1	Wind	69
7.1.2	Rainfall and Temperature.....	69
7.2	Surface water	70
7.3	Ground water.....	70
7.4	Soil	71
7.5	Land-cover	76
7.5.1	Topography	77
7.5.2	Habitat	79
7.5.3	Biodiversity	85
7.6	Land-use.....	90
7.6.1	Administrative Structure	90

7.6.2	Land tenure.....	91
7.6.3	Existing infrastructure	91
7.6.4	Wage earning activities.....	92
7.6.5	Settlements, homesteads, built environment.....	92
7.6.6	Main crops.....	94
7.6.7	Grazing areas	95
7.6.8	Other industry.....	95
7.6.9	Subsistence activities	95
7.6.10	Cost of living	95
7.6.11	Unions, co-operatives, farming associations	96
7.6.12	Value chains	96
7.6.13	Cultural Property	96
7.6.14	Ecosystem services.....	96
7.6.15	Designated lands.....	97
7.7	public consultations	97
7.8	Head-line Issues.....	100
7.9	Spatial and Temporal Constraints	101
8.	ASSESSMENT OF IMPACTS.....	102
8.1	General Methodology.....	102
8.2	ENVIRONMENTAL AND SOCIAL ASPECTS AND IMPACTS IDENTIFICATION FOR THE SEISMIC SURVEY.....	102
8.3	IMPACTS ASSESSMENT AND MITIGATION FOR THE SEISMIC SURVEY.....	104
8.3.1	Physiography and Geology	104
8.3.2	Soils.....	105
8.3.3	Air Quality.....	105
8.3.4	Surface and Ground Water Resources	106
8.3.5	WATER Quality.....	107
8.3.6	Terrestrial Environment (Habitats, Flora, and Fauna)	108
8.3.7	Land Resources	108
8.3.8	Archaeological, Historical and Cultural Sites	109
8.3.9	Visual Aesthetics	109
8.3.10	Noise and Vibrations	110
8.3.11	Solid and Liquid Wastes.....	111
8.3.12	Social Characteristics	111
8.3.13	Economic Characteristics	112
8.3.14	Occupational Health and Safety.....	113
8.3.15	Security and Public Safety.....	113

8.3.16	Construction of the Campsite.....	114
8.3.17	Fuelling Station	115
8.3.18	Camp Clinic	115
8.3.19	Water Borehole Drilling.....	116
8.4	CUMULATIVE IMPACTS IN THE PROJECT AREA.....	125
8.5	SIGNIFICANCE OF IMPACTS	125
9.	ALTERNATIVES.....	126
9.1	INTRODUCTION.....	126
9.2	PROJECT SITE ALTERNATIVES.....	126
9.3	SURVEY DESIGN ALTERNATIVE TECHNOLOGIES AND RECOMMENDATIONS.....	126
9.3.1	Acoustic Source Technologies	127
9.3.2	Line Cutting Technologies	129
9.3.3	Access Road Technologies.....	130
9.3.4	Seismic Data Recording Equipment.....	130
9.3.5	Communications Equipment	130
9.3.6	Surveying Equipment	130
9.3.7	Transport Equipment.....	130
10.	ENVIRONMENTAL MANAGEMENT PLAN	132
10.1	INTRODUCTION.....	132
10.2	OBJECTIVES OF THE EMP.....	132
10.3	PROJECT DESCRIPTION	133
10.4	APPLICABLE LEGISLATION AND REGULATIONS	133
10.5	TULLOW POLICIES AND PROCEDURES.....	133
10.6	ROLES, RESPONSIBILITIES AND TRAINING.....	133
10.7	COMMUNICATION WITH STAKEHOLDERS AND GRIEVANCE MECHANISM	134
10.8	AUDITING	134
10.9	THE ENVIRONMENTAL (AND SOCIAL) MANAGEMENT PLAN (EMP) FOR THE SEISMIC SURVEY	135
10.9.1	Physiography and Geology	137
10.9.2	Soils.....	138
10.9.3	Air Quality.....	140
10.9.4	Surface and Groundwater Resources.....	142
10.9.5	Water Quality.....	145
10.9.6	Terrestrial Environment (Habitats, Flora, and Fauna)	146
10.9.7	Land Resources	149

10.9.8 Archaeological, Historical and Cultural Sites	150
10.9.9 Visual Aesthetics	152
10.9.10 Noise and Vibrations.....	153
10.9.11 Solid and Liquid Wastes	156
10.9.12 Social Characteristics.....	158
10.9.13 Economic Characteristics.....	159
10.9.14 Occupational Health and Safety.....	160
10.9.15 Security and Public Safety	163
10.9.16 Construction of the Campsite	164
10.9.17 Fuelling Station	166
10.9.18 Camp Clinic	167
10.9.19 Water Borehole Drilling	168
10.10 OTHER GENERAL REQUIREMENTS AND TRAINING ISSUES.....	171
10.10.1 Occupational Health and Safety Plan	171
10.10.2 Vehicle Traffic Management	171
10.10.3 Waste Management Plan	171
10.10.4 Spills Prevention and Response Plan.....	172
10.10.5 Emergency Response Plan (ERP)	172
10.10.6 Environmental Awareness Plan.....	173
10.11 Campsite Decommissioning Plan	173
10.12 COST OF THE PROJECT.....	174
11. CONCLUSIONS AND RECOMMENDATIONS.....	175
11.1 SUMMARY OF THE PROJECT COMPONENTS.....	175
11.2 RECOMMENDATIONS.....	175
APPENDICES.....	177

LIST OF FIGURES

Figure 1.1: Location of the project area	2
Figure 1.2: Proposed 3D seismic survey polygons in Block 10BB	4
Figure 3.0: Proposed 3D seismic survey area in Block10BB	41
Figure 3.1: Onshore Seismology Using a Vibrator Truck as a Seismic Energy Source (Source: Adapted from http://www.cougarlandservices.net/landowner)	42
Figure 3.2: Schematic diagram of 3D seismic technique(Source: Adapted from http://static.shell.com/)	42
Figure 3.3: 3D Seismic cube (http://www.unil.ch/igp/page22625_en.html)	43
Figure 5.1: The ESIA process.....	58
Figure 7.0: Map identifying water points in Block 10BB	71
Figure 7.1: Soil map of the project area.	72
Figure 7.2 Vegetation of the study area	77
Figure 7.3 Geology of the study area	79
Figure 7.4: Administrative boundaries of Block 10BB	91
Figure 7.5: Population distribution in the project area	93

LIST OF PLATES

Plate 5.1: A public meeting at Nakukulas Village	63
Plate 5.2: A public meeting at Loperot Village	63
Plate 7.1: (a) Nimeyana Lugga east of Lokichar town and (b) Acacia tortilis along a lugga around Katamanak hills housing white headed buffalo weavers' nests.....	70
Plate 7.2: Community Borehole dug by Tullow in Nakukulas area	70
Plate 7.3: Mapping unit Y10 at Marethe area showing sandy soils with low organic matter and shallow rills that are common in the unit. The vegetation consists of dwarf shrubs and Acacia tortilis in the background.	73
Plate 7.4: Mapping unit Ps28 in the project area exhibiting sheetwash erosion (bounded area in black with sand deposited on lower area: yellow arrow) and shallow lugga interfluvies bounded by Indigofera spinosa dwarf vegetation (red arrow).....	74
Plate 7.5: Mapping unit Ux10 found in the north east of Lokichar town, exhibiting surface quartzite and basaltic pebbles. Notice the deeply dissected topography and the concentration of vegetation along the interfluvies.....	75
Plate 7.6: Katamanak hills south west of the project area	76
Plate 7.7 a) Uplands north east of Lokichar town and b) The foot slope of Katamanak hill south west of Lokichar town.	78
Plate 7.8: Katamanak footslope showing Acacia-Commiphora dominated bushland.....	80
Plate 7.9: Acacia-Commiphora bushland around Kawawar area.....	81
Plate 7.10: Kamonukwee Area vegetation type	81
Plate 7.11: Nakipomea area habitat	82
Plate 7.12: Nakukulas and Enkalale Angimamuki Vegetation type a) Aloe secudiflora, and b) Delonix elata	82
Plate 7.13: Caraluma acutangula within Sabaa-Atot-atirae vegetation type	83
Plate 7.14: Calotropis procera within Kapetatuk/Aprute habitat.....	83
Plate 7.15: (a) Ground squirrel burrow and (b)an African hare (red arrow)	85
Plate 7.16: (a) Locust, (b) beetle shell and (c) an anthill in the project area.....	86
Plate 7.17: (a) a Skink and (b) Savannah monitor lizard	87
Plate 7.18: (a) Gabar chanting goshawk, (b)Red and yellow barbet, (c) Sparrow weaver (at nest), (d) White bellied bustard, (e) Grey parrot and (f) Yellow billed hornbill....	88
Plate 7.19: An access road to Nakukulas village	92
Plate 7.20: Nakukulas and Kalapata primary schools.....	94
Plate 7.21: Livestock at a water pan in Nakukulas	95

LIST OF TABLES

Table 1.1: The EIA team composition	7
---	---

Table 2.1: Kenyan Legislation, Regulations, Standards and International Conventions Relevant to the Project	16
Table 3.1: Biomedical and pharmaceutical waste handling (NEMA Waste Management Regulations (2006)).	51
Table 3.2: Waste streams and management solutions	52
Table 7.1: Order of Key Meetings Held in Block 10BB	Error! Bookmark not defined.
Table 7.2: Demographic data by district.....	92
Table 7.3: Built areas in the project area.....	93
Table 8.1: 3D Seismic survey project environmental and social aspects and impacts. ...	102
Table 8.2: Existing environmental pressures and potential impacts of onshore (land) project operations on environmental and social factors in the project area (see Chapter 4, section 4.5 for impact assessment criteria and rating)	118

ABBREVIATIONS

CLO	Community Liaison Officer
CSR	Corporate Social Responsibility
DHMBs	District Health Management Boards
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
EMP	Environmental Management Plan
E & P	Exploration and Production
ERP	Emergency Response Plan
EPR	Exclusive Prospecting Rights
FTSE 100	Financial Times Stock Exchange 100
GDP	Gross Domestic Product
GVEP	Global Village Energy Partnership
HSE	Health Safety and Environment
IAEA	International Atomic Energy Agency
IFC	International Finance Corporation
KPR	Kenya Police Reserves
KWS	Kenya Wildlife Service
MSDS	Material Safety Data Sheet
NEMA	National Environment management Authority
NGOs	Non-Governmental Organisations
NHSSP	National Health Sector Strategic Plan
NOCK	National Oil Corporation of Kenya
OGP	Oil and Gas Producers
OHS	Occupational Health and Safety
PPE	Personal Protective Equipment
PRSP	Poverty Reduction Strategy Paper
PSC	Production Sharing Contract
SPRP	Spill Prevention and Response Plan
TOR	Terms of Reference
UNEP	United Nations Environment Programme
WRMA	Water Resource Management Authority

NON TECHNICAL SUMMARY

Tullow Oil PLC is one of the world's largest independent oil and gas exploration companies, and is an FTSE100 company. The Group has over 100 licences in more than 22 countries, with operations in Africa, Europe, South Asia and South America. Tullow has been successfully operating in Africa since 1986 where it is already a dominant player following exploration success in Ghana and Uganda. This EIA was carried out for Tullow Kenya B.V. (Pin P051340553u), a subsidiary company of Tullow Oil PLC, with respect to the proposed 3D seismic survey in the project area.

Block 10BB is located in North Western Kenya and covers the southern part of Lake Turkana, the southern part of the Kerio Basin and most of the Lokichar Basin. These Tertiary age half-graben basins, trend generally north to south. The 3D seismic survey project will be conducted in Block 10BB that covers the entire Lokichar and Lokori Divisions and part of Keiyo Division in Turkana Central in a total area of approximately 12,491 km². The block has a fragile ecosystem with up to 90% of the landmass being arid while the remaining 10% semi-arid. Several dry riverbeds including the River Kerio bed traverse the vast area. The study area is rural, sparsely populated and under-developed.

The project is an exploratory activity for determination of potential oil and gas resources in the assigned area (Block 10BB) in Northern Kenya. Seismic survey techniques vary according to the environment and are guided by various international standards. In this regard, the best environmentally acceptable practises would be employed to ensure minimum negative impacts on the environment.

The incorporation of findings and recommendations of this EIA at the various stages of the project activity, and adherence to the EMP would ensure environmental sustainability.

Earthview Geoconsultants (K) Ltd. was contracted by Tullow to undertake an ESIA for the proposed 3D seismic programme within block 10BB. The EIA approach with respect to the proposed 3D seismic survey was as follows:

- Scaling and work evaluation (determination of geographical and other boundaries; preliminary assessment);
- Detailed assessment based on: project design and technologies vis-à-vis environment, social, cultural and economic considerations of the project area; evaluation of pre-existing environmental, social, cultural and economic conditions, pressures and impacts; identification and evaluation of potential environmental, social, cultural and economic impacts that may arise from the proposed project; public consultations to explain what the proposed project is all about and to receive their views, perceptions, concerns and local expert knowledge and advice with respect to the proposed project;
- Determination/evaluation of the significance of the potential project impacts and recommendation of mitigation measures;
- Development of an Environmental Management Plan and Monitoring Programme; and decommissioning of the project; and
- Preparation of the EIA Project Report.

From an environmental point of view, it can objectively be concluded that the project is viable and will not adversely affect the environment given the effective execution of the EMP. The recommendations that should be considered during development and implementation of the seismic operations include but are not limited to the following:

- Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country;
- Use low sulphur fuels if available and where suitable;

- Employees must use appropriate PPE in accordance with Kenya legislation;
- A water supply borehole (approved by WRMA) should be drilled to provide the water required for the project; this could be donated to the community on completion of the seismic survey;
- Ensure that all vehicles and machinery operating in the field (and in the campsite) are properly maintained so as not to have any oil leaks that could contaminate the soils, ground or surface waters;
- Any planned lines that are considered to be a threat to the ecosystem integrity especially ecologically sensitive site such as luggas and trees serving as nesting spot for birds should be relocated;
- Consultations should be undertaken in a culturally appropriate and transparent manner as per the procedure set out in the Tullow stakeholder engagement plan for the project to help in identifying and avoiding any sensitive cultural sites during the seismic survey in order to avert possible conflict with the community;
- Use of modern line cutting technology, preferably *mulchers* (in areas with dense bushland) for clearing of the geophysical survey transects will ensure that minimal vegetation is removed, hence ensuring that re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote faster re-growth;
- Consideration should be given to acquisition methods and appropriate offsets that may be used in urban areas; It is recommended that segregation of solid wastes at source is appropriately carried out and consideration given to re-use, recycling, or disposal as appropriate;
- A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations;
- The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location as per the stipulated project stakeholder engagement plan;
- Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan;
- Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place; and
- The company should liaise with the Provincial Administration, the Kenya Police, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation.

The environmental and social management and monitoring plan recommended in this report should be followed and the Company should strive to set high environmental standards at all times.

1. INTRODUCTION

1.1 INTRODUCTION

This EIA has been prepared by Earthview Geoconsultants (K) Ltd for Tullow, the project proponent. The EIA report provides a critical examination of issues considered important in the fulfilling the requirements of a clean, sustained and healthy environment. This report is primarily aimed at establishing the impacts of the proposed 3D seismic survey project to be conducted in Block 10BB (Figure 1.1), Turkana South and Turkana East Districts in Northern Kenya by Tullow. The methodology used for this assessment includes a review of available literature, meetings and consultations with local stakeholders and government officials, interviews and public consultation with the local residents.

1.2 DEVELOPER IDENTIFICATION

Tullow Oil PLC is one of the world's largest independent oil and gas exploration companies, and is a FTSE100 company. The Group has over 100 licences in more than 22 countries, with operations in Africa, Europe, South Asia and South America. Tullow has been successfully operating in Africa since 1986 where it is already a dominant player following exploration success in Ghana and Uganda.

This EIA was carried out for Tullow (Pin P051340553U), a subsidiary company of Tullow Oil PLC, with respect to the proposed 3D seismic survey in the project area.

Offices In Kenya:	Contact:
Ground Floor, Acacia House, Westlands Office Park, Waiyaki Way.	Mr. Martin Mbogo, Country Manager, Tullow Kenya B.V. P.O. Box, 63298-00619, Nairobi, Kenya.

Tullow will engage an internationally experienced seismic survey contractor to carry out the 3D seismic survey operations.

1.3 ACTIVITIES OF TULLOW OIL PLC: AN OVERVIEW

Tullow Oil PLC is one of the largest independent oil and gas exploration companies, and is a FTSE100 company. The Group has over 80 licences in more than 20 countries, with operations in Africa, Europe, South Asia and South America.

1.4 BRIEF SITE DESCRIPTION

Block 10BB is located in North Western Kenya and covers the southern part of Lake Turkana, the southern part of the Kerio Basin and most of the Lokichar Basin. These Tertiary age half-graben basins, trend generally north to south. The 3D seismic survey project will be conducted in Block 10BB that covers the entire Lokichar and Lokori Divisions and part of Keiyo Division in Turkana Central in a total area of approximately 12,491 km². The block has a fragile ecosystem with up to 90% of the landmass being arid while the remaining 10% semi-arid. Several dry riverbeds including the River Kerio bed traverse the vast area. The study area is rural, sparsely populated and under-developed.

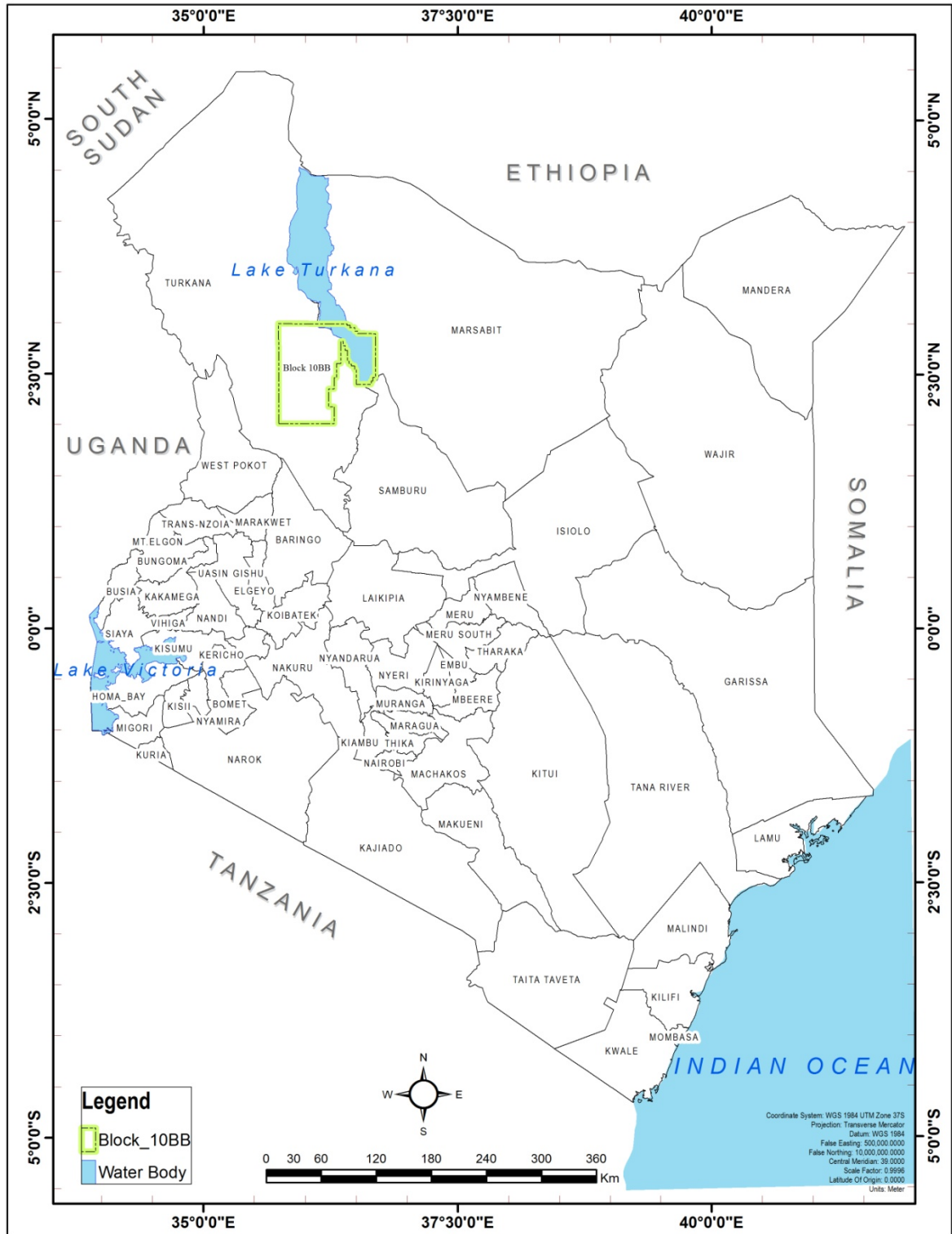


Figure 1.1: Location of the project area

1.5 PROJECT BACKGROUND, OVERVIEW, JUSTIFICATION AND OBJECTIVES

1.5.1 PROJECT BACKGROUND

The initial Production Sharing Contract (PSC) with the Government of Kenya was awarded to Africa Oil B.V. with the aim of exploring in detail, the assigned project area of 14,747.57 km², in accordance with its contractual obligations under the PSC, in order to: (a) delineate potential hydrocarbon prospects, (b) carry out exploratory drilling within the identified potential prospect areas, and (c) carry out well appraisal and production of oil and/or gas if the prospects turn out to be economically viable.

Tullow has since become the operator in the project area and is working in collaboration with its partner, Africa Oil Corporation. Tullow is committed to ensuring that the activities that will be carried out to achieve the stated objectives will be done in a manner that is not detrimental to the natural environment or to the local communities.

1.5.2 OVERVIEW OF THE PROJECT

The project is a 3D seismic survey activity for determination of potential oil and gas resources in part of Block 10BB in Northern Kenya. Seismic survey techniques vary according to the environment and are guided by various international standards. In this regard, the best environmentally acceptable practises would be employed to ensure minimum negative impacts on the environment.

The incorporation of findings and recommendations of this EIA at the various stages of the project activity, and adherence to the EMP would ensure environmental sustainability.

1.5.3 PROJECT JUSTIFICATION

The critical role that energy plays as an input to socio-economic development and environmental protection is now universally acknowledged, as it is an important vehicle for income and employment generation and for satisfying basic human needs (GVEP Kenya, 2006). The international community is today confronted with the daunting task of reducing poverty and achieving sustained economic growth and development for the benefit of all. The provision of adequate, quality and affordable energy services can play a decisive role in poverty reduction (GVEP Kenya, 2006).

Kenya has in the past relied on hydroelectric power as the main source of power supply in addition to a limited supply of geothermal power, which has not been fully harnessed due to financial constraints. In the past ten years or so, the country has been affected by prolonged periods of drought and this has significantly affected the hydroelectric power supply which has been erratic, consequently leading to prolonged periods of power rationing impacting the industry and the country negatively. The insufficient hydroelectric power supply has been due to insufficient rainfall as well as deforestation and subsequent erosion in water catchment areas. This has often led to siltation in the hydroelectric reservoirs reducing the volume of water available for storage for hydroelectric power generation.

To improve on the security of energy supply, industries have had to invest in stand-by generators, which run on expensively imported diesel, thus pushing the cost of production even higher. The industry sector has thus been faced with costly energy supply, which has in part resulted in high production costs. Thus the availability of fossil fuels locally would significantly reduce the energy cost as well as production cost of industries. The project, if successful, will therefore provide energy for both commercial and domestic use, reducing the costs of production, and in the long run, the cost of living.

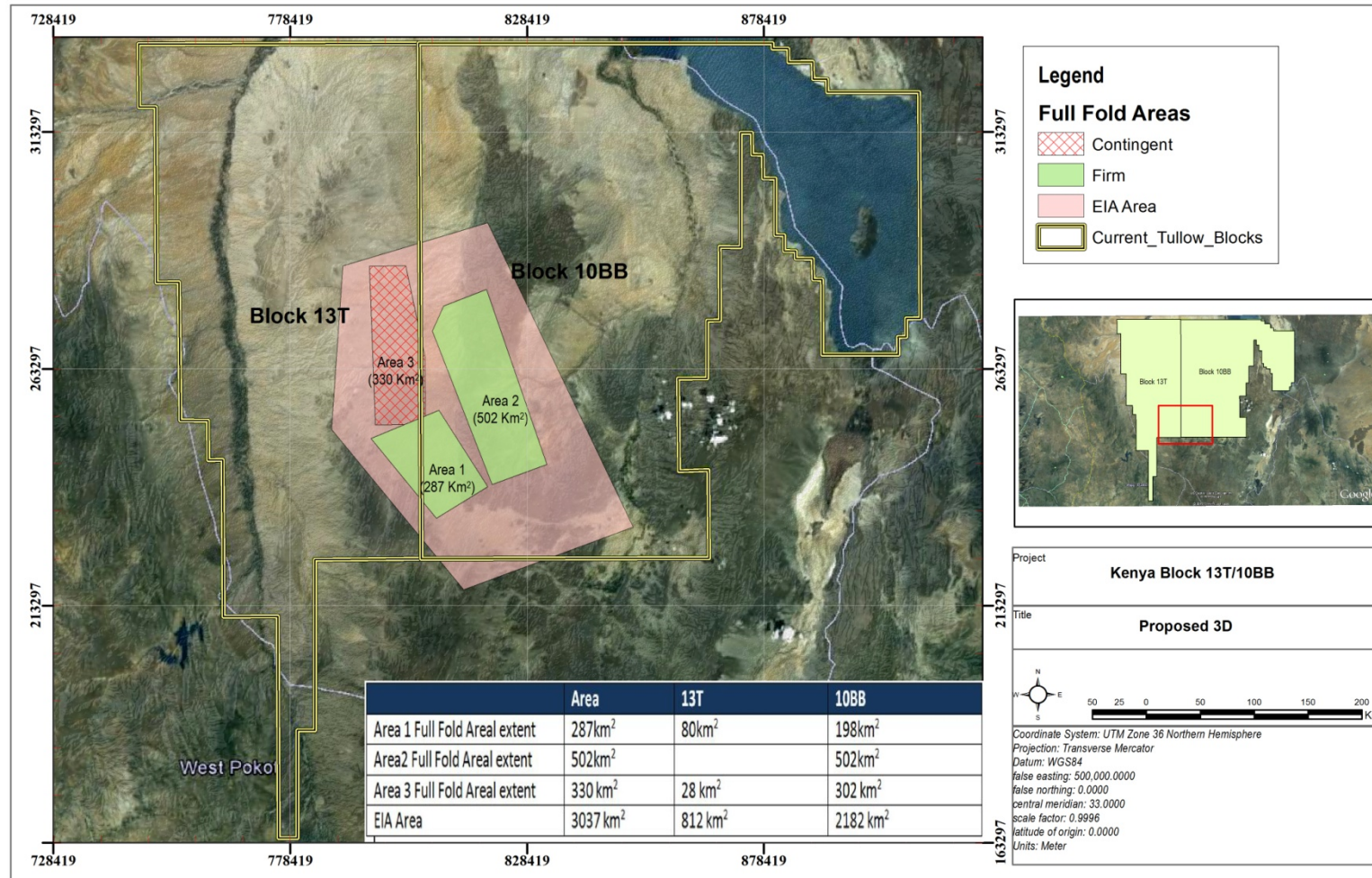


Figure 1.2: Proposed 3D seismic survey polygons in Block 10BB

1.6 PURPOSE OF THE EIA

1.6.1 THE MANDATE OF NEMA

The National Environment Management Authority (NEMA) is the institution that has been established under the Environmental Management and Coordination Act (EMCA) of 1999 in order to deal with matters pertaining to the environment, with the object and purpose of exercising general supervision and co-ordination over all matters relating to the environment, and to act as the principal instrument of government in the implementation of all policies relating to the environment. Some of its mandates that are relevant to EIAs are to:

- Co-ordinate the various environmental management activities being undertaken by the lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects with a view to ensuring the proper management and rational utilisation of environmental resources on a sustainable yield basis for the improvement of the quality of human life in Kenya;
- Carry out surveys which will assist in the proper management and conservation of the environment;
- Undertake and co-ordinate research, investigation and surveys in the field of environment and collect, collate and disseminate information about the findings of such research investigation or survey;
- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under the Act;
- Monitor and assess activities, including activities being carried out by relevant lead agencies in order to ensure that the environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impending environmental emergencies is given;
- Undertake, in co-operation with relevant lead agencies, programmes intended to enhance environmental education and public awareness about the need for sound environmental management as well as for enlisting public support and encouraging the effort made by other entities in that regard;
- Publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation;
- Render advice and technical support, where possible, to entities engaged in natural resources management and environmental protection so as to enable them carry out their responsibility satisfactorily.

1.6.2 REQUIREMENTS AND SCOPE OF WORK FOR THE EIA

A project report is defined, in the preliminary section of the EMCA (1999) and the interpretation section of the Environmental (Impact and Audit) Regulations (2003), as a summarized statement of the likely environmental effects of a proposed development referred to in section 58 of the EMCA, 1999. Section 58 requires that a proponent intending to carry out any undertaking listed in the Second Schedule to the Act must submit a project report to the National Environment Management Authority ('the Authority') in the prescribed form accompanied by the prescribed fee.

Regulation No.7 of the Environmental (Impact and Audit) Regulations, 2003 lays down the specific issues that the project report must address, which in summary are: the nature, location, activities, and design of the project; the materials that are to be used; the potential environmental, economic and socio-cultural impacts and mitigation measures; plans for the prevention and management of accidents and for ensuring the health and safety of workers and neighbouring communities; and the project budget. These issues are to further address, as outlined in the Second Schedule of the Environmental (Impact Assessment and Audit) Regulations (2003): ecological considerations; sustainable use; ecosystem maintenance; social considerations; landscape and land uses; and water. Within this framework, the collection of relevant baseline data, and consultations with stakeholders and the public are important, and ought also to be included in the report.

The scope of this EIA project report can be summarised as:

- Stakeholder engagement;
- Review of relevant data and ground-truthing;
- Utilising existing baseline data (biophysical, social and health) for the description of the project area;
- Prediction and evaluation of potential impacts;
- Determination of appropriate mitigation measures that can eliminate, reduce/minimise the impacts;
- Development of an Environmental Management Plan (EMP); and
- Report preparation.

1.6.3 THE EIA REVIEW AND APPROVAL PROCESS

Where the Authority finds that the project report conforms to the requirements of Regulation 7 (1), it must within seven days of receiving the report, submit a copy to each of the relevant lead agencies, the relevant District Environment Committee, and where it involves more than one district, to the relevant Provincial Environment Committee. Each of these lead agencies and Committees must then submit their written comments to the Authority within twenty-one days from the date on which they received the project report from the Authority or within any other period that the Authority may prescribe (Regulation 9). Once the Authority comes to a decision, it must communicate that decision, together with the reasons for it, to the proponent within forty-five working days from the date on which the project report was submitted to it (Regulation 10(1)). Where the Authority is satisfied that the project will have no significant impact on the environment, or that the project report discloses sufficient mitigation measures, it may issue a licence (Regulation 10(2)). If, however, it finds that the project will have a significant impact on the environment, and the project report discloses no sufficient mitigation measures, the Authority will require that the proponent undertake an environmental impact assessment study in accordance with the Regulations.

1.7 THE EIA TEAM

Earthview Geoconsultants (K) Ltd. was contracted by Tullow to undertake an ESIA for the proposed 3D seismic programme within block 10BB. Earthview Geoconsultants (K) Ltd is a well-established consultancy firm based in Nairobi with good capacity in environmental and social impact assessments and audits, geological and hydrogeological studies, geographic information systems, natural resource surveys, and project planning, implementation and management. Earthview Geoconsultants (K) Ltd is officially registered with the National Environment Management Authority as an Environmental Consultancy Firm. The firm comprises of individuals with many years' experience and knowledge in these and other

areas. The firm is conversant with national legislation and regulations that relate to the sectors in which it carries out its activities, including NEMA requirements for environmental and social impact assessments and audits, as well as applicable international best practices and standards.

Table 1.1: The EIA team composition

Name	Role	Qualifications	Experience (years)
Prof. Norbert Opiyo-Akech	Overall coordination/Geological issues	PhD	30
Dr. Daniel Olago	Coordination/Biophysical and Socio-economic issues	PhD	20
Mr. Joseph Nganga	Soil and Waste Management	BSc	20
Dr. Stephen Mathai	Ecology	PhD	25
Mr. Adams Gakuo	Ecology	MSc	6
Ms. Sheena Ogutu	Biophysical and Socio-economic issues	BSc	3
Ms. Brenda Onnungah	Biophysical and Socio-economic issues	BSc	2
Mr. Edwin India Omori	Socio-economics, Health and Socio-cultural issues	MSc	10
Mr. Stanley Chasia	GIS Expert	MSc	5
Mr. Nicholas Aketch	Logistics/Administration	BSc	8
Ms. Emily Atieno	Policy/Legislation/Regulations	LLB	25

1.8 OBJECTIVES OF THE EIA PROJECT REPORT

In carrying out the project, and considering the national legislative and regulatory requirements for EIA's, Tullow shall seek to:

- a) Identify, evaluate and propose suggested mitigation measures for potential environmental impacts of the proposed project on the various biophysical and socio-economic structures of the area.
- b) Assess and analyse the environmental costs and benefits associated with the proposed project.
- c) Outline environmental management plans and monitoring mechanisms during the project execution phase
- d) Ensure that concerns and aspirations of the local community are addressed in all stages of the project cycle.
- e) Ensure that the project activities do not in any way interfere with the environmental sustainability of the area. This is ensured by giving due consideration to:
 - Ecosystem in general;
 - Land resources and national heritage sites in and around the project area;
 - Local communities and land tenure systems, and;
 - Sensitive historical, archaeological and cultural sites.
- f) Put in place mitigation and monitoring measures that will ensure that any potential negative impacts arising from activities of the project are eliminated or reduced at the earliest opportunity to obviate any harmful effect to the environment.
- g) Boost the economy by providing jobs and trading opportunities to the local community in the region.

1.9 TERMS OF REFERENCE (TOR)

The following are the Terms of Reference (TOR) for the EIA:

- To hold meetings with the project proponent to establish the procedures, define requirements, responsibilities and a time frame for the proposed project;
- To carry out a systematic environmental and social impact assessment of the proposed seismic survey project within the project area, following the National Environment Management Authority legislative and regulatory requirements and best international practice for an activity of this nature;
- To provide a description of the proposed activities throughout the entire implementation process of the proposed project with special focus on potential impacts to the surrounding environment and the socio-economic fabric of the local communities;
- To produce an Environmental Impact Assessment Project Report that contains the details of potential negative impacts, together with recommendations for their mitigation and/or prevention, as well as positive impacts and recommendations for enhancing and/or encouraging them; and
- To develop an Environmental Management and Monitoring Plan.

2. PLANNING, POLICY AND LEGISLATIVE FRAMEWORK

2.1 THE CONSTITUTION OF KENYA, 2010

The Constitution provides that every person has the right to a clean and healthy environment (Article 42). The State is obliged to ensure that the environment and natural resources are conserved and genetic resources and biological diversity are protected. In that regard it must eliminate any processes or activities that would be likely to endanger the environment. Everyone is expected to cooperate with the State organs and other people to protect and conserve the environment and ensure that the use and development of the natural resources are ecologically sustainable (Article 69). These environmental rights are enforceable in a court of law (Article 70). Land must be used in a sustainable manner, and in accordance with the principles of sound conservation and protection of ecologically sensitive areas. The State may regulate the use of any land or right over any land in the interest of land use planning (Article 66).

The Constitution of Kenya gives recognition to public, community and private land. Land use regulation goes beyond exploitation merely for economic purposes, and lays emphasis on conservation. It is required that wildlife conservation promotes sustainable development which includes both environmental conservation and economic development. Parliament has five years from the date of promulgation to enact legislation to give full effect to the provisions relating to the environment. Community land vests in communities identified on the basis of ethnicity, culture, or other similar common interest. Apart from land registered or transferred, it consists of land that is lawfully held, managed or used by specific communities as grazing areas or shrines, and ancestral lands (Articles 60 – 72). The State is generally mandated to regulate the use of any land in the public interest. Public land is described as including: all minerals and mineral oils; specified government forests; government game reserves; water catchment areas; national parks; government animal sanctuaries; specially protected areas; and all rivers, lakes and other water bodies as defined by law. However, land on which mineral and mineral oils exist is held by the national government in trust for the Kenyan people (Article 62).

2.2 THE POLICY FRAMEWORK

2.2.1 ENVIRONMENT AND DEVELOPMENT POLICY

The Environment and Development Policy is outlined in the draft Sessional Paper No.6 of 1999. It covers the following environment and development issues: biological diversity; land and land based resources; water resources; fisheries and marine resources; energy resources; atmospheric resources; waste management; management of toxic and dangerous chemicals; radiation management; environmental health and occupational safety; human settlements; disaster management; implementation strategies; priorities for action; human resources development; environmental planning; environmental laws; environmental impact assessment; environment and land use practices; environment, industry and economic development; environment, research and technology coordination and participation; regional and international cooperation; and environmental management authority.

It outlines the following principles, goals and objectives:

Principles

- a) Environmental protection is an integral part of sustainable development.

- b) The environment and its natural resources can meet the needs of present as well as those of future generations if used sustainably.
- c) All the people have the right to benefit equally from the use of natural resources as well as an equal entitlement to a clean and healthy environment.
- d) Poverty reduction is an indispensable requirement for sustainable development.
- e) Sustainable development and a higher quality of life can be achieved by reducing or eliminating unsustainable practices of production and consumption, and by promoting appropriate demographic policies.
- f) Endogenous capacity building is essential for development, adaptation, diffusion, and transfer of technologies for sustainable development.
- g) Indigenous/traditional knowledge and skills are vital in environmental management and sustainable development.
- h) Effective public participation is enhanced by access to information concerning the environment and the opportunity to participate in decision-making processes.
- i) Public participation including women and youth is essential in proper environmental management.
- j) For sustainable management, the polluter pays principle should apply.
- k) Access to judicial and administrative proceedings, including redress and remedy, is essential to environmental conservation and management.
- l) Private sector participation in environmental management is essential for sustainable development.
- m) Effective measures should be taken to prevent any threats of damage to the environment, notwithstanding lack of full scientific certainty.
- n) Peace, security, development, and environmental protection are interdependent and indivisible.
- o) International co-operation and collaboration is essential in the management of environmental resources shared by two or more states.

Overall Goal

The overall goal is to integrate environmental concerns into the national planning and management processes and provide guidelines for environmentally sustainable development.

Specific Goals

- a) To incorporate environmental management and economic development as integral aspects of the process of sustainable development.
- b) To promote maintenance of a quality environment that permits a life of dignity and well-being for all.
- c) To encourage sustainable use of resources and ecosystems for the benefit of the present generations, while ensuring their potential to meet the needs of future generations.
- d) To promote maintenance of ecosystems and ecological processes essential for the functioning of the biosphere.
- e) To promote the preservation of genetic resources, biological diversity, their cultural values and their natural heritage.
- f) To incorporate indigenous knowledge, skills, and interests for effective participation of local communities in environmental management and sustainable development.

Objectives

- a) To conserve and manage the natural resources of Kenya including air, water, land, flora, and fauna.
- b) To promote environmental conservation with regard to soil fertility, soil conservation, biodiversity, and to foster afforestation activities;
- c) To protect water catchment areas;
- d) To enhance public awareness and appreciation of the essential linkages between development and environment;
- e) To initiate and encourage well-coordinated programmes of environmental education and training at all levels of society;
- f) To involve NGOs, private sector, and local communities in the management of natural resources and their living environment;
- g) To support a coordinated approach to policy formulation on environmental matters;
- h) To ensure development policies, programmes, and projects take environmental considerations into account;
- i) To ensure that an acceptable environmental impact assessment report is undertaken for all public and private projects and programmes;
- j) To develop and enforce environmental standards;
- k) To enhance, review regularly, harmonize, implement, and enforce laws for the management, sustainable utilization, and conservation of the natural resources;
- l) To provide economic and financial incentives for sustainable utilisation, conservation, and management of natural resources;
- m) To apply market forces, taxation, and other economic instruments including incentives and sanctions to protect the environment and influence attitudes and behaviour towards the environment;
- n) To ensure adherence to the polluter pays principle; and
- o) To develop adequate national laws regarding liability and compensation for the victims of pollution and other environmental damage.

2.2.2 NATIONAL POLICY ON WATER RESOURCES MANAGEMENT AND DEVELOPMENT (SESSIONAL PAPER NO.1 OF 1999)

The management of water resources in Kenya is guided by four specific policy objectives, namely:

- a) Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way.
- b) Supply water of good quality in sufficient quantities to meet the various water needs, including poverty alleviation, while ensuring the safe disposal of wastewater and environmental protection.
- c) Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector.
- d) Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

2.2.3 ENERGY POLICY (SESSIONAL PAPER NO.4 OF 2004)

The broad objective of the national energy policy is to ensure adequate, quality, cost-effective and affordable supply of energy to meet development needs, while protecting and conserving the environment. The specific objectives are to:

- a) Provide sustainable quality energy services for development;
- b) Utilise energy as a tool to accelerate economic empowerment for urban and rural development;

- c) Improve access to affordable energy services;
- d) Provide an enabling environment for the provision of energy services;
- e) Enhance security of supply;
- f) Promote development of indigenous energy resources; and
- g) Promote energy efficiency and conservation as well as prudent environmental, health and safety practices.

2.2.4 LAND POLICY (SESSIONAL PAPER NO. 3 OF 2009)

The overall objective of the National Land Policy is to secure land rights and provide for sustainable growth, investment and the reduction of poverty in line with the Government's overall development objectives. Specifically, it seeks to develop a framework of policies and laws designed to ensure the maintenance of a system of land administration and management that will provide all citizens with:

- a) The opportunity to access and beneficially occupy and use land;
- b) An economically, socially equitable and environmentally sustainable allocation and use of land;
- c) Effective and economical operation of the land market;
- d) Efficient use of land and land-based resources; and
- e) Efficient and transparent land dispute resolution mechanisms.

2.2.5 MINING POLICY 1945

The National Mineral Resources and Mining Policy is currently at an advanced stage of being adopted. In tandem with this process, the Government has developed new mining legislation (currently The Mining and Minerals Bill, 2011) to replace the Mining Act, Cap.306 of 1940, which is both antiquated and ineffective. Under the new mining legislation, rights and interests in minerals of all kinds, including commonly found minerals, will be regulated. The proposed new mining legislation has been harmonised with existing environmental legislation. In particular, mining companies will be required to comply with the requirements of the Environmental Management and Co-ordination Act and other applicable environmental legislation and, the new legislation will provide that mining licences may not be granted unless the applicant has obtained an Environmental Impact Assessment ('EIA') Licence.

2.2.6 HEALTH POLICY

The Kenya Health Policy Framework (1994) sets out the policy agenda for the health sector up to the year 2010, so this is likely to be reviewed in the near future. The policy includes strengthening of the central public policy role of the Ministry of Health (MoH), adoption of an explicit strategy to reduce the burden of disease, and definition of an essential cost-effective healthcare package. To operationalise this Health Policy Framework Paper, the National Health Sector Strategic Plan (NHSSP, 1999-2004) was developed in 1994. The strategic plan emphasized the decentralisation of healthcare delivery through redistribution of health services to rural areas. The plan is currently being revised to reflect the Poverty Reduction Strategy Paper (2001-2004) agenda. The new plan focuses on the essential key priority packages based on the burden of disease and the required support systems to deliver these services to the Kenyans. The ensuing NHSSP II (2005 – 2010) was intended to keep people well and to promote the involvement of communities in their own healthcare. Major players in the health sector include the government represented by the Ministry of Health and the Local Government, private sector and non-governmental organisations (NGOs). The organisation of Kenya's healthcare delivery system revolves around three levels, namely the MoH headquarters, the provinces and the districts. The headquarter sets policies, coordinates the activities of NGOs and manages, monitors and evaluates policy formulation and implementation. The provincial tier acts as an intermediary between the central ministry and the districts. It oversees the implementation of health policy at the district level, maintains quality standards and coordinates and controls all district health activities. In addition, it

monitors and supervises district health management boards (DHMBs), which supervise the operations of health activities at the district level.

2.2.7 ECONOMIC RECOVERY FOR WEALTH AND EMPLOYMENT CREATION STRATEGY

The overall goal of the Strategy is to ensure clear improvements in the social and economic well-being of all Kenyans, thereby giving Kenyans a better deal in their lives and in their struggle to build a modern and prosperous nation (GVEP Kenya, 2006). The key areas covered in the Strategy are:

- a) Expanding and improving infrastructures;
- b) Reforms in Trade and Industry;
- c) Reforms in forestry;
- d) Affordable shelter and housing;
- e) Developing arid and semi-arid lands; and
- f) Safeguarding environment and natural resources.

The Strategy, which has commanded a great deal of attention in recent years, essentially subsumes the Poverty Reduction Strategy Paper (PRSP).

2.2.8 KENYA VISION 2030

Kenya Vision 2030 was launched on October 30, 2006, and is the country's new development plan for the period 2008 to 2030. It seeks to transform Kenya into an industrialized "middle-income country providing a high quality of life to its citizens by the year 2030".

Vision 2030 is based on three 'pillars': the economic, the social and the political. The adoption of the Vision follows the successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation (ERS) launched in 2002. The Vision is to be implemented in successive five-year medium-term plans, with the first such plan covering the period 2008-2012.

The economic, social and political pillars of Kenya Vision 2030 are anchored on macroeconomic stability, continuity in government reforms, enhanced equity and wealth-creation opportunities for the poor, infrastructure, energy, science, technology and innovation, land reform, human resources development, security, as well as public sector reforms.

The foundations for the Vision are:

- a) **Macroeconomic Stability for Long-term Development:** The Vision places the highest premium on Kenya's current stable macroeconomic environment which works in favour of the poor, and expects it to continue in the future as a matter of policy. The projects proposed under Vision 2030 will be subjected to the parameters set under the macroeconomic stability framework.
- b) **Continuity in Governance Reforms:** These will be accelerated in order to create a more conducive environment for doing business, and also to enable Kenyans to fully enjoy their individual rights under the Constitution. Towards this end, the government will intensify the anti-corruption programme through more efficient investigation and prosecution; eliminating bribery in the public service and increasing public education and judicial and legal reform. The government will also fully support the people of Kenya, parliament, civil society and the press, recognising that they are the ultimate defence against abuse of office.
- c) **Infrastructure:** The Vision aspires for a country firmly interconnected through a network of roads, railways, ports, airports, water and sanitation facilities and telecommunications. This is a high priority issue.

- d) **Enhanced Equity and Wealth-Creation Opportunities for the Poor:** The Vision includes equity as a recurrent principle in economic, social and political programmes. Special attention has been given to arid and semi-arid districts, communities with high incidence of poverty, the unemployed youth, women, and all vulnerable groups.
- e) **Science, Technology and Innovation (STI):** The government will intensify the application of STI to increase productivity and efficiency levels across all three pillars. It recognises the critical role played by research and development in accelerating development in the emerging nations. The government will create and implement an STI policy framework to support Vision 2030.
- f) **Land Reform:** Land is a vital resource for the socio-economic and political developments set out in the Vision. It is recognized that respect for property rights to land, whether owned by individuals, communities or companies, is key to rapid economic growth (A national land use policy has now been created to enable this growth) (section 4.2.4).
- g) **Human Resources Development:** Kenya will create a globally competitive and adaptive human resource base to meet the needs of a rapidly industrializing economy through training and education, raising labour productivity to international levels, creating a human resource database to facilitate better planning, and establish more training institutions.
- h) **Security:** The government will increase security in order to lower the cost of doing business and provide Kenyans with a more secure environment to live and work in. The strategies will include improving community policing, reducing the police-to-population ratio, and adopting information and communication technology in crime detection and prevention. These measures will be supported by judicial reforms.
- i) **Energy:** Since development projects recommended under Vision 2030 will increase demand on Kenya's energy supply, she must generate more energy at a lower cost and increase efficiency in energy consumption. The government is committed to continued institutional reforms in the energy sector, including a strong, regulatory framework, and will encourage more power generation by the private sector. New sources of energy will be found through the exploitation of geothermal power, coal, and renewable energy sources.
- j) **The Public Sector:** An efficient, motivated and well-trained public service is expected to be one of the major foundations of the Vision. Kenya intends to build a public service that is more citizen-focused and results-oriented. The government will intensify efforts to bring about an attitudinal change in public service that values transparency and accountability to the citizens of Kenya.

2.3 THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

2.3.1 THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT, 1999

The Environmental Management and Co-ordination Act, 1999, provides for the establishment of an appropriate legal and institutional framework for the purpose of managing the environment and matters connected with it. The National Environment Management Authority ("the Authority") is established under section 7 of the Act. Its mandate is to monitor the operations of industries, projects or activities to determine their immediate and long-term effects on the environment. Tullow, being a project whose activities fall within the ambit of the Act, is therefore subject to its provisions. The Act (Part VIII) lays down provisions pertaining to environmental quality standards. It establishes a Standards and Enforcement Review Committee whose broad functions are to (a) advise the Authority on how to establish criteria and procedures to measure water and air quality and (b) issue standards and guidelines for the safe and proper disposal of waste (Sections 70, 71, 78, 86). Where Kenya is a party to an international convention, treaty or agreement on the management of the environment, the Authority must initiate legislative proposals to give

effect to them (Section 124). The Authority may prescribe measures to ensure that the biological resources in place are preserved, issue guidelines to promote the conservation of the various terrestrial and aquatic systems, and protect species, ecosystems and habitats threatened with extinction.

2.3.2 THE EIA GUIDELINES AND ADMINISTRATIVE PROCEDURES

The Environment Impact Assessment and Administrative Procedures arose from the policy framework and the legislative and regulatory (the Environmental Management and Co-ordination Act, 1999, and its regulations) procedures in order to assist in the integration of environmental concerns in economic development so as to foster sustainable development. The document sets out guidelines for carrying out Environmental Impact Assessment, Environmental Audit and Monitoring, Strategic Environmental Assessment and dealing with issues of transboundary, regional and international conventions, treaties and agreements. It sets out the procedure in Environmental Impact Assessment studies and Environmental Audits as well as the contents and format of the reports required to be submitted to the National Environment Management Authority for consideration. The Environmental Impact Assessment study review process and decision-making are also explained. The guidelines are mainly intended to assist project proponents, Environmental Impact Assessment practitioners, lead agencies and members of the public to understand the process and the basis on which decisions are made.

2.4 KENYA LEGISLATION, REGULATIONS, STANDARDS AND INTERNATIONAL CONVENTIONS

The Kenyan legislation, regulations, standards and international conventions relevant to this study is presented in table 2.1 below.

Table2.1: Kenyan Legislation, Regulations, Standards and International Conventions Relevant to the Project

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
Physiography and Geology	The Petroleum (Exploration and Production) Act, Cap. 308	The Energy Ministry	Tulow activities must be restricted to the area specified in the terms and conditions of the petroleum agreement. Tulow must take necessary measures to conserve petroleum and other resources, and protect the environment and human life.	The Minister may take any action, decision, or give any permission or consent or exercise any other control as may be necessary or desirable for the purposes of the Act.
	The Petroleum (Exploration and Production) Regulations	The Energy Ministry	Tulow may not occupy or exercise any rights: in burial land in the locality of a church, mosque or other place of worship; any area within 50m of any building in use, or any reservoir or dam; any public road; any area within a municipality or township; any land within 1000m of the boundaries of an aerodrome; and any land declared to be a national park or national reserve. Directional drilling into the subsurface from land adjacent to these areas is permitted with the consent of competent authority. A fair and reasonable compensation must be paid to an occupier whose rights have been infringed by the contractor's activities.	The Minister may take any action, decision, or give any permission or consent or exercise any other control as may be necessary or desirable for the purposes of the Regulations.
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	After an environmental impact assessment, the prior written approval of the Director-General must be obtained in relation to a river, lake or wetland to: erect, reconstruct, place, alter, remove or demolish any structure or part of any structure in, or under it; excavate, drill, tunnel or disturb it; introduce into it any animal, whether indigenous or alien; deposit in, on or under its bed any substance that would have adverse environmental effects on it; direct or block it from its natural and normal course; or drain it.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			The Environmental Impact Assessment project report must include the potential environmental impacts of the project on the physiography and geology of the area, and propose mitigation measures to be taken during and after the implementation of the project. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	
Soils	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the soils, including the vegetation cover, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Air Quality	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Tulow must comply with the emission standards in the Act so as to ensure that substances which cause pollution are not emitted during the course of the project. Its motor vehicles should be operated in a manner that will not cause air pollution, and it must ensure that its machinery, equipment and appliances do not cause emissions in contravention of the prescribed standards.	An imprisonment term not exceeding two years, or a fine not exceeding five hundred thousand shillings, or both. The offender must in addition, pay the cost of removing the pollution and the cost to third parties in the form of reparation, restitution, restoration or compensation.
			Tulow must apply to the Authority for a licence	Cancellation of

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			in respect of activities that will emit substances or energy causing or likely to cause air pollution. Any conditions specified in the licence must be complied with.	licence.
	<p>The Public Health Act, Cap. 242</p> <p>The Local Government Act, Cap. 265</p>	<p>The Public Health and Sanitation Ministry</p> <p>The Local Government Ministry</p>	Tulow must comply with any rules the Minister may make as to the safe discharge of any liquid or other material prone to cause offensive smells. Tulow must also abide by any conditions the Minister may lay down, under which an activity producing smoke, fumes, chemicals, gases or dust that may cause a danger to people in the vicinity, may carry out its business. A licence may be cancelled or denied if the method adopted or proposed to prevent noxious or offensive vapours, gases or smells arising from the activity are not effective.	Deliberately fouling the air is a misdemeanour under the Penal Code, Cap. 63 and the offender is liable to imprisonment for up to one year.
	The Environmental Management Co-ordination (Fossil Fuel Emission Control) Regulations, 2006	The National Environment Management Authority	Internal combustion engines are subject to inspection and must pass tests to show that they comply with the standards and requirements for the control of air pollution or contamination. It is an offence to operate an internal combustion engine which emits smoke or other pollutant in excess of the emission standards. Tulow must ensure that power generators and associated machinery and vehicles do not emit toxic carbon gases and particulates matter. The polluter must bear the cost of clearing the pollution generated through fuel emission.	It is an offence to contravene these Regulations, and the offender, if convicted, is liable to a maximum fine of three hundred and fifty thousand shillings or to imprisonment for a term not exceeding eighteen months, or to both.
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the ambient quality of the air, and the mitigation measures to be taken during and after the implementation of the project. The views of the	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	million shillings, or to both.
	The Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 1997		Tulow must show that it is consistently taking steps to control/reduce greenhouse gas emissions.	
Water Quality	The Public Health Act, Cap. 24	The Public Health and Sanitation Ministry	Tulow must guard against pollution of the camp's water supply source, underlying aquifers and surface water from liquid effluent discharges or solid waste emanating from sanitation systems at the campsite, oil, or chemical leaks from vehicles and equipment. There must be compliance with any rules the Minister may make as to the safe discharge of liquid or other material prone to pollute streams or that are likely in any way to be a nuisance or dangerous to health.	The relevant local authority may take legal action against any person causing water pollution.
	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Tulow must comply with the water pollution control standards against discharge of noxious matter, radioactive waste or other pollutants into the aquatic environment.	Imprisonment for a term not exceeding two years, or a fine of up to one million shillings, or both. The offender must in addition, pay the cost of removing the poison, radioactive waste, etc., including restoration of the environment, as well as payment of the cost to third parties in the form of reparation, restitution, restoration or

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			A licence must be obtained from the Authority if it is intended to discharge waste into the environment. The application must be made within twelve months of commencement of the project. This does not apply to treated (or untreated) black- and grey water unless it is intended to discharge such waste directly or indirectly into the aquatic environment.	compensation. Cancellation of licence for contravening any provision of the Act or failing to comply with any specified conditions in the licence.
	The Water Act, 2002 The Environmental Management and Co-ordination (Water Quality) Regulations, 2006	The Water and Irrigation Ministry The National Environment Management Authority	Tulow may not wilfully obstruct, interfere with, divert or obstruct water from any watercourse or water resource, or negligently allow such acts, or throw any dirt, effluent, or waste (e.g. oils or chemicals) or other offensive or unwholesome matter into or near any water resource in such a way as to cause or be likely to cause pollution of the water resource. Tulow must obtain an environmental impact assessment licence in order to carry out any activity near lakes, streams, springs and wells that is likely to have an adverse impact on the quality of the water.	Any person who contravenes the Water Quality Regulations commits an offence and is liable to a fine not exceeding five hundred thousand shillings.
	The Water Resources Management Rules, 2007	Water Resources Management Authority	Tulow has a duty to ensure that no toxic or obstructing matter, radioactive waste or other pollutants are discharged into any water resource unless the discharge has been treated to permissible levels. Discharge of effluent into a water resource requires a valid discharge permit issued by the National Environment Management Authority. The wilful and deliberate spilling into any water source or onto land where such spillage may contaminate any surface or groundwater is not permitted. Any threat of contamination must swiftly be dealt with.	Deliberately polluting water meant for public use is a misdemeanour under the Penal Code, Cap. 63 and the offender is liable to imprisonment for up to one year.
	The Environmental (Impact		The Environmental Impact Assessment project	The offender is liable

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
	Assessment and Audit) Regulations, 2003		study report must include the potential environmental impacts of the project on the water sources (quantity and quality) and the drainage patterns, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Terrestrial Environments (Habitats, Flora and Fauna)	The Wildlife (Conservation and Management) Act, Cap. 376 The Petroleum (Exploration and Production) Regulations	The Forestry and Wildlife Ministry The Energy Ministry	The Minister may declare an area protected, and restrict or prohibit activities there in order to secure the safety of the flora and fauna or to preserve the habitat and ecology within a national park, reserve or sanctuary. Anyone who acts in contravention of a notice issued in respect of a protected area commits an offence. Tullow should, as a matter of course, avoid carrying out its activities close to these areas so as to avoid disturbance of wildlife as a result of noise generated by its vehicles, machinery and equipment during seismic acquisition program, and the introduction of weeds and pests among the flora.	A fine not exceeding five thousand shillings or to imprisonment for a term not exceeding six months or to both.
	The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit-Sharing) Regulations, 2006	The National Environment Management Authority	Tullow must not engage in any activity that may have an adverse impact on any ecosystem; lead to the introduction of any exotic species; or lead to unsustainable use of natural resources.	Any person convicted of an offence under the Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit-Sharing Regulations is liable to imprisonment for up to eighteen months, or to a fine

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
				not exceeding three hundred and fifty thousand shillings, or both.
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment study report must include the potential environmental impacts of the project on the area's ecology, incorporating the biological diversity including the effect of the project on the number, diversity, breeding habits, etc., of wild animals and vegetation, and the gene pool of domesticated plants and animals, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Land Resources	The Land Act, 2012	The National Land Commission	<p>The National Land Commission is mandated to take appropriate action to maintain land that has endangered or endemic species of flora and fauna, critical habitats or protected areas. The Commission is required to identify ecologically sensitive areas that are within public lands, and demarcate or take any action on those areas to prevent environmental degradation and climate change. Tullow must minimise activities that would degrade the environment and cause climate change.</p> <p>It is an offence to wilfully hinder or obstruct the Commission or an officer authorized to enter and inspect land for any approved purpose, or to wilfully fill up, destroy, damage or displace any trench, post or mark made or put on land under the Act.</p> <p>Anyone who illegally occupies public land or</p>	<p>Imprisonment for a term not exceeding five years or to a fine not exceeding three million shillings, or to both.</p> <p>A fine not exceeding</p>

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
	The Convention on Biological Diversity, Rio de Janeiro, 1992		<p>erects any building on it, clears, digs or ploughs it, or cuts or removes any timber or other produce on or from it commits an offence.</p> <p>No one may wrongfully obstruct or encroach on any public right of way. In such event the Commission may make an order requiring the person responsible to remove the obstruction or encroachment within a specific period (not less than fourteen days).</p>	<p>five hundred thousand shillings, and in the case of a continuing offence to an additional fine not exceeding ten thousand shillings for every day during which the offence shall have continued.</p> <p>If such a person does not comply with the order, the Commission may take any necessary steps to attain compliance.</p>
	The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit-Sharing) Regulations, 2006	The National Environment Management Authority	<p>Anyone who intends to access genetic resources must apply to the Authority for an access licence, and thereafter comply with the conditions imposed on the licence or those implied under the Regulations, or of the agreements made in relation to its grant.</p> <p>Contravention or failure to comply with any of the matters provided in the Regulations will constitute an offence.</p>	<p>Suspension, cancellation or revocation of the licence.</p> <p>Imprisonment for a term not exceeding eighteen months, or to a fine not exceeding three hundred and fifty thousand shillings, or both.</p>
	The Environmental (Impact Assessment and Audit) Regulations, 2003		The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the current and surrounding land use and land use potentials, and indicate the mitigation measures	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	of not more than two million shillings, or to both.
Archaeological, Historical and Cultural Sites	The National Museums and Heritage Act, Cap. 216 The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972	The State Ministry for National Heritage and Culture	The Minister may prohibit or restrict access or any development on an open space or on a specified site on which a buried monument or object of archaeological or palaeontological interest exists, if, in his/her opinion, it is liable to damage that monument or object. The restriction may include the adjacent area, or a geo-park. A breach of a prohibition or restriction order or a breach of any law made by the Minister in respect of protected areas amounts to an offence. Tullow should avoid the use of heavy vehicles and machinery in or close to these areas as they may damage the archaeological, historical or cultural sites.	A fine not exceeding one million shillings or imprisonment for a term not exceeding twelve months, or to both.
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the historical, cultural and natural heritage of the local community, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Visual Aesthetics	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the landscape, including the views opened up or closed, visual impacts (features, removal of vegetation, etc.), compatibility with the surroundings, and amenities opened up or	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			closed (e.g., recreation possibilities) and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	both.
Noise and Vibrations	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Emitting noise in excess of the noise emissions standards (subject to the Civil Aviation Act) is an offence. However, the Authority may on request the grant of a temporary licence allowing emission of noise in excess of the established standards for activities such as demolitions and specific heavy industry on specified terms and conditions. Where exemption is granted, workers exposed to the excessive noise levels must be adequately protected as directed by the Authority.	Imprisonment for a term of not more than eighteen months, or a fine of not more than three hundred and fifty thousand shillings, or both.
	The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009		<p>Tulow must not exceed the laid-down permissible noise levels unless the noise is reasonably necessary to preserve life, health, safety or property. The use of generators and vehicles, and activities such as drilling operations which are likely to emit noise or excessive vibrations must be carried out within the prescribed levels as set out in Schedules 1 – 3 of the Regulations.</p> <p>Anyone who contravenes any of the provisions of the Regulations, for which no penalty is stipulated, commits an offence.</p>	<p>Making loud noises so as to annoy a considerable number of people amounts to a common nuisance under the Penal Code, Cap. 63 and the offender is liable to imprisonment for up to one year.</p> <p>A fine not exceeding three hundred and fifty thousand shillings, or imprisonment for a term not exceeding eighteen months, or both.</p>
	The Environmental (Impact Assessment and Audit)		The Environmental Impact Assessment project	The offender is liable

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
	Regulations, 2003		study report must include the potential environmental impacts of the project on the natural serenity of the surroundings, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	on conviction to imprisonment for a term not exceeding two years, or to a fine of not more than two million shillings, or to both.
Solid and Liquid Wastes	The Public Health Act, Cap. 242	The Public Health and Sanitation Ministry	Tulow must comply with any rules the Minister may make as to the standard(s) of purity of any liquid which may be discharged as effluent after treatment.	[The stated rules are yet to be made].
	The Physical Planning (Building and Development) (Control) Rules, 1998	The Lands and Physical Planning Ministry	<p>All developments and all alterations or additions to an existing building must have the prior approval of the local authority in consultation with the Director of Physical Planning. Where this approval is not obtained, the local authority will serve the person responsible with a notice to cease the work or development. Failure to comply with the notice is an offence.</p> <p>Any proposed building so approved must be erected according to the approved plans, sections, elevations, descriptions and particulars. Failure to comply with these requirements is an offence.</p>	The local authority may serve an enforcement notice on the owner, occupier or developer of the land. Enforcement may entail restoring the land to its original condition or seek to secure compliance with the conditions of the development permission.
	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Tulow must ensure that it discharges or disposes of waste in a manner that will not cause pollution to the environment or ill health to any person. A licence must be obtained from the Authority in order to: transport waste;	Imprisonment for not more than two years or a fine not exceeding one million shillings, or both.

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			<p>dispose of the waste to a waste disposal site (set up in accordance with the licence issued); or operate a wastes disposal site. Tullow must employ measures essential to minimize wastes by treating, reclaiming or recycling such waste.</p> <p>Hazardous wastes may not be transported, imported or exported without a valid licence issued by the Authority.</p> <p>Tullow must not discharge any hazardous substance, chemical, oil or mixture containing oil into any segment of the environment.</p> <p>Tullow is required to mitigate any discharge from its storage facility/ies, motor vehicle(s) or vessel(s) by: giving immediate notice to the Authority and other relevant Government officers of the occurrence of such discharge contrary to the Act; immediately beginning clean-up operations using the best available clean-up methods; and by complying with any directions that the Authority may prescribe.</p>	<p>Payment of the cost of removing the hazardous substance, chemical, oil or mixture containing oil, including restoration of the environment, as well as payment of the cost to third parties in the form of reparation, restitution, restoration or compensation.</p> <p>Seizure of the storage facility/ies, motor vehicle(s) or vessel(s). Where the operator fails to take the mitigation measures within a reasonable time (not more than six months), the Authority may, upon a court order, dispose of the storage facility/ies, motor vehicle(s) or vessel(s) to meet the costs of taking the necessary remedial and restoration measures.</p>
	The Environmental Management and Co-	The National Environment	Tullow must obtain an Environmental Impact Assessment licence if it intends to engage in any	Imprisonment not exceeding two years,

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
	<p>ordination (Waste Management) Regulations, 2006</p> <p>Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, Bamako, 1991,</p> <p>The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989</p>	Management Authority	<p>activity likely to generate hazardous waste. Toxic or hazardous waste generated, e.g. from the test-well drilling operations, the campsite and the field worksites, must be treated and disposed of according to the laid-down guidelines (Schedule 3 of the Regulations). Waste generated must be minimized by adopting cleaner production methods. The waste product can also be reused and recycled. Tullow is required to mitigate pollution by installing at its premises anti-pollution equipment for treating the waste it generates.</p> <p>Appropriate legal, administrative and other measures must be taken within the area under the project's jurisdiction to prohibit the import of all hazardous wastes. A licence is required for trans-boundary movement of waste, and to export or transit waste. It is an offence to violate the provisions of the Regulations.</p>	<p>or a fine not exceeding one million shillings, or both.</p> <p>Imprisonment and fine as provided in the Act (see the Environmental Management and Coordination Act, 1999 above)</p>
	The Environmental (Impact Assessment and Audit) Regulations, 2003		The Environmental Impact Assessment project study report must include the potential environmental impacts of the project's methods of waste discharge and disposal into the environment, and indicate the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Social Characteristics	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment process requires that Tullow considers the project's environmental effects, including the socio-cultural consequences and the anticipated direct, indirect, cumulative, irreversible, short-term and long-term impacts and create an environmental management plan proposing the measures for eliminating or mitigating adverse impacts on the	

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			<p>environment. The social considerations as set out in Schedule 2 include: economic impacts, social cohesion or disruption, effect on human health, influx or emigration, communication, and effects on culture and valued cultural objects.</p> <p>The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the daily lives of the local community, their health, and culture, and the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.</p>	
Economic Characteristics	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	<p>Tullow is required to consider the positive and negative economic impacts that the project may have on the lives and livelihoods of the local population (e.g. increased development, job opportunities, disruption of livelihoods tied to the area's land and/or water resources, e.g., fishing, agriculture, and livestock-keeping.</p> <p>The Environmental Impact Assessment project study report must include the potential environmental impacts of the project on the economy and development of the area, and the mitigation measures to be taken during and after the implementation of the project. The views of the people who may be affected by the project must be sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.</p>	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Occupational Health and Safety	The Explosives Act, Cap. 115	The Environment and Natural Resources	Tullow must obtain a licence if it intends to purchase and use blasting materials or convey explosives. The use or transport of explosives, in the working of the project is forbidden, unless	A fine not exceeding three thousand shillings, and in default of payment,

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
		Ministry	an explosives manager has been appointed and the inspector notified in writing. The explosives manager is responsible for the safety and security of all explosives used, transported or stored, until they are handed to the blaster for use. The explosives manager is also responsible for the safety of every person who may be employed on the project, whether under his direct supervision or not.	imprisonment for a term not exceeding one year.
	The Energy Act, No. 12 of 2006	The Energy Regulatory Commission	Tullow must comply with the Kenyan or other approved standards on environment, health and safety, and in conformity with the relevant laws. It must notify the Energy Commission of any accident or incident causing loss of life or personal injury, explosion, oil spill, fire or any other accident or incident causing significant harm or damage to property or to the environment. All Tullow's petroleum equipment must conform to the relevant Kenya Standard, and where that does not exist, the relevant international standards approved by the Kenya Bureau of Standards will apply.	A general penalty applies - a fine not exceeding one million shillings.
	The Occupational Safety and Health Act, No. 15 of 2007	The Labour Ministry	Tullow has a duty to ensure the safety, health and welfare of all its workers at work at the site and in the field environment, including work procedures that are safe. Visitors to the work sites should be similarly protected. The likely emission of poisonous, harmful, or offensive substances such as chemicals or vehicle fumes into the atmosphere should be prevented, and where they occur, they must be rendered harmless and inoffensive. Machinery, protective gear, and tools used at the project site have to comply with the prescribed safety and health standards. Dust, fumes or impurities may cause respiratory problems and must not be allowed to enter the atmosphere without appropriate	

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			<p>treatment to prevent air pollution or harm of any kind to life and property. Highly inflammable substances must be kept in a safe place outside any occupied building. Where dangerous fumes are liable to be present, Tullow must provide a means of exit and suitable breathing apparatus. Means for extinguishing fire must be available and easily accessible, and evacuation procedures must be tested regularly.</p> <p>Where the occupier of the workplace contravenes the provisions mentioned above, or where the owner of the workplace is found to be responsible, that person is guilty of an offence. If there are people in the workplace who are employed contrary to the provisions of the Act, there will be deemed to be a separate contravention in respect of each employee.</p>	<p>A fine not exceeding three hundred thousand shillings or to imprisonment for a term not exceeding three months or to both. In addition to or instead of imposing a penalty, the court may order specific steps to remedy the matters contravened within a stated time period, and on application, extend that period.</p>
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include a plan to ensure the health and safety of the workers. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	The offender is liable on conviction to imprisonment for a term not exceeding two years or to a fine of not more than two million shillings, or to both.
Security and Public Safety	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority	The Environmental Impact Assessment project study report must include a plan to ensure the health and safety of the neighbouring communities. Failure to prepare an	The offender is liable on conviction to imprisonment for a term not exceeding

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Penalties
			environmental impact assessment in accordance with the Act and regulations is an offence.	two years or to a fine of not more than two million shillings, or to both.

2.5 INTERNATIONAL PRACTICES AND CONVENTIONS

2.5.1 INTERNATIONAL BEST PRACTICES

The International Association of Oil & Gas producers (OGP) is a unique global forum in which members identify and share best practices to achieve improvements in every aspect of health, safety, the environment, security, social responsibility, engineering and operations.

Industry guidelines, based on information from OGP, International Association of Drilling Contractors, and ISO14001, have become widely accepted as providing a strong basis for preparing regulations, policies and programmes to minimize the impact that these operations have on the environment. The E&P Forum (Oil Industry International Exploration and Production Forum), jointly with UNEP, published a document on the best approaches to achieving high environmental performance and standards worldwide. Within the framework provided, various technical reviews and guidelines already available from other relevant sources can be applied. It developed a common management system to deal with health, safety and environmental (HSE) issues. Its key elements are as follows:

1. Leadership and commitment

It is vital to have a senior management committed to ensuring that the management system is developed and maintained, and that the company's policy and strategic objectives are achieved. Management should ensure that the policy requirements are adhered to during operations and support local initiatives to protect health, safety and the environment. Management commitment will involve delegating responsibility, providing resources and motivation, and ensuring participation and open communication.

2. Policy and strategic objectives

The HSE management system requires that the company's policies and strategic objectives are well-defined and documented. The policies must be relevant and consistent and should be on a par with other company policies and objectives. Here also, commitment to carrying out the company's policies towards protecting people's health and safety as well as the environment, is vital, as are responses to community concerns. Partnerships with stakeholders are just as essential. Where relevant legislation and regulations do not exist, the company must commit to apply responsible standards.

3. Organization, resources and documentation

Organization of personnel, resources and documentation make for a sound HSE management system. Roles must be clearly defined from the beginning to the end of the project. Appropriate periodic training and review will enhance competence and effective performance.

4. Evaluation and risk management

Procedures must be in place to identify on a regular basis the dangers and effects of the undertaking. This identification should apply to all the activities from the start to the decommissioning of the project. Environmental impact assessment study becomes a suitable criterion to gauge what is acceptable, particularly in the absence of appropriate legislative control.

5. Planning

Environmental planning and compliance programmes should include ways and means of preventing or minimizing adverse impacts, as well as enhancing the beneficial impacts that may accrue. It is also imperative that internal standards and targets are set for compliance. A detailed decommissioning plan should be considered in the initial planning of the project, and a plan to restore the environment should be developed before the end of the project.

6. Implementation and monitoring

The purpose of monitoring is to ensure that the results forecast at the planning stage are being achieved, and where the contrary is the case, to identify the cause and take action to correct the situation. Managers must strictly adhere to legal and statutory requirements and controls as well as the company's own commitment to responsible management of the environment. Monitoring will indicate whether or not commitments and compliance with legal and corporate requirements are being met. It also provides the basis for audit.

7. Audit and review

This management tool enables the senior management to regularly assess its performance, effectiveness and suitability. It also provides an opportunity to obtain feedback on the effectiveness of the organization and its environmental performance. In addition, it is useful in verifying compliance with monitoring programmes and ensuring that plans, procedures and standards are working effectively.

Other renowned national and international standards for best practice, particularly the ISO 9000 and 14000 series, also offer management systems models that can be used by companies to enhance their environmental performance.

2.5.2 INTERNATIONAL CONVENTIONS

The Kenya Constitution provides that the general rules of international law shall form part of the laws of Kenya, as shall any treaty or convention that she ratifies (Article 2). Kenya has ratified or subscribed to a number of international conventions that relate to the environment within her borders.

Table 2.2: International conventions that Kenya has ratified

	Convention	Entry into force	Date of ratification
1.	African Convention for the Conservation of Nature and Natural Resources, Algiers, 1968 Parties must conserve their natural resources – soil, water, flora and fauna – ensuring that they are used and scientifically developed in a manner that will benefit their people.	16 June, 1969	12 May, 1969 (accession)
2.	African Convention on the Conservation of Natural Resources (Revised Version) Maputo, 2003 Parties must ensure that developmental and environmental needs are met in a sustainable, fair and equitable manner.	11 July, 2003	17 December, 2003 (signature)
3.	Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar, 1971 It provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	21 December, 1975	5 October, 1990
4.	Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972 It establishes a system of collective protection of cultural and natural heritage of outstanding universal value.	17 December, 1975	1 July, 1983
5.	Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 It aims at ensuring that international trade in specimens of wild animals and plants does not threaten their survival.	1 July, 1975	13 March, 1979
6.	Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 It aims to protect those species of wild animals that migrate across or outside of national boundaries. Parties must protect them, conserve and restore their habitat, mitigate obstacles to migration and control other factors that might endanger them.	1 November, 1983	
7.	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Basel, 1989 It aims at protecting human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous wastes.	5 May, 1992	2000 (accession)
8.	Amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Geneva, 1995	5 May, 1992	9 September, 2009

	Convention	Entry into force	Date of ratification
	The amendment prohibits exports of hazardous wastes destined for final disposal or recycling purposes from Annex VII countries to non-Annex VII countries (Annex VII not yet in force).		(acceptance)
9.	United Nations Framework Convention on Climatic Change, New York, 1992 It sets an overall framework for intergovernmental efforts to tackle the challenge posed by climatic change, recognizing that the climate system can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.	21 March, 1994	30 August, 1994
10.	Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 1997 It sets binding targets for 37 industrialized countries and the European Community as well as for countries undergoing the process of transition to a market economy in order to reduce greenhouse gas emissions.	16 February, 2005	2005 (accession)
11.	Convention on Biological Diversity, Rio de Janeiro, 1992 It aims at granting the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the use of genetic resources.	29 December, 1993	27 June, 1994
12.	Stockholm Convention on Persistent Organic Pollutants, Stockholm, 2001 It protects human health and the environment from chemicals that remain intact in the environment for long periods, become widely distributed geographically and accumulate in the fatty tissue of humans and wildlife. It requires Parties to take measures to eliminate or reduce the release of persistent organic pollutants into the environment.	17 May, 2001	24 September, 2004
13.	Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, Bamako, 1991 It binds Parties to take appropriate legal, administrative and other measures within the area under their jurisdiction to prohibit the import of all hazardous wastes, for any reason, into Africa from non-Contracting Parties.	22 April, 1998	17 December, 2003 (signature)

2.6 TULLOW OIL POLICIES

Environmental, health and safety policy



At Tullow Oil, we are committed to high standards of Environment, Health and Safety (EHS) performance across our business.

Our goal is to preserve biodiversity and promote sustainable development by protecting people, minimising harm to the environment and reducing disruption to our neighbouring communities.

We seek to achieve continual improvement in our EHS performance.

Tullow Oil has established an EHS management system to ensure that:

- We plan and organise EHS efficiently and effectively.
- Safe places, safe systems of work and suitable procedures are provided and maintained.
- We minimise discharges, emissions and waste that adversely affect the environment.
- Staff and contractors are given appropriate EHS training to perform their tasks competently, safely and with due regard for the environment.
- Risks from our activities are assessed and either eliminated or reduced to acceptable levels.
- We comply with all applicable EHS laws and regulations, and apply responsible standards where the legislation is inadequate or non-existent.
- We are comprehensively prepared to respond effectively in the event of an emergency.
- We promote a culture of reporting and investigating accidents, incidents and near misses, and the sharing of lessons learned.
- We have an audit programme which verifies compliance with this policy and monitors our EHS performance.
- We are all empowered to stop any activity if there is an unacceptable risk of accident or environmental incident.

This EHS policy is reviewed periodically to ensure its ongoing suitability and effectiveness.

Whilst we provide a strong and visible leadership commitment to EHS, everyone in Tullow Oil has individual authority, responsibility and accountability for the safety of themselves and others, and an obligation to actively participate in promoting an effective EHS culture. We will regularly set and review our EHS objectives and targets with the aim of driving continual improvement in EHS knowledge and performance.

Aidan J Heavey,
Chief Executive Officer, Tullow Oil plc
May 2009



TO-EHS-POL-001-Rev7

- Think Environment
- Think Health
- Think Safety
- Think Forward





Environment, Health and Safety Policy

At Tullow Oil, we expect everyone to **Think** about their role in managing Environmental Health and Safety (EHS) risks that exist in our business and, in particular, within their own area of responsibility and influence.

To help us manage these risks we require everyone connected with our activities to:

- **Respect** our stakeholders and our values
- **Reflect** on lessons learned and their actions
- **Protect** the environment and each other

By following these principles and **Thinking Forward** we will ensure that EHS risk management forms an integral part of our day-to-day working practices and alignment with the EHS Vision.

To achieve this, we commit to:

- Proactively manage EHS risks and plan our operations taking those risks into account;
- Maintain a safe working environment by implementing safe systems and taking responsibility for the health and wellbeing of our staff and contractors;
- Comply with the requirements of all applicable EHS laws and regulations, and apply industry best practice where legislation is lacking;
- Ensure those working on our behalf adopt similar high standards of EHS;
- Invest in building a competent and capable organisation to deliver consistently high levels of operational and EHS performance, supported by strong visible EHS leadership;
- Monitor our progress against strong EHS objectives and targets to continually improve our performance.
- Prevent pollution and minimise other adverse impacts on the environment and the local communities where we operate;

In adhering to this Policy, everyone in Tullow or working on our behalf is empowered to stop any activity they regard as irresponsible or unsafe.



Aidan J Heavey
Chief Executive Officer, Tullow Oil plc
May 2012

T-EHS-POL-0001 Rev9



Corporate social responsibility policy

Tullow Oil's policy is to conduct all our business operations to best industry standards and to behave in a socially responsible manner.

Our goal is to behave ethically and with integrity in the communities where we work, and to respect cultural, national and religious diversity.

Directors, company personnel and contractors are responsible for ensuring compliance with this policy, and specifically to:

- Respect the rights of all employees, treating them fairly and without discrimination
- Commit to providing opportunities for staff development
- Provide equal employment opportunities
- Recognise individual and team contributions
- Ensure compliance with Tullow's EHS policy by all personnel involved in our activities
- Provide clear direction on key CSR initiatives, policies, performance data and targets
- Actively engage with communities in areas where we operate
- Support selected social and community development projects
- Maintain high ethical standards and support transparency in our activities
- Encourage our partners and stakeholders to observe similar standards wherever possible

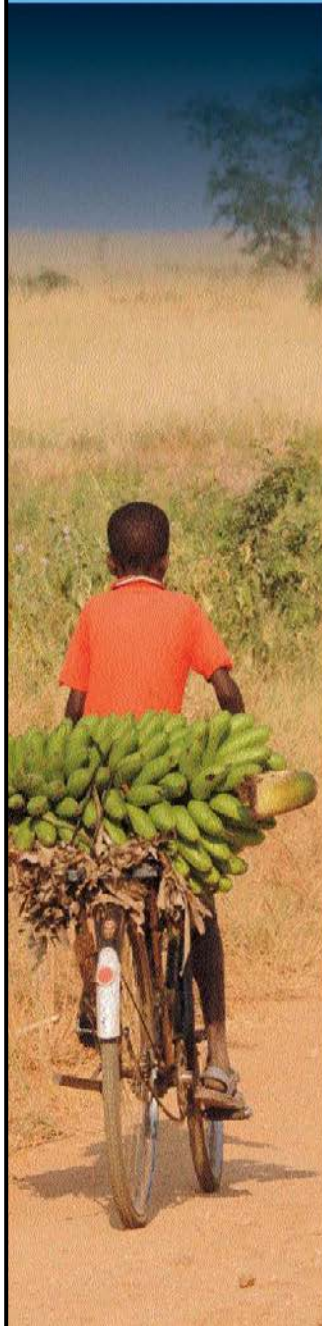
Tullow is committed to continual improvement in all its standards and practices.

Aidan J Heavey

Aidan J Heavey,
Chief Executive Officer, Tullow Oil plc
May 2009



TO-EHS-POL-001-Rev7



Driving policy – Land transportation



As part of its commitment to high standards of Environment, Health and Safety, Tullow has stipulated the following minimum requirements for vehicle use and general Land Transportation.

These minimum requirements are applicable to all company vehicles, employees and contractors of Tullow Oil while on company business and may be exceeded by detailed local procedures.

- Safe/Defensive driver training is to be provided for drivers (those employed as drivers) of Tullow vehicles;
- Speed limits and all applicable local laws are to be adhered to;
- The use of hand held mobile phones/Blackberries while driving is prohibited;
- Smoking is prohibited in all Tullow vehicles;
- All 4 x 4 and other heavy vehicles should be fitted with reverse alarms/warning lights;
- Travelling in rear freight compartments (open or enclosed without seating or seat belts) of 4 x 4 field vehicles is not allowed;
- Driving hours should be aligned with the OGP publication "Land transportation safety recommended practice – Journey Management";

Requirement	Recommended practice
Maximum driving time between breaks and minimum break time	4.5 hours followed by a 30 minute break. However it is strongly recommended to have a 15 minute break every two (2) hours, or more frequent breaks during periods of circadian lows.
Maximum duty hours within a rolling 24 hour period	16 hours (i.e. employee cannot drive after 16 duty hours). This shall include driving, loading, unloading, waiting, rest breaks, and any other work (including air travel)
Maximum driving hours within a rolling 24 hour period	Ten (10) hours total excluding commuting time. Eleven (11) hours including any commuting time
Maximum duty hours in a rolling 7 day and 14 day period	14 day period: 120 hours, subject to an 80 hour/7 day maximum, and an average of 60 hours per week over an extended period
Off duty period in a rolling 7 day period	Minimum of a continuous 24 hour break prior to driving again

- Regular breaks are to be taken on long journeys, recommend a 15 minute break every 2 hours;
- Tullow vehicles should contain as a minimum the following equipment: First aid kit, Communication devices, Fire extinguisher, Drinking water, Warning triangle (for breakdowns), Torch, Basic Tool Kit (to include spare bulbs/fuses), (Extra fuel for remote locations).
- Three point seat belts are to be installed for all driver and passenger seats in Tullow vehicles and must be worn at all times;
- Drivers must be appropriately licensed, approved, and be fit to drive;
- Drivers must not drive under the influence of drugs, alcohol or medication that could affect their ability to drive.
- Vehicles should be fit for purpose and maintained in a safe working order in line with the manufacturers' specifications and local legal requirements.

Further requirements for developing countries:

- People intending to drive in developing countries should liaise with the Country Manager and/or EHS Advisor as in each case there will be specific requirements and hazards that they should be aware of;
- No night driving outside of city limits is allowed unless in an emergency or with prior approval by Country Manager or their nominated Incident Responsible Person;
- In-Vehicle Monitoring Systems (such as "Drive Rights units") and/or GPS tracking systems should be fitted where possible;
- Journey Management procedures reflecting local driving conditions and identified risks shall be in place that complies with the OGP publication "Land transportation safety recommended practice – Journey Management";

Any incidents in which a breach of the local procedures or this policy has occurred should be reported as near misses in investigated accordance with the Accident and Incident Investigation and Reporting Procedure. Violation of the policy will be investigated and may result in disciplinary action.



TOP-EHS-POL-002-Rev2

3. PROJECT DESCRIPTION

3.1 INTRODUCTION

Seismic data acquisition survey is one of the first activities in oil prospecting, exploration and exploitation. It is essentially carried out to locate viable hydrocarbon reservoirs in the subsurface. A typical seismic data acquisition project lasts for a relatively short period of time and does not usually involve the establishment, or use of long-term facilities and structures.

3.2 PROJECT LOCATION

The proposed project area lies in Block 10BB. Block 10BB lies in parts of Turkana East and Turkana Central administrative districts located in the Rift Valley Province. The administrative headquarters of Turkana Central is Lodwar while that of Turkana South is based Lokichar. There is one local authority, Turkana County Council, which still serves the larger Turkana district. It is anticipated that the seismic activities will be phased out, starting in Area 1, followed by either Area 2 or Area 3 (See Figure 3.0 below)

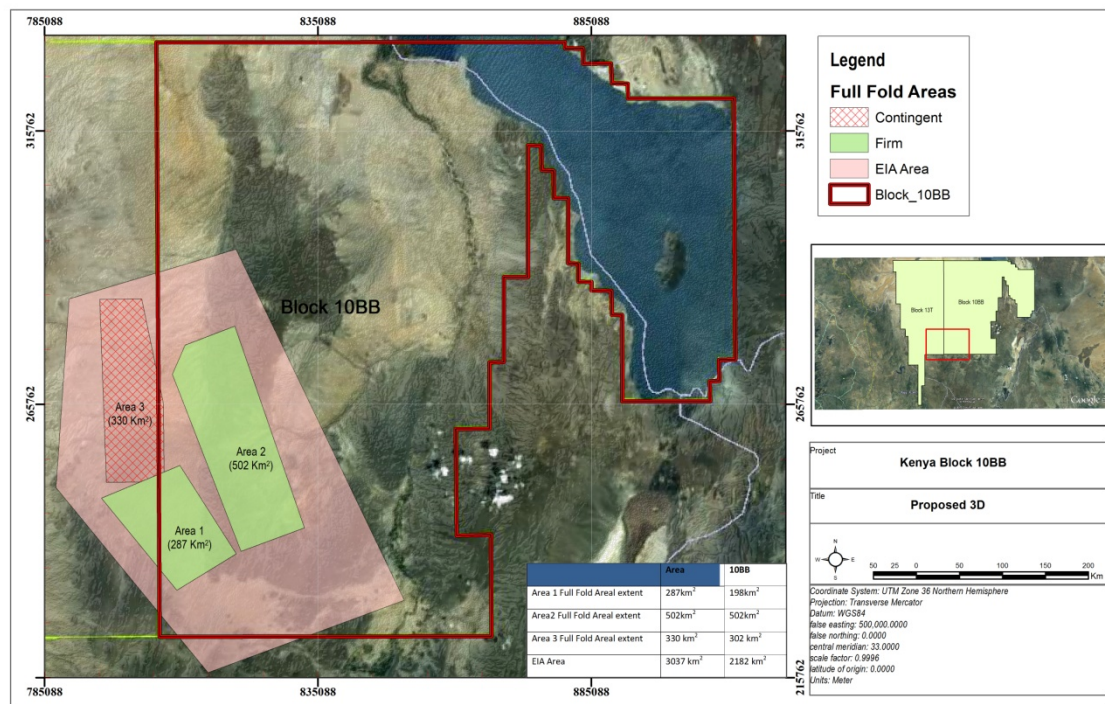


Figure 3.0: Proposed 3D seismic survey area in Block10BB

3.3 OVERVIEW OF 3D SEIMIC SURVEY PROGRAMME

3.3.1 PRINCIPLES OF SEISMIC SURVEYS

Seismic surveys are a primary tool utilized during the exploration of hydrocarbons over land and water. A seismic survey is conducted by creating an energy wave commonly referred to as a 'seismic wave' on the surface of the ground/ over water along a predetermined line, using an energy source. This wave travels into and through the earth strata, where it is reflected and refracted by various subsurface formations, and returns to the surface where receivers called geophones are used to detect the waves and convey them to a recorder for analysis. Seismic waves can be induced by the following

methods: small explosive charges, primarily dynamite, set off in shallow holes known as 'shot holes'; or by large 'Vibroseis' trucks equipped with heavy plates that vibrate on the ground or air guns for water based surveys. By analyzing the time it takes for the seismic waves to reflect off subsurface formations and return to the surface (Figure 3.1), formations can be mapped and potential oil or gas deposits identified.

3D surveys are acquired by laying out energy source points (vibroseis or dynamite charges) and receiver points (geophones) in a grid over the area to be surveyed. The receiver points - to record the reflected vibrations from the source points - are laid down in parallel lines (receiver lines), and the source points are laid out in parallel lines that are approximately perpendicular to the receiver lines. The spacing of the source and receiver points is determined by the design and objectives of the survey.

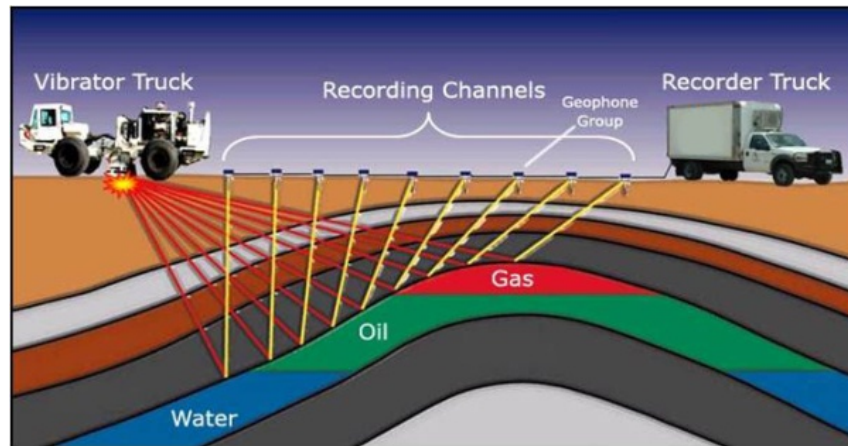


Figure 3.1: Onshore Seismology Using a Vibrator Truck as a Seismic Energy Source (Source: Adapted from <http://www.cougarlandservices.net/landowner>)

3D seismic surveys are generally conducted in a similar way to 2D seismic surveys but with the variation of setting up six or eight geophone cables side by side at the same time at a distance in most cases of about 400 metres apart. Several "shots" from calculated positions along and between the receiver lines are taken, before the cables are moved up and the process repeated. (Figure 3.2)

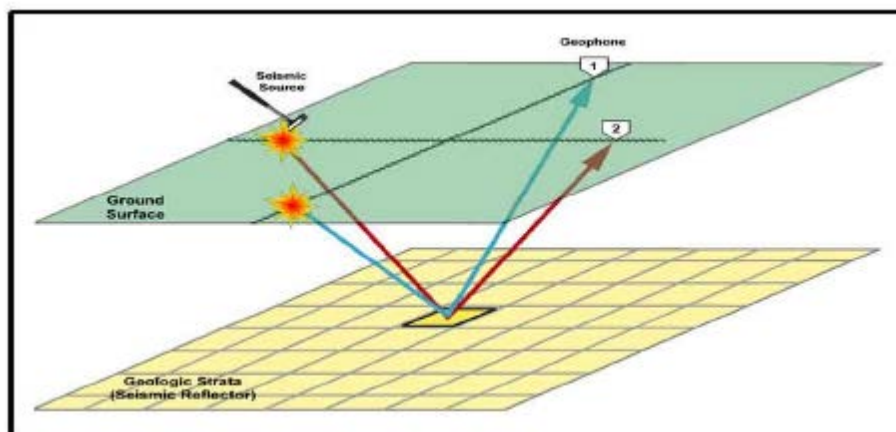


Figure 3.2: Schematic diagram of 3D seismic technique (Source: Adapted from <http://static.shell.com/>)

3D seismic surveys must be conducted over a large area in order to provide sufficient data for accurate interpretation of the subsurface geology. These surveys can be conducted at different times and cover different but adjacent areas. The complicated structures causing sideswipes can only be imaged properly using 3D reflection techniques in which a 3D volume (x,y,z) of crust is sampled and monitored using a planar, rather than a linear array of shots and receivers. The data collected can later be combined into

a single data set for processing and analysis, provided there is sufficient overlap of the areas covered by the surveys.

3D seismic surveys are complicated by the fact that a typical survey contains orders of magnitude more data to process. The end result, however, is a data cube that can be sliced to produce synthetic profiles in any arbitrary direction through the data, horizontal slices at arbitrary depths (time slices); horizon slices showing reflectivity variations in map plan for picked marker horizons, and 3D tomographic images that can be viewed from any perspective.

Computer analyses of the recorded seismic waves provide a profile of the underlying rock strata and offer the basis for identifying potential hydrocarbon traps. The analysis creates a three-dimensional picture (Figure 3.3) that shows the subsurface geology of the earth's strata along the line of the cable.

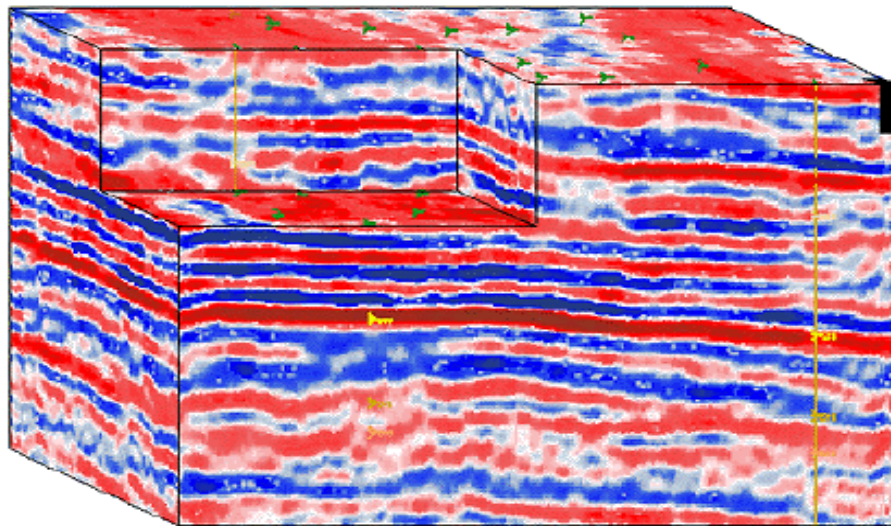


Figure 3.3: 3D Seismic cube (http://www.unil.ch/igp/page22625_en.html)

A 3D seismic volume or cube is created by shooting a closely spaced grid of 2D lines and interpolating between the lines to create a "3-dimensional volume" of data that is also referred to as a cube. This volume can then be sliced in any vertical dimension to create 2D lines, or sliced in horizontal plane to create time slices, which represent constant time. The volume can also be sliced along reflection boundaries to create "horizon slices" that, more or less, parallel bedding

3.4 THE PROPOSED SEISMIC SURVEY

3.4.1 SEISMIC SURVEY OBJECTIVES

The objective of the proposed seismic survey is to identify and delineate potential prospects, if any, in sufficient detail to be able to, at a later and different stage, test one or more by drilling.

3.4.2 SEISMIC SURVEY SCALE AND EXTENT

The seismic survey operation will involve the collection of approximately 382 Square kilometres of seismic data within block 10BB area. The seismic data acquisition exercise (Recording) will take approximately 152 to 255 days beginning in May to June 2013 .

The seismic survey operation will be constrained along the seismic survey lines and to the base and fly camps, as well as to the access roads to these areas.

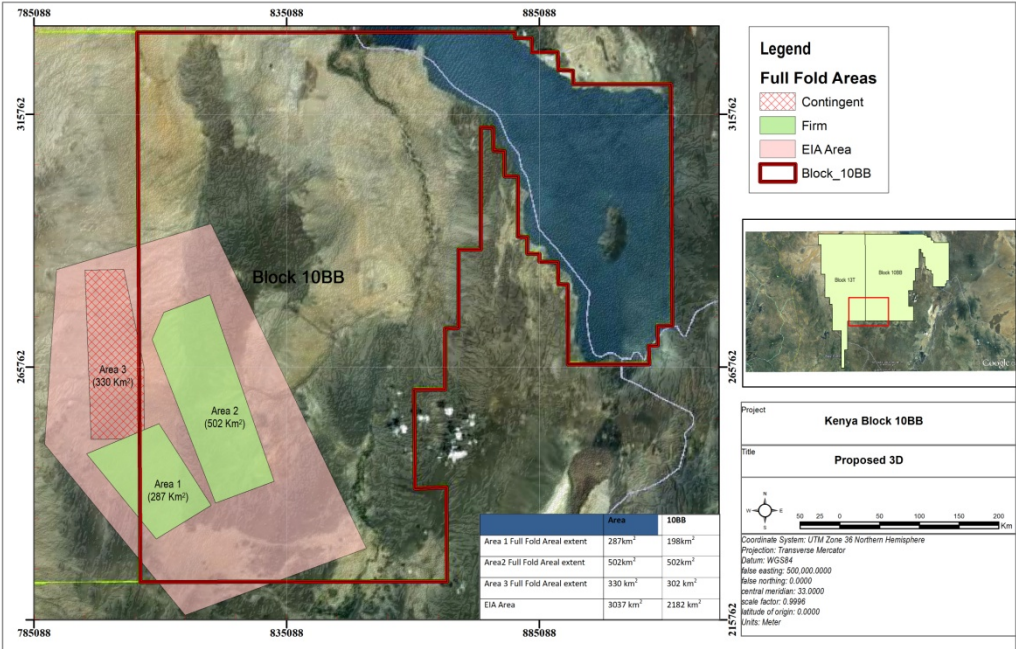


Figure 3.4: Proposed 3D seismic survey area.

Survey design

The seismic survey will be conducted using standard onshore seismic survey operations and procedures. The survey will consist of an array of seismic lines arranged in a grid with lines spaced 100-400 m apart. The survey will be carried out in phases, beginning with Area 1 which will cover an area of approximately 382 km² that incorporates the existing Ngamia 1 and Twiga 1 well sites, followed by surveys in Area 2 then 3 or vice versa. Since Areas 2 and 3 will be covered some months later (after Area 1 survey), Tullow will carry out site-specific stakeholder consultations to sensitise and enhance awareness among those communities. The seismic lines will have a width of approximately 3m to 4.5m.

Preparation of the seismic lines, including rolling, raking or scraping for line delineation, will take place a few days before the lines are acquired. The seismic survey data acquisition will take approximately 152 to 255 days. The preparation of seismic lines and data acquisition activities will be run concurrently such that the duration of the proposed 3D seismic survey from mobilisation to demobilisation shall be approximately 257 to 360 days depending on daily production rates ranging from 1.5 to 2.5 Sq Km per day.

Seismic Upholes

Seismic 'upholes' are shallow drill holes (20–50m in depth) placed at regular intervals (1–2km) along exploration seismic lines. 'Uphole shooting' allows estimation of the thickness and seismic velocity of the weathered zone as well as the sub-weathering velocity. These data are then used in computing time corrections to a nominal seismic datum, which is a fundamental step in computer processing of seismic field data. Uphole shooting involves successive detonation of a series of charges at varying depths inside the drill hole and recording of the 'uphole time' with a surface geophone placed near the uphole

Seismic upholes will be drilled at regular intervals along the seismic lines. The upholes will be drilled by a small truck mounted rig using a fully contained water based mud system. Uphole drilling will take place after the seismic survey has been completed.

Uphole drilling is a relatively simple process and no drill casing is used. The drilling fluids used in uphole drilling consist of soil, ground sandstone and locally sourced groundwater as a wet mix. Apart from soil, ground sandstone and groundwater, no chemicals will be added to the drilling fluid. Once recordings have been made, the majority of the cuttings will be returned to the hole. The cuttings present no risk to the environment in toxicity terms. Excess cuttings at each uphole, if any, are placed on top of the uphole and will integrate into the soil over time.

3.4.3 SEISMIC SURVEY LOGISTICS

The seismic surveys are expected to take about 8 to 12 months to complete and will require a crew of approximately 400 to 500 persons. A base camp will support the crew, and "fly camps" will accommodate smaller-sized groups of personnel in outlying areas, and will be set up as and when required. A 'fly camp' is a temporary advanced camp located at a distance from the main base camp (see 3.4.6 below). A fully equipped and staffed ambulance will be on standby in case of any accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the base camp. There is airstrip in Lokichar that can handle small fixed-wing aircraft. A Medevac plan will be developed for transporting injured parties out of the field.

Where possible unskilled and semi-skilled workers will be hired from the local communities; this will be done following consultations with the relevant local authorities and communities. The aim will be to ensure a fair distribution of employment opportunities.

Seismic survey operations

4x4 vehicles will be required for movement of personnel and equipment, and to support camp operations. A number of Vibroseis trucks will be used for acoustic energy generation, and there will also be recording trucks to receive the data relayed from the geophones. Bulldozers and mulchers will be used for improving or opening up new access roads (the latter only if absolutely necessary), and for cutting the transect lines, respectively.

3.4.4 DATA ACQUISITION METHODS AND EQUIPMENT

The seismic survey will be conducted using Vibroseis and/or dynamite charges. The seismic acquisition methodology has been designed to minimise disruption to local flora and fauna as well as the local communities. Low Impact Seismic technologies will include: the use of Vibroseis as acoustic energy sources; line-cutting with mulchers to minimise line width and accelerate re-growth of vegetation; and use of bulldozers to open up new or improve existing access roads.

A Vibroseis truck has a large metal plate under the center of the truck body that is lowered onto the ground so that the entire weight of the truck is on the plate. The plate is then caused to vibrate for a short period (typically 20 seconds) at a specified power and frequency, creating seismic waves that travel into the ground.



KZ34 Vibrators operating around Kavarwar area of block 10BB

The 3D seismic data acquisition process¹ is as follows:

- Surveying-The main tasks during survey exercise include initial installation of a small number of survey control points, then setting-out source points and receiver stations for use. This would be done by the conventional survey method of using RTK GPS backpack surveying units and biodegradable markers. . Cutting activities though minimal for the receiver and source lines shall be done manually or

¹Source www.static.shell.com

mechanically where appropriate. In open areas where there is clear line of sight no cutting shall be done.

- Recording-This involves laying of geophones on the receiver stations and generating energy (vibrations) on the perpendicular source lines to generate seismic energy, which are reflected and recorded on magnetic tapes via the recording instrument.

The proposed onshore seismic survey will involve the use of four-wheel drive (4x4) vehicles, vibroseis trucks, and recording trucks, small 'shot hole' drill rigs, a mulcher, and a bulldozer to provide vehicular access roads (cut-lines).

3.4.5 PERSONNEL AND FACILITIES

The project requires a base camp to be constructed within the survey area. Base camps range in size and are constructed to accommodate 400 to 500 persons depending on the size of the project. There will, in addition, be small, mobile fly camps that will be serviced from the main base camp. A mobile fly camp is used to extend the operational reach of the seismic line crews during operations. Mobile fly camps range in size from 50 to 100 persons. Thus, the base camp will support the crew, and "fly camps" will accommodate smaller-sized groups of personnel in outlying areas, and will be set up as and when required. Such campsites will be located away from community settlements. They will be provided with appropriate security personnel and security features such as fences, guard gate, etc.

Land clearing for campsite construction will be undertaken both manually and mechanically. The crew will use tents and containerised portable buildings as office and residential accommodation. This would largely minimize fresh cuttings. Although, activities in the camp site require running of generator sets as source of power, the noise level from the power-generating sets shall be routinely checked to ensure that it does not exceed required levels as per NEMA regulations. It is advisable to use previously occupied sites wherever possible to minimize impact on the environment. Maintenance of vehicles, generator sets and line equipment would be done within the base camp.

A fully equipped and staffed ambulance will be on standby in case of accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the base camp. There are a number of airstrips in the area that can handle small fixed-wing aircraft such as at Lokichar. A Medevac plan will be developed for transporting injured parties out of the field if such a case happens to occur.

Where possible, labour will be sourced from local communities. All personnel will be issued with necessary personal protection equipment (PPE) and trained by their supervisors to complete their assigned tasks in a safe and secure manner.

3.4.6 OCCUPATIONAL HEALTH AND SAFETY

Safety and environmental protection responsibility are among the most important aspects of modern seismic surveying in oil and gas exploration and production activities. The health and safety of all personnel and the impact of operations on third parties and on the environment are of paramount importance. It is the responsibility of crew managers to ensure that safety standards are maintained and safe working practices are adhered to by all members of the crew. No work can be done efficiently if it is not performed safely. Some of the safety issues include, but are not limited to, the following factors:

- Risk of personal injury at work, especially during excavation and construction.

- Noise generation;
- Solid and liquid waste management, including wastewater and effluent discharges;
- Oil and chemical spills;
- Transportation;
- Fire protection; and
- Material handling.

Occupational health and safety issues are best addressed when company internal management systems that address worker and public safety are compliant with Oil and Gas Industry guidelines on international good practices, e.g. International Association of Oil and Gas Producers (OGP), International Association of Geophysical Contractors (IAGC), World Bank – International Finance Corporation (WB-IFC).

It is a requirement that the Tullow Environmental, Health and Safety Management System (EHS-MS), together with the EHS and CSR (Corporate Social Responsibility) policies be integrated into the project lifecycle. The crew must also ensure that they adhere, at all times, to all international health and safety standards applicable in the Oil and Gas industry, in addition to Tullow's internal management systems.

3.5 WATER SUPPLY

Surface water bodies are scanty in the project area. However, groundwater resources are the most available source of drinking water. Water is exploited through excavation of boreholes. Several boreholes tied to oil and gas exploration have been drilled in the proposed project area (in Nakukulas area by Tullow and Lokapel area by BGP-CNPC). These wells could serve as important sources of water during the proposed 3D seismic programme.

3.6 EMISSION AND WASTE MANAGEMENT

3.6.1 EMISSIONS

3.6.1.1 AIR EMISSIONS

Emissions to air include transient airborne dust raised by construction activities (e.g. preparation of seismic cut lines and moving vehicles and equipment) and emissions from vehicles and machinery. These emissions are transient and insignificant in nature.

Other sources of air emission may include offensive but localised odours from poorly managed waste disposal and sanitary facilities at the camp site. The proponent will ensure minimum possible emissions to the air.

3.6.1.2 NOISE EMISSIONS

Noise emissions that could be released during the seismic operations will include those generated by vibroseis machines, field machinery (mulcher, bulldozer and support vehicles) and generators and work yard at the camp site. The proponent will ensure that noise produced is within levels provided by the NEMA Regulations.

3.6.2 WASTES

The types of waste that will be generated at the camp sites and/or work sites during the survey operation can be grouped into two categories, non-hazardous and hazardous, as per the NEMA Waste Management Regulations of 2006. The non-hazardous wastes would include: domestic wastes and effluents, plastics, metal cans, and paper. The hazardous wastes would include: medical and pharmaceutical wastes, waste oils, small quantities of chemicals (e.g. paint, thinners etc) and used batteries.

All waste material from field operations should be brought back to the camp site for proper disposal. Disposal options include: compaction and removal from site and burying (especially for biodegradable material), or a combination of these activities. Non-hazardous and non-recyclable wastes should be managed as per Tullow campsite designs. At particularly sensitive locations, or with hazardous materials, these disposal methods are not permitted, requiring the wastes to be transported to off-site locations for disposal at an approved licensed commercial disposal facility or municipal landfill. Metallic and other materials such as timber may be donated to the local communities for their own use in a controlled fashion, or otherwise sold to dealers in the town centres.

All solid wastes generated during the survey will be weighed and quantities recorded so that all waste streams can be tracked.

Hazardous (medical, pharmaceutical and waste oils) and non-hazardous wastes will be segregated, and disposed of in the waste disposal facility as provided for by the relevant Local Authority (Table 3.1). Biomedical waste will not be stored above 0°C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.

Table 3.1: Biomedical and pharmaceutical waste handling (NEMA Waste Management Regulations (2006).

	Type of Wastes	Details	Colour of Container and Markings	Type of Container
1.	Infectious Waste	Waste suspected to contain pathogens e.g. laboratory cultures, waste from isolation wards, tissues (swabs), materials, or equipment that has been in contact with tubings, catheters, IGS toxins, live or attenuated vaccines, soiled plaster casts and other materials contaminated with blood infected patients, excreta.	Yellow	Strong leak-proof plastic bag with biohazard symbol
2.	Pathological waste	Human and animal tissues or fluids, e.g., body parts, blood and other body fluids, foetuses, animal carcasses.	Yellow	Strong leak-proof plastic bag with biohazard symbol
3.	Sharps	Sharp waste, e.g., needles, infusion sets, scalpels, knives, blades, broken glass that may cause puncture and cuts. This includes both used and unused sharps.	Yellow – (marked sharps)	Puncture proof
4.	Pharmaceutical waste	Waste containing pharmaceutical e.g. pharmaceuticals that are expired or no longer needed; items contaminated by or containing pharmaceuticals (bottles, boxes).	Brown	Plastic bag or container
5.	Genotoxic Waste	Waste containing substances with genotoxic properties, e.g., waste containing cytostatic drug (often used in cancer therapy), genotoxic chemicals.	Yellow	
6.	Chemical waste	Waste containing chemical substances e.g. laboratory reagents; film developer, disinfectants, (disinfectants) that are expired or no longer needed solvents	Black	Plastic bag or container
7.	Waste with high content of heavy metals	Batteries, broken thermometers, blood-pressure gauges, etc	Red	
8.	Pressurized containers	Gas cylinders, gas cartridges, aerosol cans.	No details provided	No details provided
9.	Radioactive waste	Waste containing radioactive substances e.g. unused liquids from radiotherapy or laboratory research, contaminated glassware, packages, or absorbent paper, urine and excreta from patients treated or tested with unsealed radionuclides, sealed sources.	Red	Lead box, labelled with radioactive symbol
10.	General solid waste	Waste generated from offices, kitchens, packaging material from stores.	White	

	Type of Wastes	Details	Colour of Container and Markings	Type of Container
11	Micro organisms	Any biological entity, cellular or non-cellular capable of replication or of transferring genetic material.	No details provided	No details provided
12	Non-infectious/non-hazardous (non-clinical)		Black	Plastic bag or container

Table 3.2: Waste streams and management solutions

Waste	Source	Management Control
Domestic waste water	Toilets, showers, kitchen	Containerised waste water treatment unit or similar; tertiary polishing pit. Solids removed from site by NEMA approved contractor and taken to a NEMA approved facility; treated liquor discharged to ground offsite.
Vehicle wash waste water	Vehicle wash	No detergent to be used in vehicle wash. Used wash water to be passed through an oil-water separator and discharged offsite; discharged water must be completed in a manner that does not cause pooling or lead to unabated flow direct into a lugga or surface water feature.
Recyclables (plastic bottles, aluminium cans, glass bottles)	Kitchen and welfare units	Stored in the recyclable area and removed by Tullow approved waste disposal contractor
Paper, cardboard and wood	Office and packaging	Burnt in dedicated onsite burn pits, ashes are buried in food-waste-pit.
Styrofoam and plastics	Packaging and prefabricated wall units, insulation.	Where not held for repacking, or packing of deliverable out of the field, these are stored in the recyclable area and removed by Tullow approved waste disposal contractor

Waste	Source	Management Control
Food waste	Kitchen and welfare units	Food waste is buried onsite in a dedicated, fenced, food waste pit. The pit is unlined and the bottom of the pit is at least 25cm above the water table. After each deposit of food the waste is covered with a 30cm layer of soil to prevent odours and exclude vermin. The pit will not extend above ground. No other waste type will be buried in the food waste pit. The pit will be monitored for vermin and incorrect use.
Blood and offal	Slaughterhouse	Blood is captured in containers and deposited in the food waste pit. Water wash with bloody residue is piped to the waste water treatment unit.
Oil	Vehicle maintenance, used cooking oil	Stored in the oil storage area – separated for each type of oil. Used oil is removed by Tullow approved waste disposal contractor and returned to licensed waste disposal facility
Oily rags, used oil and fuel filters, used air filters.	Vehicle and equipment repairs	Stored in the oil storage area – separated for each type of oil. Used oil is removed by Tullow approved waste disposal contractor and returned to licensed waste disposal facility
Tyres	Vehicles	Stored on camp – area cordoned. To be removed at the end of the job for recycling. Subcontractors are responsible for their own tyres not seismic contractor.
Medical waste	Clinic and 1 st Aid incidents	Brought to the nearest clinic/hospital for disposal under the supervision of the onsite paramedic
Batteries	Lead acid, alkaline, NiCad, etc	Returned to licensed waste disposal facility
Membranes Saline solution	RO plant	Servicing carried out by the company who installed the system, every few months or if an issue occurs. Paramedic also checks the system on a weekly basis.

Waste	Source	Management Control
Building waste (rubble, rebar, metal)	Camp	Buried onsite; burial not to be within 30m of a lugga or surface water feature. No other waste will be buried in the building waste pit – liquid waste, wood, oils and grease, plastics, etc are forbidden from the pit. Metal is stored in the recycling area and is removed by Tullow approved waste disposal contractor.
Printer cartridges	Office	Sent back by Contractor to the manufacture for refilling and reuse.
Light bulbs	Site lighting	Light bulbs are stored in the recycling area and is removed by Tullow approved waste disposal contractor
Used spill kits and contaminated soil and water	Clean-up of incidental spills	Stored in the oil storage area. It is removed by Tullow approved waste disposal contractor

3.7 DECOMMISSIONING/ABANDONMENT

3.7.1 GENERAL ACTIVITIES

Once seismic acquisition is completed and the cables, geophones and other equipment have been removed from a particular location a property impact assessment team are mobilised to record the actual property that will be restored in line with the Tullow Kenya BV site-specific Livelihood Restoration Procedure. The decommissioning plan will involve the following sequence of activities:

- Workers lay-off and compensation;
- Equipment demobilization (such as containers, vehicles, accommodation facilities)
- Dismantling of camp facilities;
- Cleaning the camps and disposal of solid, liquid and hazardous waste;
- Restoration of waste pits, cesspools and the whole camp site;
- Restoration of cut lines, shot hole repairs, removal of any debris and recovery and destruction of dead charges within the project area; and
- Audit and sign off.

At the end of the operation, practical, expeditious steps should be taken to restore the site to as near possible to its original condition, promote natural re-vegetation and prevent erosion.

Line stakes and markers should be removed and disposed of in a responsible manner without impairing soil, water or other resources. The following authorities NEMA, National Museums of Kenya, Kenya Forestry Services, Ministry for Local Government and KWS

among others should be consulted on the most effective means of natural re-vegetation. However, it should be noted that the community may wish to retain certain roads. Wherever possible, new access routes, camp sites and seismic lines should be rendered inaccessible to the public. Appropriate methods include breaking up of concreted (at the campsite) and compacted surfaces (at the campsite and cutlines) to encourage re-vegetation.

4. PERMITS

Permits will be required at various stages of the project including the following;

- Drilling and abstraction permits to be obtained by the borehole drilling contractor. Other water sources may be used if boreholes are not successfully installed; all appropriate permissions for alternative water sources will be acquired.
- Following the completion of ESIA studies and subsequent granting of an environmental licence there are a number of permitting activities to be completed and before a seismic crew mobilises to the survey area including:
 1. Site selection and permissions for construction of a temporary base camp.
 2. Sensitisation of local communities and other key stakeholders.
 3. Permitting of seismic lines.
- Site selection for a temporary seismic camp is required to be completed a number of months in advance of mobilisation. This activity requires approval and permission from locally authorities and communities. Lease agreements are required to be put in place with private land owners or local authorities if land is deemed to be communal.
- During base camp construction phase, the survey lines require a field team to permit the lines to:
 1. Confirm number of project impacted person along each line.
 2. Determine impact of seismic activities along the line on livelihoods of local communities.
 3. Conduct an initial assessment of potential impacts and valuation of potential damages.

5. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS AND METHODOLOGY

The impact assessment process started with the identification of project “aspects” that arise as a result of the potential interaction between a project “activity” and a natural or socio-economic environment “receptor”. Potential changes (neutral i.e. no change, positive or negative) to any given receptor were then evaluated and where a positive or negative change was predicted, it was ranked via an impact significance ranking process.

5.1 THE ESIA PROCESS

The ESIA process constituted a systematic approach to the evaluation of a project and its associated activities throughout the project lifecycle. The process (refer to Figure 5.1) included:

- Screening and Scoping;
- Project Alternatives and Base Case Design;
- Existing Environmental and Socio-Economic Conditions;
- Impact Significance Assessment;
- Mitigation and Monitoring;
- Residual Impacts; and
- Disclosure and Stakeholder Consultation.

The ESIA also included stakeholder consultation that identified the views and opinions of potentially affected people and other interested parties. Stakeholder feedback was used to focus the impact assessment and, where appropriate, influenced project design and execution.

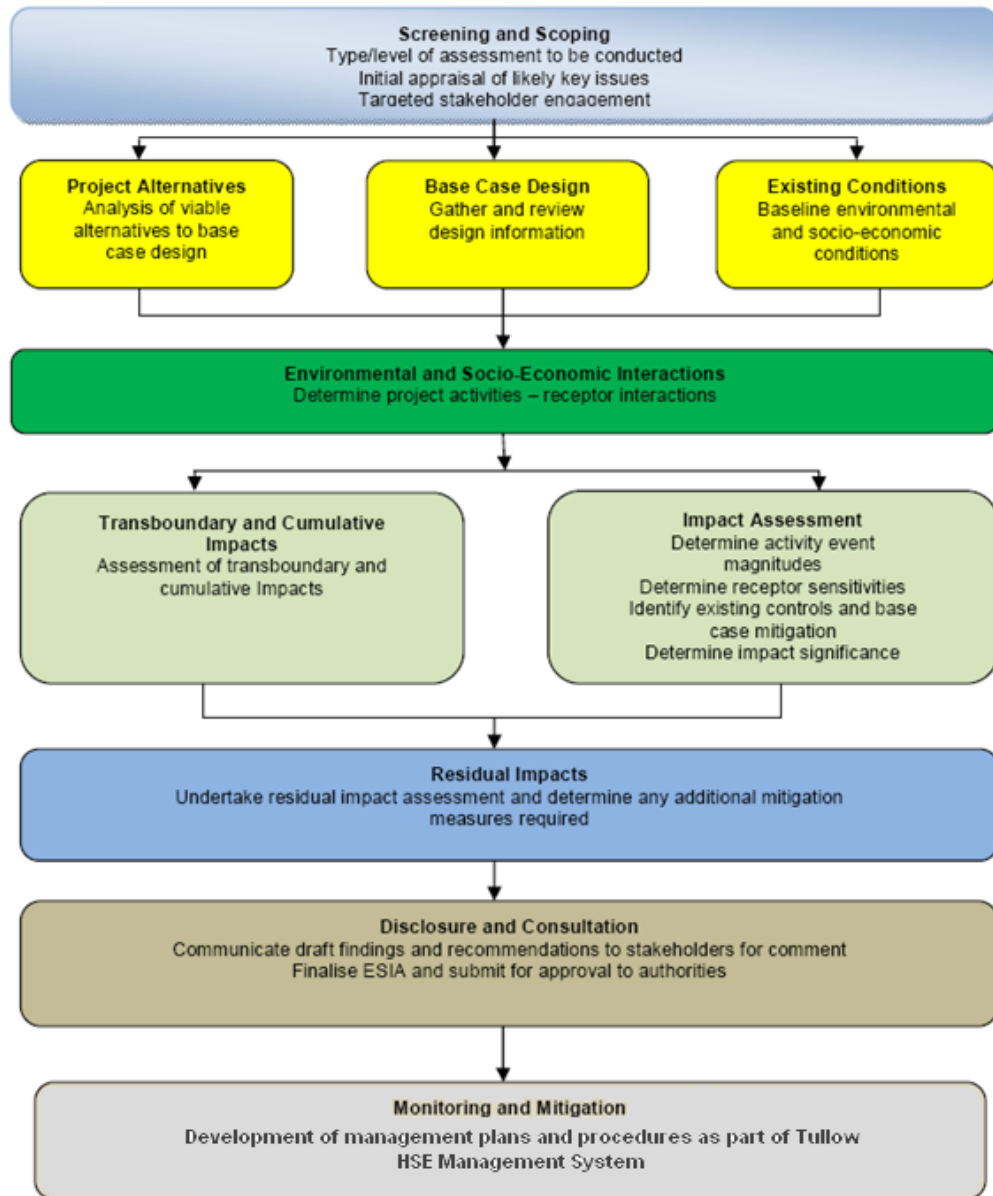


Figure 5.1: The ESIA process

5.2 ENVIRONMENTAL AND SOCIAL PARAMETERS ASSESSED

In order to identify potential impacts to receptors, an understanding of the existing conditions was established prior to execution of project activities.

Bearing in mind the elements of the TOR, including, for example, review of Tullow's Corporate Environmental requirements and associated legal and regulatory frameworks for ESIAs, we assessed the parameters below, and established both the baseline status and the status following impact by seismic survey activities.

PARAMETER TO BE ASSESSED	OUTPUTS
Geology, physiography and geomorphology	Provided a detailed description and baseline of physiographic and geological conditions. Also, a description of possible natural hazards that could impact on the development, e.g. floods, earthquakes.
Soils	Provided a detailed baseline description of soil and conditions such as erosion potential.
Climatology: winds, precipitation, evapotranspiration, moisture conditions	Climate and meteorology baseline.
Air Quality	Provided background on existing ambient conditions
Surface and Groundwater Resources	Baseline information on existing water resources including quality issues.
Wastewater Effluents/Solid waste	Description of how to handle such issues at the campsites and field
Aquatic Environment	Aquatic baseline information.
Terrestrial Environment: flora and fauna	Terrestrial baseline information.
Land and Mineral Resources: land use, recreation and tourism, mineral resources	Overview of e.g. mineral and petroleum resources, agricultural resources, recreation and tourism
Visual Aesthetics	Provided a description and cataloguing of pristine wilderness resources in the area; pre- and post-exploration.
Noise and Vibrations	Noise and vibrations baseline: activities that could produce noise and vibrations, including seismic wave generation, transport, etc
Offensive Odours	Baseline for landscape degrading materials.
Archaeological and Historic Sites	Archaeological baseline. Cultural and historic baseline. Identification of traditional use and culturally significant areas potentially affected by the development.
Economic Setting	Assessment of the Area targeted for growth and Labour and employment opportunities
Social Setting	Assessment of the Level of services available; Social support information and Identification of key community needs
Health Setting	Assessment of the status of health facilities; Access to health services; Occupational health and safety hazards; Hazards due to the use, storage, disposal or transportation of flammable, explosive, or toxic substances; Emission of electromagnetic or other radiation which may adversely affect electronic equipment or human health and Traffic hazards
Political Context	Boundaries and jurisdictions, administrative framework
Legislative Framework	This describes the regulatory framework and information requirements for the development to proceed through all phases of its life cycle.
Community Views and Concerns / Corporate Social responsibility by Tullow	Description based on key informant interviews and barazas with the public
Integrated environmental assessment	Environmental Management Plan including mitigation measures, monitoring strategies, abandonment

5.3 COLLECTION OF BASELINE DATA

5.3.1 OVERVIEW OF METHODS

The baseline data collection comprised of the following activities:

- Desktop studies on the biophysical and socio-economic conditions and issues in the proposed project area;
- Review of the regulatory framework and institutional arrangements for projects of such a nature;
- Detailed environmental assessment (26th October to 2nd November, 2012);
- Community/stakeholders public consultations and sensitization (26th October to 2nd November, 2012);
- Impact identification and development of mitigation measures; and
- Development of an Environmental Management Plan (EMP) including costs estimates and responsibility assignment.

Prior to the field study, a desktop study was conducted to review the available reports, and to design plans and maps in order to compile relevant biophysical and socio-economic information of the project area. The field study (detailed environmental and social impact assessment, public consultations and community sensitization, and development of mitigation measures and environmental management plan) was carried out. GPS coordinates were taken and recorded for all the sampling points and features of interest in the field. The field study also enabled cross checking of the data compiled during the desktop study.

5.3.2 PHYSIOGRAPHY AND GEOLOGY

A literature review and field verification of the physiography, regional geology and geological setting of the project area was undertaken and the potential of related hazards such as subsidence, landslides, earthquakes, soil erosion, etc were assessed in relation to the proposed seismic survey to be done in the area.

5.3.3 SOILS

Primary soil data was obtained using the exploratory soil and agro-climatic zone map and report of Kenya (Sombroek et al., 1982). Reference was also made to the NOCK oil blocks map for boundary delineation. The scale used in this report was 1:50,000. Field data was collected through visual observation of soil units and road/riverbed cut descriptions where applicable. The surface description assisted in classification of the soil units. Parameters assessed in surface description included: soil texture, colour, structure, drainage, soil depth, surface stones and rock outcrops. Surface physical characteristics were described to determine wind and soil-water erosion hazards, flooding, ponding and water-logging potential and accessibility of the units by equipment and vehicles. A GPS was used to geo-reference the sampling points. Soil samples were collected for fertility and texture laboratory determination. Desktop work included soil map compilation and correlation to assign soil boundaries and harmonize the soil legend.

5.3.4 CLIMATE

Temperature, wind and precipitation data were obtained from desktop studies of existing literature covering the area. In addition, wind data was supplemented by visual observations in the field.

5.3.5 AIR QUALITY

Determination of the ambient air quality in this rural and sparsely populated setting was assessed qualitatively.

5.3.6 SURFACE AND GROUND WATER RESOURCES

In order to assess the water quality, samples (from boreholes, shallow wells, water pans, springs, streams and rivers) were collected and analysed to determine their physico-chemical parameters, and compared with data from published literature. The locations of all sampling points were determined and recorded using a GPS receiver.

5.3.7 TERRESTRIAL ENVIRONMENT

Collection of baseline information for the terrestrial environment including floral and faunal components in the project area was based on field observations and supported by literature review. Considerations included inventories of habitat types and species (including local names, where provided); vegetation cover, classes, and dominance levels; presence of rare and endangered species; presence of ecological reserves, and any critical ecosystem components. In addition, assessment was done to determine whether the area has experienced any known loss of habitat or biodiversity decline, and whether the proposed seismic survey activity would have any adverse effect on the existing ecosystems, flora, and fauna. Field guide books were handy in helping to confirm identified species.

Habitats and animal encounters of interest were recorded, and photographs of species of mammals, birds, reptiles, amphibians, and arthropods present at the time of observation were taken.

5.3.8 LAND RESOURCES AND PARKS

The assessment was achieved through literature review and field observations. The issues considered included land use patterns in the area as well as available natural resources and heritage sites (including cultural and archaeological) which at the moment are not officially gazetted by the National Museums of Kenya. Also considered was the potential impact of the seismic exploration in the area on land use patterns and their sustainability.

5.3.9 VISUAL AESTHETICS

An assessment of visual aesthetics was based on observations in the field. The following issues were considered: -

- Scenery;
- Geomorphology and landscapes;
- Pristine natural environments;
- Potential impacts of seismic surveys and associated operations on the visual aesthetics of the area.

5.3.10 NOISE AND VIBRATIONS

The potential disturbance caused by noise levels during the seismic operation within the study area were taken into consideration during the fieldwork period. The mitigation of noise and vibrations arising from the use of Vibroseis and dynamite to generate the acoustic (seismic) waves, and associated support vehicles and equipment, was addressed.

5.3.11 SOLID AND LIQUID WASTES

Possible impacts from solid and liquid wastes generated as a result of the proposed seismic operation were assessed taking into account the increased use of motor vehicles and marine vessels, and mitigation measures suggested. An assessment of methods to be employed in solid waste and effluent management in the proposed project was made and implementation suggestions recorded.

5.3.12 PUBLIC CONSULTATIONS AND SOCIO-ECONOMICS

Public consultations were carried out in diverse parts of the project area (Table 5.1 below) with the following aims:

- To inform the local people and their leaders about the proposed seismic data acquisition project and its objectives.
- To gather the concerns and views of the local people and fishermen on the proposed project.
- To establish if the local people foresee any positive and/or negative impacts associated with the proposed seismic survey project, and suggest possible ways of mitigating negative impacts and enhancing positive impacts arising from it.
- To identify and document the diverse socio-cultural and economic setups in the project area that could be potentially impacted by the project activities.

Other social and economic aspects relating to the project area, including livelihoods and cultures, education and health, among others, were assessed.

The methodologies employed include review of available literature, public meetings and consultation with local residents and their leaders; and administration of formal questionnaires and interviews with interested parties and at household level.



Plate 5.1: A public meeting at Nakukulas Village



Plate 5.2: A public meeting at Loperot Village

5.3.13 HEALTH AND PUBLIC SAFETY

This assessment carried out by way of literature review of the available health data in the area. It also consisted of a site-walk survey using a checklist of environmental health issues such as general level of sanitation, waste disposal practices, water supply and availability of health facilities.

The main issues assessed included:

- Sources of water;
- Types of sewage disposal/facilities;
- Types and quality of housing;

- Refuse disposal;
- The general cleanliness of the environment;
- Availability of health facilities;
- Interaction between environment and health, and;
- Potential health impacts related to the project.

5.3.14 KEY INFORMANT INTERVIEWS

Some administrative, social, economic, cultural and health issues were captured through interviews with key informants such as district administration officers, opinion leaders, councillors, community elders, chiefs among others. They were asked to indicate their views and concerns regarding the following issues through a self-administered questionnaire:-

- Effect of the proposed 3D seismic survey on the operations of organizations/communities;
- Main concerns regarding the proposed 3D seismic survey;
- Suggestion to address these concerns;
- Anticipated positive impacts;
- Anticipated negative impacts ;
- Ways through which positive impacts can be enhanced; and
- Ways, through which negative impacts can be avoided, reduced or mitigated.

6. ENVIRONMENTAL AND SOCIAL BASELINE

6.1 PHYSIOGRAPHY AND GEOLOGY

The topography of the project area comprises mountains, hills, uplands, foot slopes, piedmont plains, sedimentary plains, lacustrine plains and floodplains. The expansive plains have elevations ranging between 437-768 m asl.

A distinctive feature in the project area is the large number of dry lugga channels that flow for only a few hours or days following rains. Often, gullies with high banks occur in grounds that are slightly more elevated than their immediate surroundings.

6.2 SOIL

The proposed 3D seismic survey programme areas lie within piedmont plains (Mapping unit Y10), Uplands (Ux 7 and Ux10), sedimentary plains (Ps28), and Hills and minor scarps (H9). The mapping units within the proposed 3D seismic survey programme are summarised below. The soil classification process follows the FAO-UNESCO legend that accommodates the worlds' soils in order to overcome gaps in national classification systems and to provide a common basis for soil correlation. The identification of soils is based on the presence of diagnostic horizons and diagnostic properties which are defined by measurable morphological, physical and chemical criteria related to soil characteristics that are the result of soil formation.

6.3 CLIMATE

The area, which is arid to semi-arid, receives low average annual rainfall and average temperatures range from 24 to 38°C (Republic of Kenya, 2002). During the dry seasons which are between August-February, temperatures vary between 26 and 40°C, while in the rainy seasons from March-July, the range is from 20 to 25°C. The lowest temperatures are experienced in the months of November and December, and the highest in the months of January, March and August and may exceed 37°C especially in the afternoons. The long rains occur between April and August, while the short rains occur in October and November. The annual rainfall amount is erratic and unreliable (Republic of Kenya, 2002). Rainfall is distributed on an east-west gradient with more rainfall in the western parts and other areas of higher elevation (Republic of Kenya, 2002), and is higher in the southern sector than in the northern sector of the project area. Rain falls in brief violent storms resulting in flash floods, particularly in the northern sector. The high temperatures and low rainfall causes high rates of evapo-transpiration that result in deposition of salt in the soil and capping on the surface (Republic of Kenya, 2002).

6.4 AIR QUALITY

There are no large scale industrial activities in the area. Cottage industries are mainly concentrated in Lodwar town and a few in Lokichar town. There are relatively few vehicles in the towns as compared to other towns in the more densely populated parts of Kenya. Consequently, the concentrations of carbon dioxide, sulphur dioxide, and nitrogen dioxide in air in the project area are considerably low and do not exceed the WHO

guidelines. Total suspended particulate matter tends to be naturally high as a result of the barren and windy environment.

Total Suspended Particulate Matter (TSPM):

The concentrations of TSPM in Lokichar exceeded the 1 year WHO guideline but did not exceed the 24 hour guideline. The levels of particulate matter at one site in Lodwar Town exceeded the 1 year WHO standard but not the 24 hour guideline. The TSPM levels are, however, related to natural wind-borne dust and represent daily wind variation and low vegetative soil conditions that characterise the area (see Appendix IV).

Nitrogen Dioxide:

The concentrations of nitrogen dioxide at all sites were considerably low and did not exceed the WHO guidelines (Appendix IV). This was attributed to minimal industrial activities and aerial dispersion of the oxides of nitrogen that were emitted by vehicles.

Carbon Dioxide:

The concentrations of carbon dioxide in Lodwar were higher than the levels that are generally found in ambient air (about 565 mg/m³ at the then prevailing temperatures of 29 to 34 degrees centigrade). In Lokichar, they were lower as the readings were taken after 6pm at a low level activity time. Vehicular emissions, other anthropogenic activities and natural sources often lead to elevated emissions of carbon dioxide.

6.5 SURFACE AND GROUND WATER RESOURCES

The dry (ephemeral/seasonal) sandy river beds within the project area, known as *luggas*, are sources of surface as well as potable groundwater. Other sources of surface and groundwater are water pans; hand dug wells and deep boreholes.

6.6 TERRESTRIAL ENVIRONMENT

The dominant species of vegetation in the project area includes *Acacia reficiens*, *Acacia tortillas*, *Bosnia curiae*, *Commiphora rostrata*, *Jatropha spp.*, *Cissus sp.*, *Acacia nubica*, *Euphorbia cuneata* and *Calotropis procera*. The bird species observed include; White headed Buffalo weaver, Chestnut bellied sand grouse, White bellied go-away bird, superb starling, and Fork tailed drongo among others.

6.7 LAND RESOURCES

Pasture and browse are the major land resource in the area and support the pastoral lifestyle of the local community.

6.8 VISUAL AESTHETICS

The project area lies in a location which has pristine and rugged scenic beauty with hills, riverine forests, plains and several sand rivers (*luggas*).

6.9 NOISE AND VIBRATIONS

Ambient noise in the project area is of low level as it is in a rural setting where there are neither industries nor significant traffic movement even within the towns.

6.10 SOLID AND LIQUID WASTES

There are no significant solid or liquid wastes that are generated within the project area. There are minimal activities concentrated in small town centres that can generate solid waste or oil waste at present.

6.11 SOCIO-ECONOMICS BASELINE

The proposed project area cuts across Turkana South and Turkana East districts in Turkana County. These are sparsely populated districts with an average of 6.7 persons per square kilometre, with clustered settlements within the major centres. The major communities within the project area are the Turkana and the Pokot although there are minorities like the Somalis found mainly in the major centres. . There are two Tswana clans (Nybilai and Sonyoka) in the area, who are mainly nomadic pastoralists. Each of these clans has their own traditions. They however live together both in the currently emerging permanent settlements and in the manyattas while looking for pastures. It is possible however to identify where each family lives even within the mixed settlements. A man lives together with his wife because there is a change in the number of women a man can marry in the present days. People marry few wives because, due to drought and cattle raids they have become poor hence cannot sustain big families.

Social networks and friendship is one strategy that ensures the survival of the people in this area, and these are created mainly through friendship and marriage. It is within these networks that a person will give gifts and other items to a friend in the hope that reciprocation will occur in future, in case this is needed due to loss of livestock due to natural disasters, theft or raids. In terms of decision making and asset distribution, the elders in a family play the main role. It is the elders who decide when to move to search for new pastures, where to build, where to first graze and how much property will be allocated to the wives and children. Some of the other issues that the men decide on include marriage, war and the fine an offender is supposed to produce. Women can give their opinions on issues concerning the community but the final decision is made by the men. They however all agree that women who are unmarried and still live with the parents are also entitled to a share of property, just like the male children. Family and clan conflicts are resolved by elders and where this is not possible; the chief is called in to arbitrate.

Education in the area faces numerous challenges among them being the nomadic livestock husbandry lifestyle that is practiced by the local communities hence low school attendance. In the project area, housing varies from semi-permanent to temporary structures called manyattas.

There is a high number of unskilled labour force in the extended project area due to lack of major economic activities except for livestock rearing. Communities in the extensive project area live together in villages and mainly rely on the Administration Police and Kenya Police Reservists for their security needs. The villages surveyed claimed that they do not have formal markets where they buy and sell goods, but there are some sale yards that are used for the sale and purchase of livestock. However, observations indicated that women in some areas especially Kanaodon sold goods such as maize in an informal market under a tree, where people could come to buy. Other observed economic activities included retail shops, bicycle repairs, motorcycle taxi (Boda Boda), Mpesa outlets, selling used clothes, bars and restaurants. These are clustered within the shopping centres around the nine villages visited.

There are no formal burial sites that were identified by the communities that were consulted. They bury within their homesteads or in their own plots as there are no specific burial grounds. They bury on any empty lot, where there are neither homesteads nor plots.

The places of worship identified by the communities were mainly churches built mainly by the Catholic and Reformed churches. They did not identify any traditional places of worship. Meetings are typically held under trees, which are also important as they are a source of food for goats and sheep.

Water is scarce in the whole of the area covered by Block 10BB and they use a network of often dilapidated wells and boreholes. The residents claimed that the search for water especially at the Turkwel River exposed them to risk of attack from a neighbouring community.

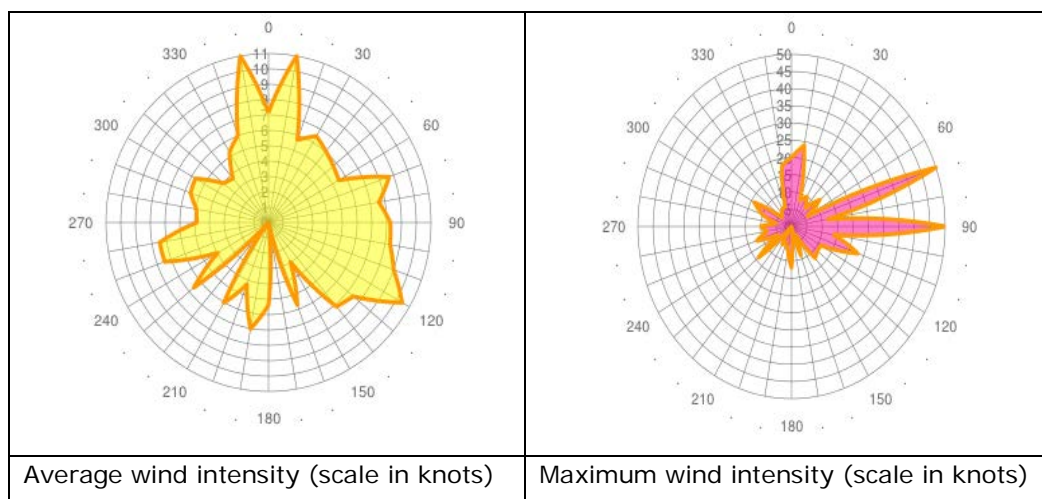
7. AREA OF INTEREST BASELINE

7.1 CLIMATE

Data obtained for climate from the Lodwar Meteorological Station is as follows:

7.1.1 WIND

Wind travels in the project area at an average speed of 11.5km/h east. Wind rose² data for intensity for the area is as shown below.



7.1.2 RAINFALL AND TEMPERATURE

The rainfall in the project area is scarce with an annual average of 117 mm. The area experiences an average maximum temperature³ of 38°C and an average minimum of 25°C.

Monthly Average	January	February	March	April	May	June	July	August	September	October	November	December
Rainfall (mm)	9	7	21	48	25	7	14	10	3	8	13	13
Max. Temp (°C)	34.5	35.5	35.5	33.8	33.8	32.8	32.2	32.8	34.4	35	33.8	33.8
Min. Temp (°C)	25	25.6	26.7	26.7	26.7	26.1	25.6	25.6	26.1	26.7	25.6	25

²Data obtained for Lodwar Meteorological Department obtained from; <http://www.aviador.es/Weather/Wind/HKLO-4,2012>

³ Source: <http://www.lodwar.org/climate-time.htm> (data recorded for 2011)

7.2 SURFACE WATER

The surface water potential is extremely low in the project area. The local communities are adapted to this situation, but persistently long droughts or successive seasonal droughts sometimes put at risk their lives and livelihoods, including frequent loss of livestock. Sources of surface water are seasonal rivers (*luggas*) and water pans. Several *luggas* exist within the project site namely *Nimeiyana*, *Lomokaamar*, *Kaguga* and *Kapetatuk luggas* east and north east of Lokichar town. The *luggas* flow from a west/southwest direction tending east/north east direction.



Plate 7.1: (a) Nimeiyana Lugga east of Lokichar town and (b) *Acacia tortilis* along a lugga around Katamanak hills housing white headed buffalo weavers' nests

7.3 GROUND WATER

The main ground water sources in the project area are boreholes and hand dug wells. The shallow hand-dug wells may, in a few cases, be equipped with hand pumps. Groundwater is the major source of potable water supply for both humans and livestock in the project area.



Plate 7.2: Community Borehole dug by Tullow in Nakukulas area

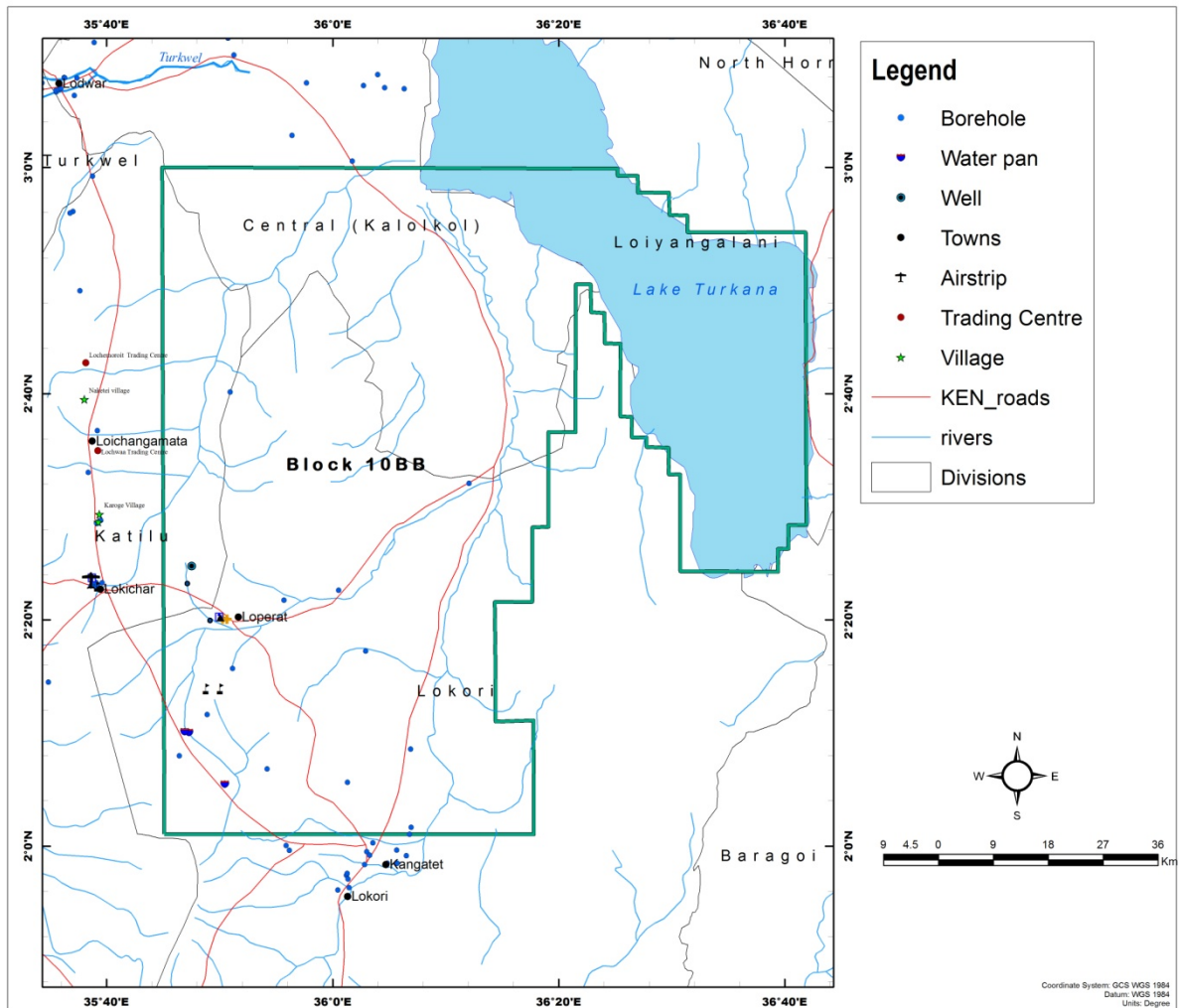


Figure 7.0: Map identifying water points in Block 10BB

7.4 SOIL

The proposed 3D seismic survey programme areas lie within piedmont plains (Mapping unit Y10), Uplands (Ux 7 and Ux10), sedimentary plains (Ps28), and Hills and minor scarps (H9). The mapping units within the proposed 3D seismic survey programme are summarised below. The soil classification process follows the FAO-UNESCO legend that accommodates the world's soils in order to overcome gaps in national classification systems and to provide a common basis for soil correlation. The identification of soils is based on the presence of diagnostic horizons and diagnostic properties which are defined by measurable morphological, physical and chemical criteria related to soil characteristics that are the result of soil formation. There are 26 soil units recognized by the FAO-UNESCO legend of which Kenya has 23. The soil mapping unit description refers mainly to the characteristics of the subsoil usually 'B' horizon, to a depth of 100cm (less if impenetrable material such as bedrock occurs at a shallower depth). Among the parameters described is: drainage condition, effective soil depth, colour (moist condition), mottling (if present), consistence (moist condition), calcareousness (if present), salinity, sodicity (if present), rockiness (if present), stoniness (if present), cracking (if present), texture, additional information on special topsoil or subsoil features, landform, geology, inclusions of other soils, etc (Sombroek *et al.*, 1982). For mapping units the first letter represents the landform while the second letter represents the geology of the unit.

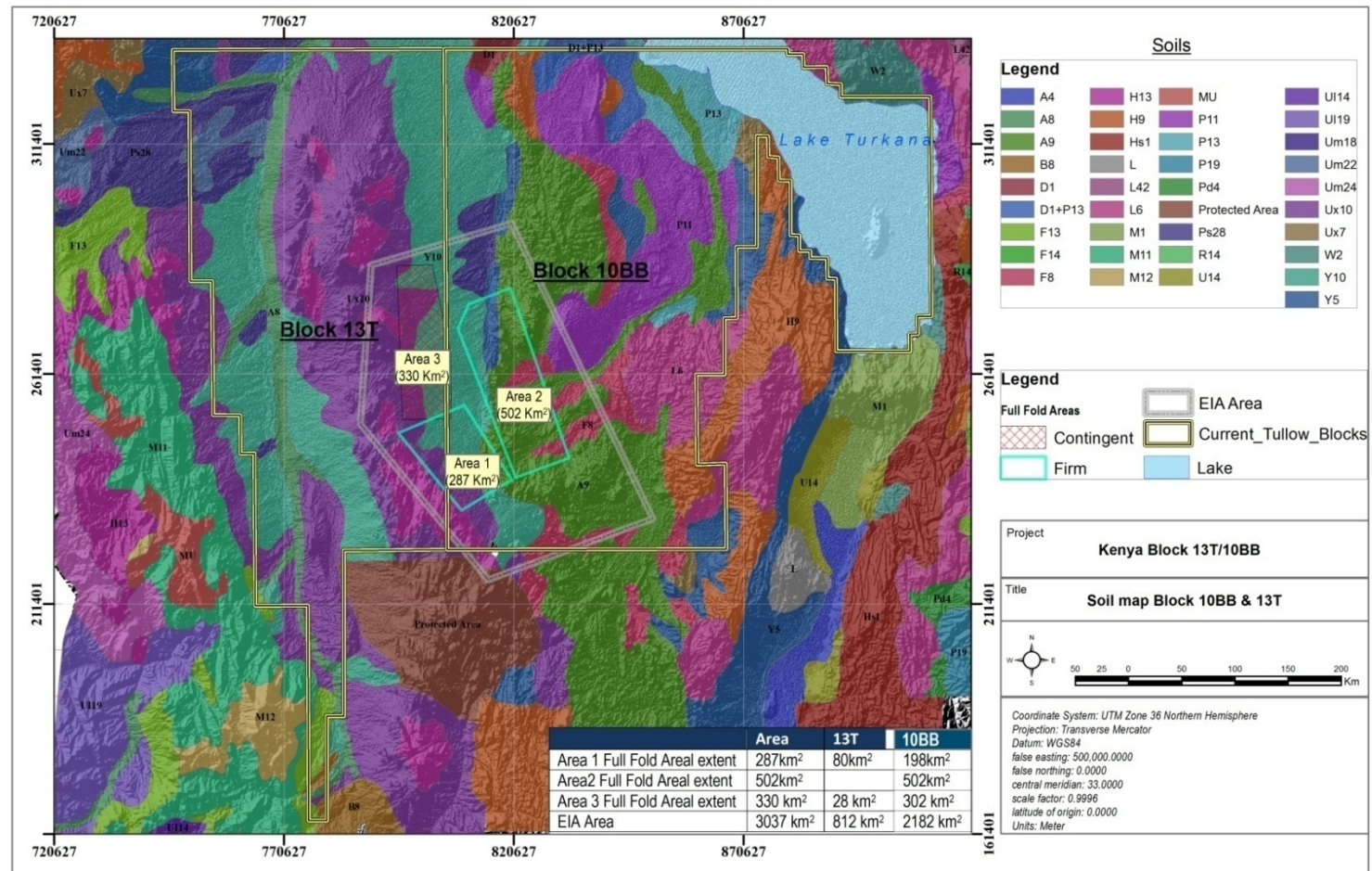


Figure 7.1: Soil map of the project area

Mapping unit Y10

This unit is found to the western part of Block 10BB from the northern border of the greater 3D area, traversing southwards to Katamanak Hills. This unit also covers the 3D demarcated area on the western fringes. The geology of Y10 is alluvium from undifferentiated basement system rocks, mainly gneisses. The landform/topography is piedmont plain, consisting of nearly level to gently undulating slopes (0-3%) that are dissected by narrow rills tending south-north direction. The meso relief consists of common small dunes (<1m) that are stabilized by *Indigofera spinosa* dwarf shrubs and *Grass spp.* The soils are moderately well drained, deep, dark yellowish brown to dark brown, sandy loam to gravely clay, moderately saline and strongly sodic. The surface consists of sealed and crusted sandy clay loam to sandy clay textured soils with low soil organic matter content, overlain by quartzite surface pebbles. The soils classify as *mollic Solonetz*. The vegetation of the area is a moderately dense Acacia shrubland dominated by *Acacia tortilis*. There are also *Cadaba farinosa* and *Indigofera spinosa* dwarf shrubs. The area serves as grazing grounds with goats being predominant. The unit is susceptible to wind and water erosion.



Plate 7.3: Mapping unit Y10 at Marethe area showing sandy soils with low organic matter and shallow rills that are common in the unit. The vegetation consists of dwarf shrubs and *Acacia tortilis* in the background.

Mapping unit Ps28

This mapping unit exists in the western part of Block 10BB. Within the demarcated 3D area, it is found from the central part of Mbango B to its eastern border. Its geology is cover sands. The landform/topography is sedimentary plain that is nearly level to gently undulating slopes (0-4%). The plain is dissected by narrow (<2m wide) and shallow luggas tending north-east to south-west direction. There are rills and potential gullies forming in the unit where the luggas cross land sloping perpendicularly to the drainage pattern. The meso relief consists of elevated surface (<1m) that is gently undulating due to erosion processes. The soils are well-drained, very deep, strong brown, friable,

moderately calcareous, moderately sodic sandy loam to sandy clay loam. The surface exhibits sheet wash and rill erosion that has resulted in a rugged surface with undulations and depressions. The subsoil is compact and though the surface soils are porous, they exhibit some sealing in places and thin crusts with sandy loam to sandy clay loam texture. The topsoil is also low in soil organic matter and due to the sealing; there is increased soil erosion as runoff is abetted with flow movement from upper to low lying land. The soils classify as *ferralic cambisols*. The vegetation of the area is an open grassed shrubland dominated by *Acacia tortilis*, *A. reficiens* and *Indigofera spinosa* dwarf shrubs and *grass spp.* forming the undergrowth. Trampling by grazing animals in the unit abets the degrading soils condition making it fragile.

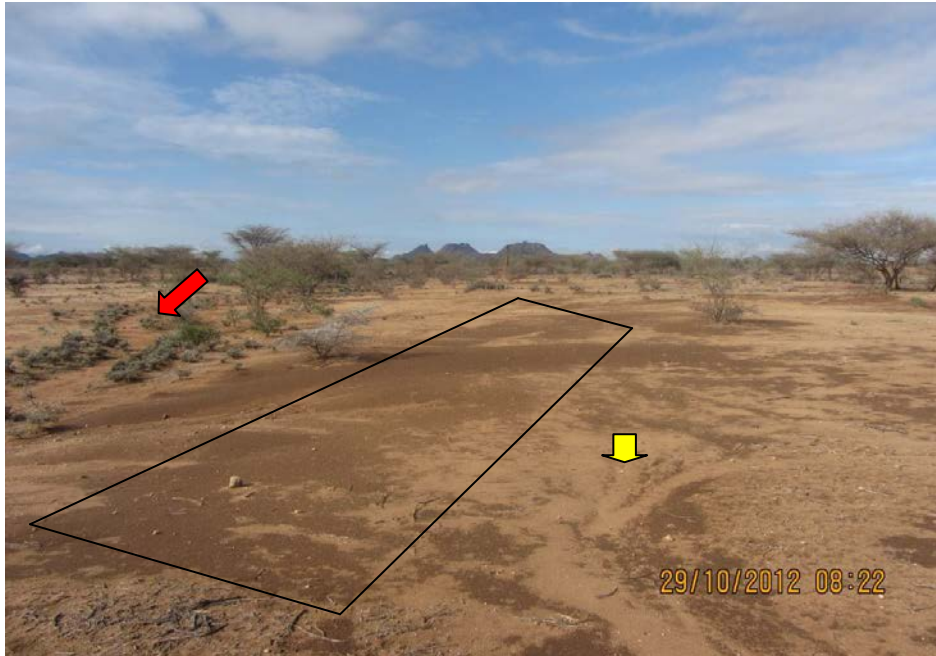


Plate 7.4: Mapping unit Ps28 in the project area exhibiting sheetwash erosion (bounded area in black with sand deposited on lower area: yellow arrow) and shallow lugga interfluvial bounded by *Indigofera spinosa* dwarf vegetation (red arrow).

Mapping unit Ux7 and Ux10

Ux7 mapping unit extends from NW to SW areas of the block while Ux10 is on the western part of the block. Within the demarcated 3D area the Ux10 unit is found on the western border of the block in Mbango B, from Lochwaa traversing southwards to its south-western border. The Ux7 unit within the demarcated 3D area is found around Ngamia 1 drilling well site. These mapping units classify as uplands of undifferentiated levels consisting of rolling topography and base level variables. Ux7 mapping unit extends from NW to SW areas of the block while Ux10 is on the western part of the block. The geology of Ux10 unit is undifferentiated basement systems, rocks predominantly gneisses while the geology of Ux7 is volcanic rocks predominantly basalts.

The uplands are intensely dissected with narrow and moderately deep interfluvial and the macro relief is rolling uplands. The soils are well-drained, shallow, yellowish brown, friable, strongly calcareous, moderately to strongly sodic and saline, gravely, sandy clay with a gravel surface. There are surface stones and rock outcrops in the uplands. The soils classify as *Calcaric Regosols*. The uplands support open and scattered *Acacia reficiens*, *A. tortilis*, *A. Senegal*, *Balanities aegyptiaca* and *Delonix elata* vegetation. The undergrowth is sparse *Indigofera spinosa*. The plant life is found in the interfluvial where there is water.



Plate 7.5: Mapping unit Ux10 found in the north east of Lokichar town, exhibiting surface quartzite and basaltic pebbles. Notice the deeply dissected topography and the concentration of vegetation along the interfluves.

Mapping unit H9

H9 unit is found in Kwarwar and Katamanak areas south west of the block. Within the greater 3D area, the hills are found in pockets on the north eastern and south eastern and south western parts of the block. This mapping unit classifies as hills and minor scarps. It consists of soil developed on undifferentiated tertiary volcanic rocks. The soils are saline shallow loam to clay loam, well drained dark reddish brown friable very calcareous bouldery and stony. They classify as *Lithosols* with *calcic Xerosols*.



Plate 7.6: Katamanak hills south west of the project area

7.5 LAND-COVER

The vegetation was divided into two different habitat types based on transects sampled, each of which was described individually (See Figure 7.2 below). In each vegetation type, a full description of habitat terrain features as well as vegetation structure and dominant species composition is given.

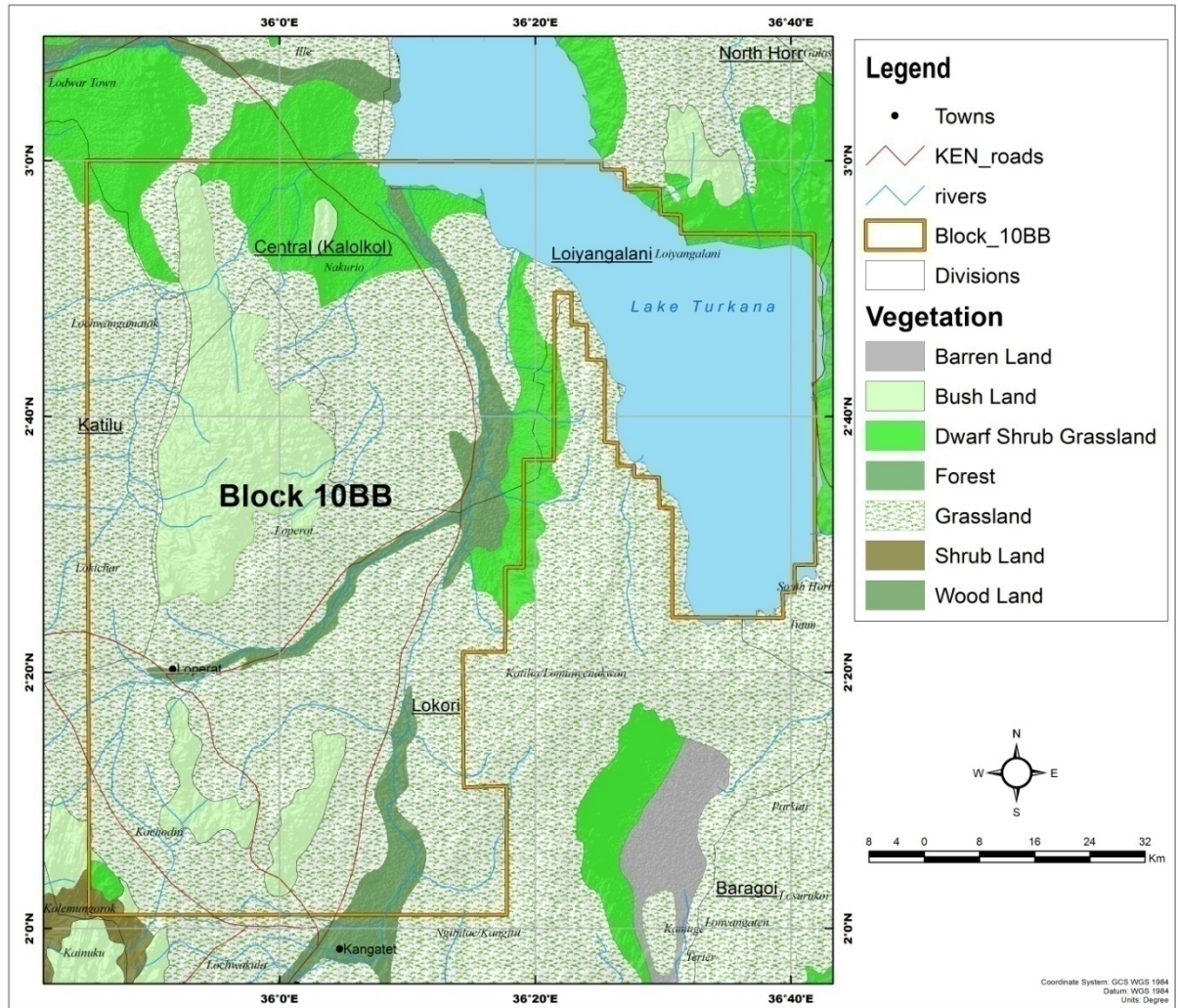


Figure 7.2 Vegetation of the project area

7.5.1 TOPOGRAPHY

The landform/topography is a kaleidoscope of mountains, hills, uplands, foot slopes, piedmont plains, sedimentary plains, lacustrine plains and floodplains. The expansive plains have elevations ranging between 437-768 m asl. Lava flows, which generally occur in a north-south direction, form the major central mountains and hills, including Kavarwar and Katamanak. The sedimentary plains on the western side of these mountains and hills break into piedmont plains of various parent materials. Denudation has been active within the study area and the once volcanic capped hills now reveal exposures of basement system rocks.

There are numerous seasonal as well as ephemeral streams (referred to locally as *luggas*) that flow for only a few hours or days after the rains (Walsh and Dodson, 1969). The flows are often torrential and flooding outside the shallow stream/river channels is a common phenomenon.

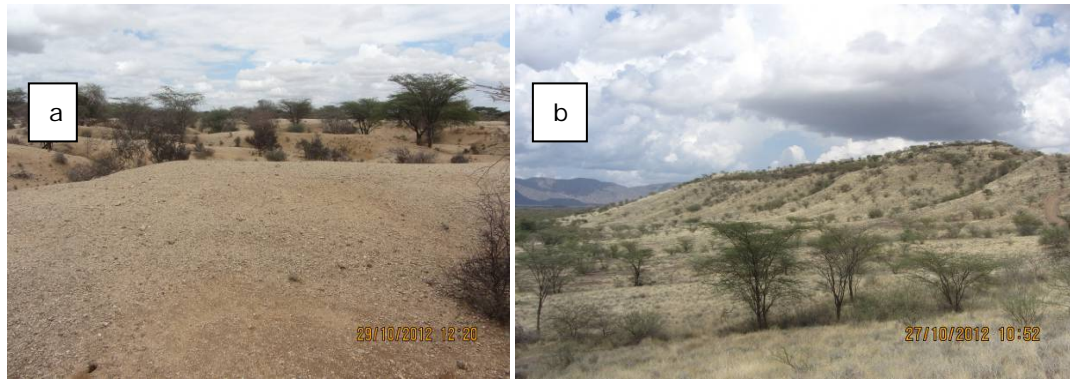


Plate 7.7 a) Uplands north east of Lokichar town and b) The foot slope of Katamanak hill south west of Lokichar town.

The geology of the area is dominated by rocks ranging from Precambrian (Neo-Proterozoic) to Recent age. These include:

- The Precambrian (Neo-Proterozoic) basement rocks consisting of a variety of gneisses and undifferentiated brecciated rocks;
- Tertiary metamorphics such as quartzites and Tertiary lavas mainly basalts, phonolites, nephelinites, trachytes, andesites and overlying tuffs and gritty tuffs;
- Pleistocene to recent deposits.

The general stratigraphic succession of the Lokichar basin is described by Morley et al. (1992) as consisting, in ascending order; of the Precambrian basement rocks, Turkana (Loperot) grits, volcanic rocks and Pliocene to Recent sediments.

The Precambrian metamorphic basement system rocks of Turkana East consists of a stratiform sequence of successive layers of differing lithology that represents a sedimentary succession which has been subjected to granitization and metamorphism of a high degree. These are comprised of an upper fine-grained pelitic series with crystalline limestone and quartzites overlying a series of coarse gneisses, migmatites and a variety of undifferentiated brecciated rocks. The gneisses are marked by an increase in granularity and are lighter in overall color. Localized bands of crystalline limestone and highly weathered quartzites are common. Due to the overlying thick sediment and volcanic cover of approximately 4-8 km (Wescott et al., 1999) the basement rocks are of no hydrogeological significance in Turkana East. Localized exposures of the basement rocks occur in river channels and on hills where they have been exposed due to erosion of the overlying volcanic cover.

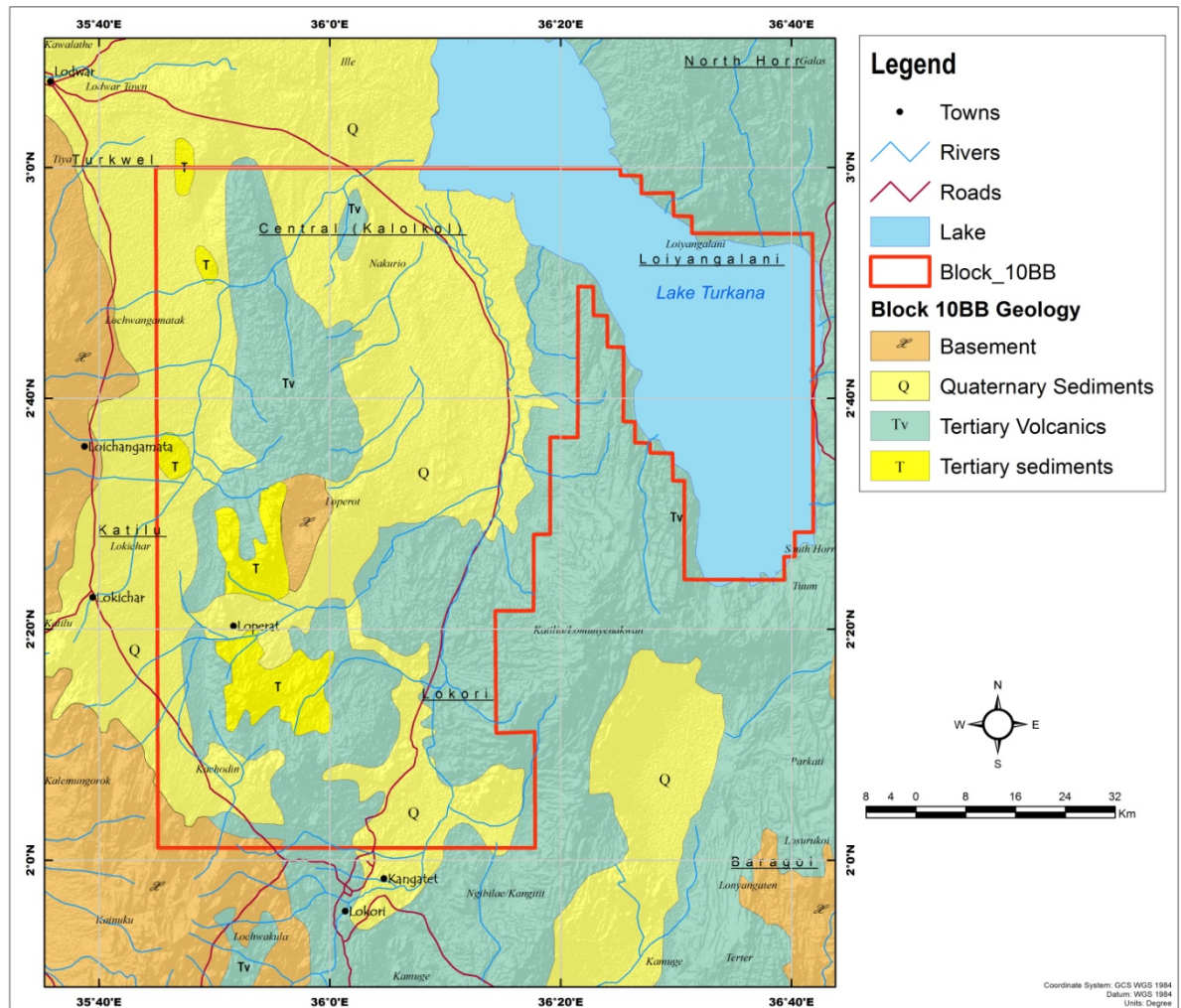


Figure 7.3 Geology of the study area

7.5.2 HABITAT

The vegetation was predominately intercepted by natural (bushland/woodland) trees with dry natural grass and bushes below them. The natural habitats include open grassland, bushed grassland, bushland and riverine indigenous trees (e.g., *Acacia tortilis*, *Delonix elata*, *Salvadora persica* and *Boscia coriacea*). The dominant plant species included trees of *Acacia tortilis*, *A. nubica*, *A. senegal*, *A. reficiens*, *A. mellifera*, *A. paolii*, *Ziziphus mucronata*, *Delonix elata*, *Commiphora rostrata*, *Balanites aegyptiaca*, *Salvadora persica* and *Dobera glabra*. Shrubs and herbs of *Indigofera spinosa*, *Sericocomopsis pallida*, *Euphorbia cuneata*, *Maerua endlichii*, *Euphorbia heterochroma*, *Cadaba coriacea*, *Caralluma acutangula* and other herbaceous species such as *Cyathula cylindrica*, *Pavonia patens*, *Heliotropium sp.*, *Sericocomopsis pallida*. Ecologically the few relic trees in the study site are important as they were observed to have created microhabitats of grasses and bushes below them with their shade. Such areas were also heavily grazed. These habitats host insects, reptiles, birds, animals and maintain the biodiversity of the study site and need to be conserved under whatever development may take place. *No plant species of special conservation status was recorded in this study.*

7.5.2.1 KATAMANAK HILLS AREA

This sampling site is within the footslopes of Katamanak Hills. The site is dominated by *Acacia-Commiphora* bushland that comprises *Acacia tortilis*, *A. reficiens*, *A. nubica*, *Commiphora rostrata*, *Euphorbia cuneata*, *Maerua endlichii*, *Cadaba sp.* The herbaceous taxa include *Indigofera spinosa*, *Sericocomopsis pallida* and *Cissus sp.* *Eragrostis sp.* is the only grass enumerated on the site.



Plate 7.8: Katamanak footslope showing *Acacia-Commiphora* dominated bushland

7.5.2.2 KAWARWAR /KATAMANAK AREA

This is *Acacia-Commiphora* dominated sampling site running parallel on the eastern part of cutline KE13T-48. The habitat comprises of mature *Acacia senegal*, *A. tortilis*, *A. mellifera*, *A. reficiens*, *A. paolii*, *Commiphora strata*, *Dobera glabra*, *Balanites aegyptiaca*, *Grewia tenax*, *Cadaba sp.*, *Boscia endchilii*, *Euphorbia cuneata* trees and shrubs and the herbaceous includes *Indigofera spinosa*, *Asparagus Africana*, *Sericocomopsis pallida*, *Barleria sp.*, *Euphorbia heterochroma*, *Polygala sp.* and *Euphorbia hirta*. *Indigofera spinosa* dominates the undergrowth.



Plate 7.9: *Acacia-Commiphora* bushland around Kawawar area

7.5.2.3 KAMONUKWEE AREA

This sampling site is on the western side of Kavarwar hills extending to the intersection of cutlines KE 10BB 24 and KE 13T 48. It comprises of patch of purely indigenous trees of *Acacia reficiens*, *A. tortilis*, *Acacia paolii* (vern. Name: *Epetet*), *Acacia nubica* (Vern name: *Eyelel*), *Salvadora persica* (vern Name: *Mswaki*), *Balanites aegyptiaca*, *Cadaba sp.*, and *Indigofera spinosa*, *Justicia exigua*, *Sericocomopsis pallida* herbaceous taxa. The little under storey vegetation is small bushes of *Indigofera spinosa*.



Plate 7.10: Kamonukwee area vegetation type

7.5.2.4 NAKIPOMEA AREA

This sampling site is on the western side of Kwarwar hills extending to the intersection of cutline KE13T 48 and the Lokichar-Lokori road. This is a patch of *Acacia reficiens*; *Commiphora africana* type, *Boscia coriacea*, *Euphorbia cuneata*, *Euphorbia heterochroma*, and the parasitic *Loranthus* sp. with open gaps filled with *Indigofera spinosa* and *Sericocomopsis pallida*. The indigenous patches are ideal for conservation.



Plate 7.11: Nakipomea area habitat

7.5.2.5 NAKUKULAS AND ENKALALE ANGIMAMUKI AREA

These sites are to be found east of Ngamia 1 well site. The habitat comprises bushland and grassland. The vegetation is open grassland with a few scattered trees of *Acacia tortilis*, *A. reficiens*, *A. nubica*, *Commiphora rostrata*, *Boscia coriacea*, *Delonix elata*, *Capparis* sp., *Cadaba* sp. and *Maerua endlichii*, *Cissus* sp., *Indigofera spinosa*, *Jatropha villosa*, *Aloe secudiflora*, *Leuca* ssp. The woodland in this area is mainly of *Acacia tortilis* and good habitat for bird and insect biodiversity.

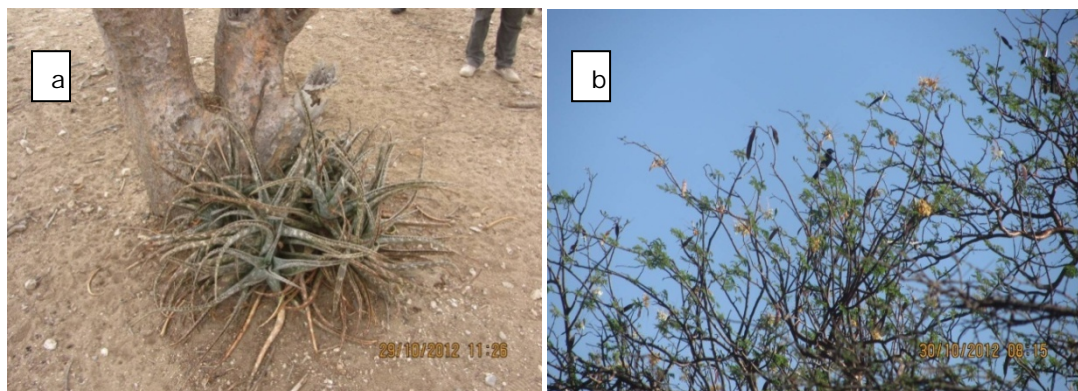


Plate 7.12: Nakukulas and Enkalale Angimamuki vegetation type a) *Aloe secudiflora*, and b) *Delonix elata*

7.5.2.6 SABAA-ATOT-ATIRAE AREA

These habitat types are to be found north east of Lokichar town. The habitat comprise of open *Acacia/ Balanites/* bushland and open grassland with scattered trees and few clumps of bushes and heavily grazed and rocky. They comprise *Acacia tortilis*, *A. reficiens*, *A. senegalensis*, *A. mellifera*, *Balanites aegyptiaca*, *Salvadora p rsica*, *Delonix elata*, *Boscia coriacea*, *Grewia tenax*, *Commiphora rostrata*, *Indigofera spinosa*, *Barleria eranthemoides*, *Euphorbia cuneata*, *Heliotropium sp.*, *Caralluma acuntangula*. The habitats have little impact on biodiversity if any.



Plate 7.13: *Caralluma acuntangula* vegetation type within Sabaa-Atot-Atirae area.

7.5.2.7 KAPETATUK/APRUTE AREA

These are open sites, scattered *Acacia* wooded/bushlands dominated by undergrowth of *Indigofera spinosa*, rocky and heavily grazed, isolated bushes of *Balanites aegyptiaca*. The tree species are *Acacia tortilis*, *A. reficiens*, *A. nubica*, *Boscia coriacea*, *Cadaba sp.*, *Acacia senegal* (Gum arabicum) *Commiphora rostrata* and *Salvadora p rsica*. Other herbaceous species are *Indigofera spinosa*, *Calotropis procera*, *Caralluma acuntangula*, *Barleria eranthemoides*, *Cissus sp.*, *Polygala sp.*, and *Jatropha sp.*



Plate 7.14: *Calotropis procera* within Kapetatuk/Aprute habitat

Habitat significance

Habitat	Significance		
	Regionally	Nationally	Internationally

Habitat	Significance		
	Regionally	Nationally	Internationally
Acacia bushland	<ul style="list-style-type: none"> Support diverse animal species such as small mammals and birds. Source of wild food to people. Provide vegetative structure and diversity that provide vital nesting areas for birds. Source of materials for shelter. 	<ul style="list-style-type: none"> Maintaining the water cycle. Check global warming by using carbon dioxide in photosynthesis. Support diverse animal species. Scientific and ethical knowledge. 	<ul style="list-style-type: none"> Maintaining the water cycle. Check global warming by using carbon dioxide in photosynthesis. Scientific and ethical knowledge.
Acacia shrubland	<ul style="list-style-type: none"> Provide land cover and soil protection. Ornamental plants. Source of timber and non-timber products used by locals for building manyattas. Some shrubs such as <i>Acacia reficiens</i> are used by the locals as medicines. Source of Wood fuel and Charcoal. Provide an abundance of berries and fruit, eaten by many different birds and mammals. 	<ul style="list-style-type: none"> Provide floristic diversity. Wood fuel and Charcoal. Source of timber and non-timber products. Maintaining the water cycle. Check global warming by using carbon dioxide in photosynthesis. Scientific and ethical knowledge. 	<ul style="list-style-type: none"> Nature-based Tourism and research education and monitoring. Maintaining the water cycle Check global warming by using carbon dioxide in photosynthesis. Scientific and ethical knowledge
Grassland	<ul style="list-style-type: none"> Reduce soil erosion in the area Important source of Grazing grounds as sustainable source of livestock feed Production of Forage Mammalian species use these open areas of fields and to meet their needs for food, cover, and breeding Breeding stocks, population reservoirs for certain insects such as ants 	<ul style="list-style-type: none"> Grazing: the sustained production of forage thus improving livestock production leading to availability of livestock in the external market Maintaining the water cycle Check global warming by using carbon dioxide in photosynthesis. Scientific and ethical knowledge 	<ul style="list-style-type: none"> Maintaining the water cycle Check global warming by using carbon dioxide in photosynthesis. Scientific and ethical knowledge
Riverine	<ul style="list-style-type: none"> Resting and 	<ul style="list-style-type: none"> Maintaining the water 	<ul style="list-style-type: none"> Maintaining the

Habitat	Significance		
	Regionally	Nationally	Internationally
forest	recreational options to the locals due to their ability to provide shaded grounds. <ul style="list-style-type: none"> Have sites of religious significance 	cycle <ul style="list-style-type: none"> Check global warming by using carbon dioxide in photosynthesis. 	water cycle <ul style="list-style-type: none"> Check global warming by using carbon dioxide in photosynthesis.

7.5.3 BIODIVERSITY

The range conditions within the southern, and south eastern part of the project area have very pristine conditions due to limited human interference/ modification (sites are at the boundary of Pokot-Turkana community thus frequent tensions culminating to constant raids forcing the communities not to settle there), while the northern, eastern, and northern, eastern and western parts of the project area have undergone tremendous modification due to settlement and browsing/grazing by livestock.

In this regard, the southern, and south eastern have a high species diversity and distribution of insects, reptiles, birds and small mammal species compared to the northern, eastern, and northern, eastern and western part of the project area.

The area had a low fauna count, especially in relation to mammals, with only the presence of the following species being observed: black-backed jackal, ground squirrel, African hare, dik-dik and dwarf mongoose.

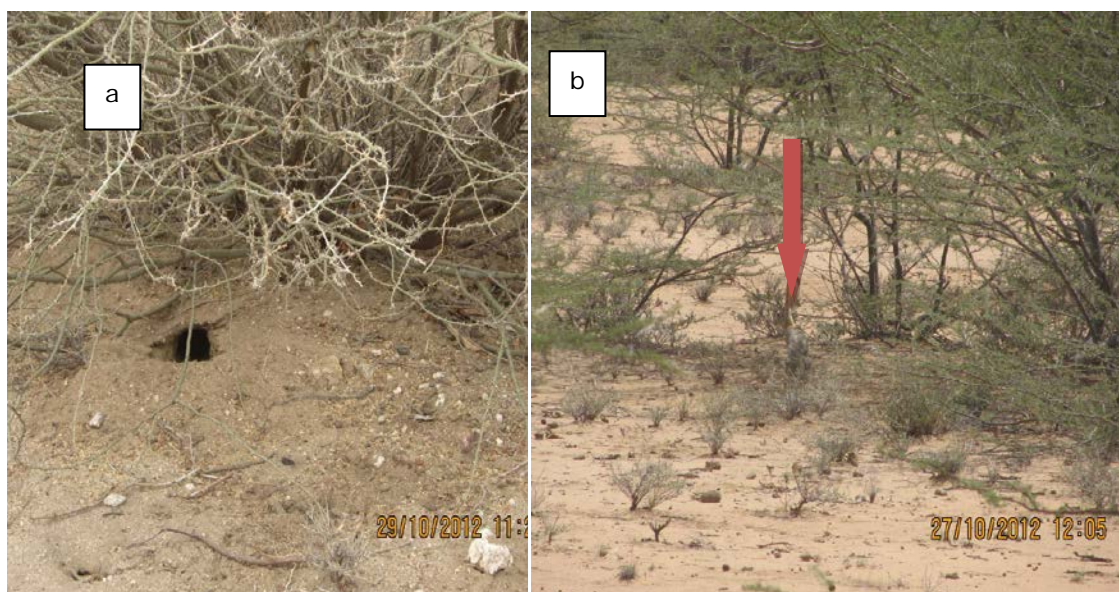


Plate 7.15: (a) Ground squirrel burrow and (b) an African hare (red arrow)

Insect species include termites, beetles, butterflies, ants, scorpions, camel spiders, bees, spiders, wasps, grasshoppers, locusts and damselflies.

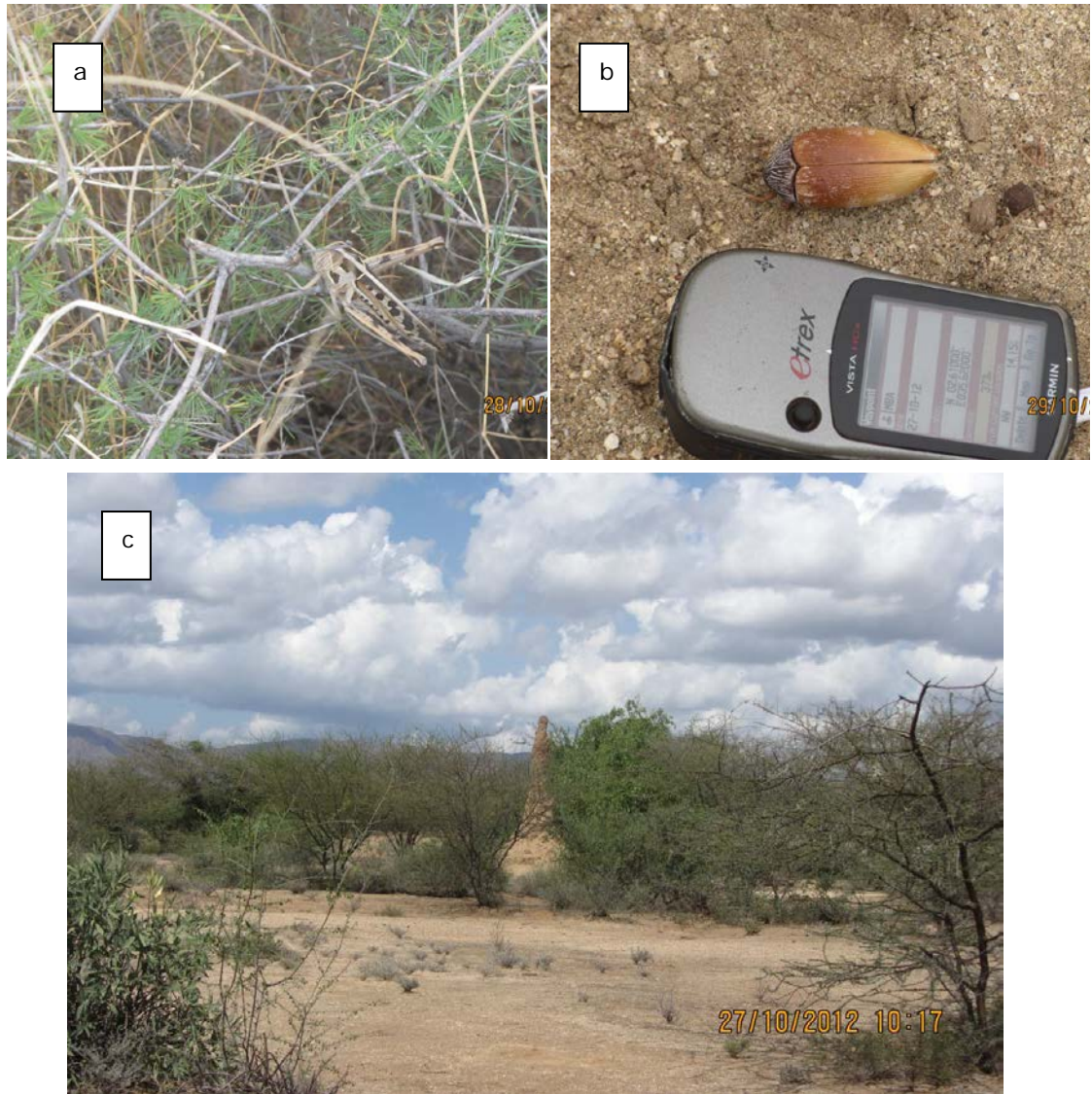


Plate 7.16: (a) Locust, (b) beetle shell and (c) an anthill in the project area

Reptile include species such as skinks, snakes and lizards

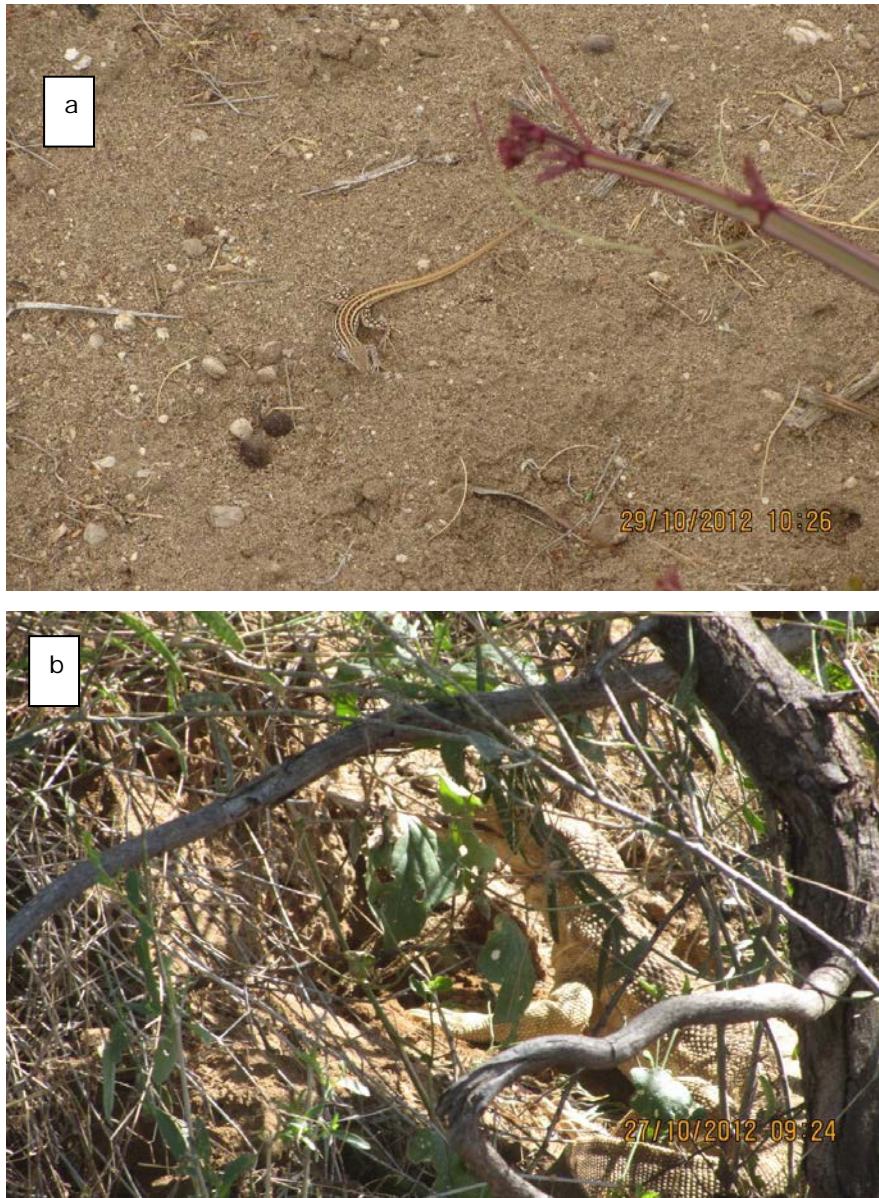


Plate 7.17: (a) a Skink and (b) Savannah monitor lizard.

Birds had a relatively richer representation with the following species being identified: Chestnut bellied sand grouse, Gabar chanting goshawk, White headed mouse bird, Augur buzzard, Red billed hornbill, Nubian woodpecker, Brubru, Abyssinian schimitar bill, White browed sparrow weaver, Black headed Plover, Red and Yellow barbet, White bellied bustard, Kori bustard, Black bellied bustard, Grey parrot, Crested Hoopoe, Eastern pale chanting goshawk, White headed Buffalo weaver, Superb starling, Fork tailed drongo and Brown necked raven among others.

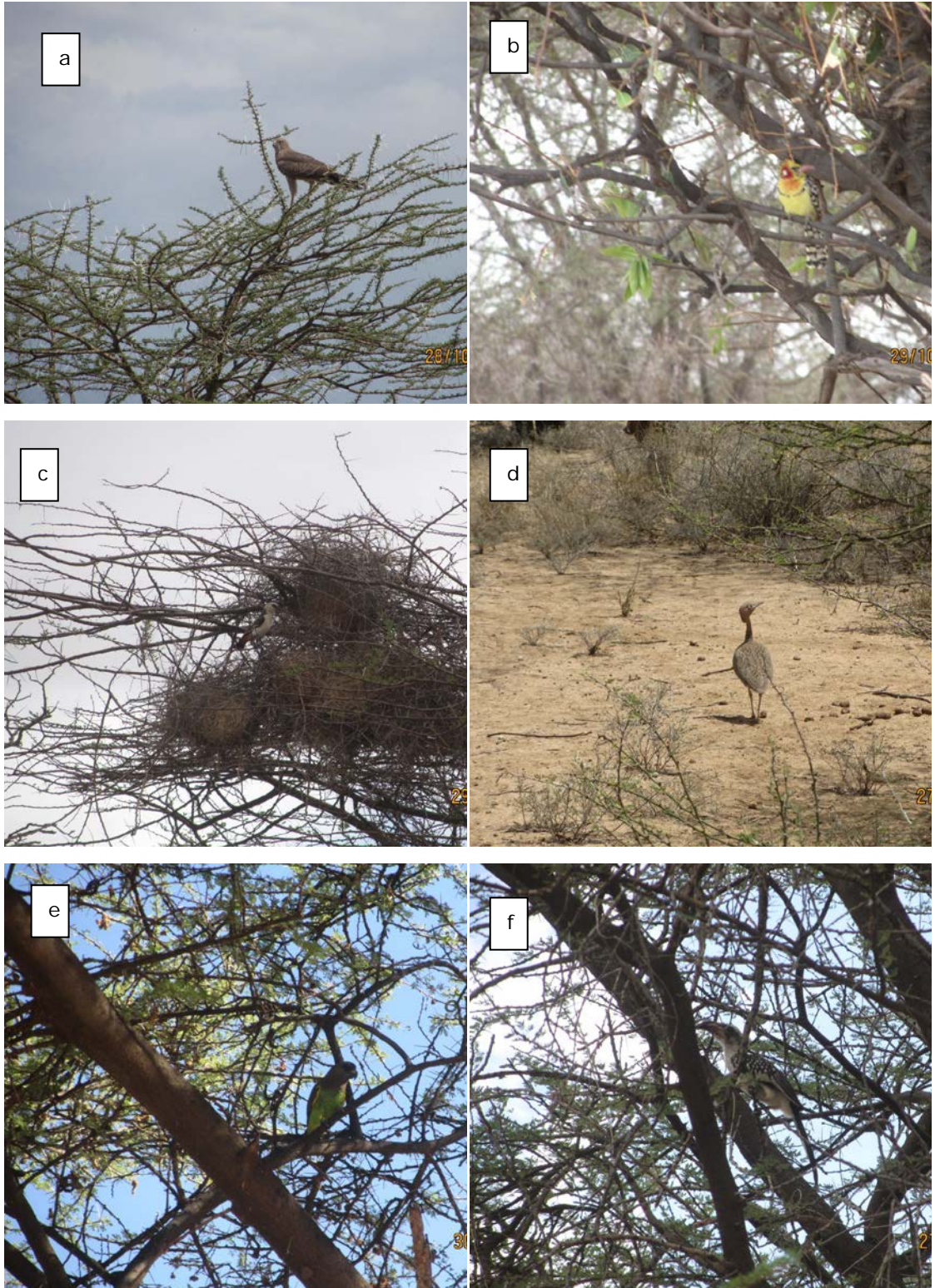


Plate 7.18: (a) Gabar chanting goshawk, (b) Red and yellow barbet, (c) Sparrow weaver (at nest), (d) White bellied bustard, (e) Grey parrot and (f) Yellow billed hornbill.

Birds listed as decreasing in population in the IUCN red list (IUCN 2012)

1. *Psittacus erithacus* (Grey parrot) spotted in Kapetatuk lugga area
2. *Eupodotis melanogaster* (Black-bellied Bustard)
3. *Ardeotis kori* (Kori Bustard)
4. *Eupodotis senegalensis* (White-bellied Bustard)

Nesting locations

The bird nests in the project area were identified in various scattered areas. It was however noted that most nests were concentrated on trees growing along luggas such as Grey parrot species found only at Kapetatuk lugga.

Biodiversity	Significance		
	Regionally	Nationally	Internationally
Birds -Egyptian vultures, Abyssinian Roller Egrets, Goliath Heron, Yellow billed egret, Red and yellow barbet, bustards and hornbills	<ul style="list-style-type: none"> • Visual quality of the area • Source of food to the locals, birds such as bustards are a source of food to the local community • Birds have the ability to deal with pests and snakes thus reducing the harmful pests and snakes in the area. • Agents of Dispersal- birds serve to spread seeds of various plants, thereby helping in plant dispersal • Food sources for bird predators thus enhancing species diversity in the area • Help in fertilizing the soil with the nutrients from their droppings. 	<ul style="list-style-type: none"> • Bird feathers are used to decorate jewellery, clothing, and hats which are sold to earn revenue. • Facilitate tourism such as bird watching 	<ul style="list-style-type: none"> • Facilitate tourism such as bird watching
Insects -Dragon flies, grasshoppers crickets, termites, beetles, butterflies, moths, mosquitoes, wasps, bees, ticks, spiders, camel spiders	<ul style="list-style-type: none"> • Insects such as bees helps in plant pollination to - facilitate the process of reproduction, thus improving the area vegetation. • Helps in improving the birds species in the area as some birds feed on insects. • They also decompose dead materials, thereby reintroducing nutrients into the soil. • Burrowing insects such as ants and beetles dig tunnels that provide channels 	<ul style="list-style-type: none"> • Scientific and ethical knowledge 	<ul style="list-style-type: none"> • Scientific and ethical knowledge

Biodiversity	Significance		
	Regionally	Nationally	Internationally
	for water, benefiting plants.		
Mammals -Ground squirrels, grey mongoose, warthogs, dik-diks, Grant's gazelles, cheetahs, and hyenas	<ul style="list-style-type: none"> Burrowing mammals aid in increasing soil porosity and drainage. mammals can keep pest species down, both insect and vertebrate, and can serve as food for larger game species Help in fertilizing the soil with the nutrients from their droppings. 	<ul style="list-style-type: none"> Important to the fur industry Scientific and ethical knowledge Source of food pelts and meat 	<ul style="list-style-type: none"> Used as laboratory subjects for the study of human-related physiology, psychology, and a variety of diseases Scientific and ethical knowledge
Reptiles: Puff adders, lizards, gecko and skinks	<ul style="list-style-type: none"> Reptiles are natural carnivores, and in this capacity they are able to eliminate many creatures are consider to be undesirable in the area. 	<ul style="list-style-type: none"> Scientific and ethical knowledge 	<ul style="list-style-type: none"> Scientific and ethical knowledge Pets

7.6 LAND-USE ¹

7.6.1 ADMINISTRATIVE STRUCTURE

The project area lies in Turkana East and part of Turkana South district. Turkana South and Turkana East are administrative districts located in Turkana County. The administrative headquarter of Turkana South is Lokichar. There is one local authority, Turkana County Council, which still serves the larger Turkana County.

¹ Data in this section includes information from 2009 Kenya Population and Housing Census (Kenya National Bureau of Statistics - KNBS); Turkana District Development Plan, 2002-2008 (Republic of Kenya, 2002, Ministry of Finance and Planning, Government Printers); and field assessments by the ESIA team.

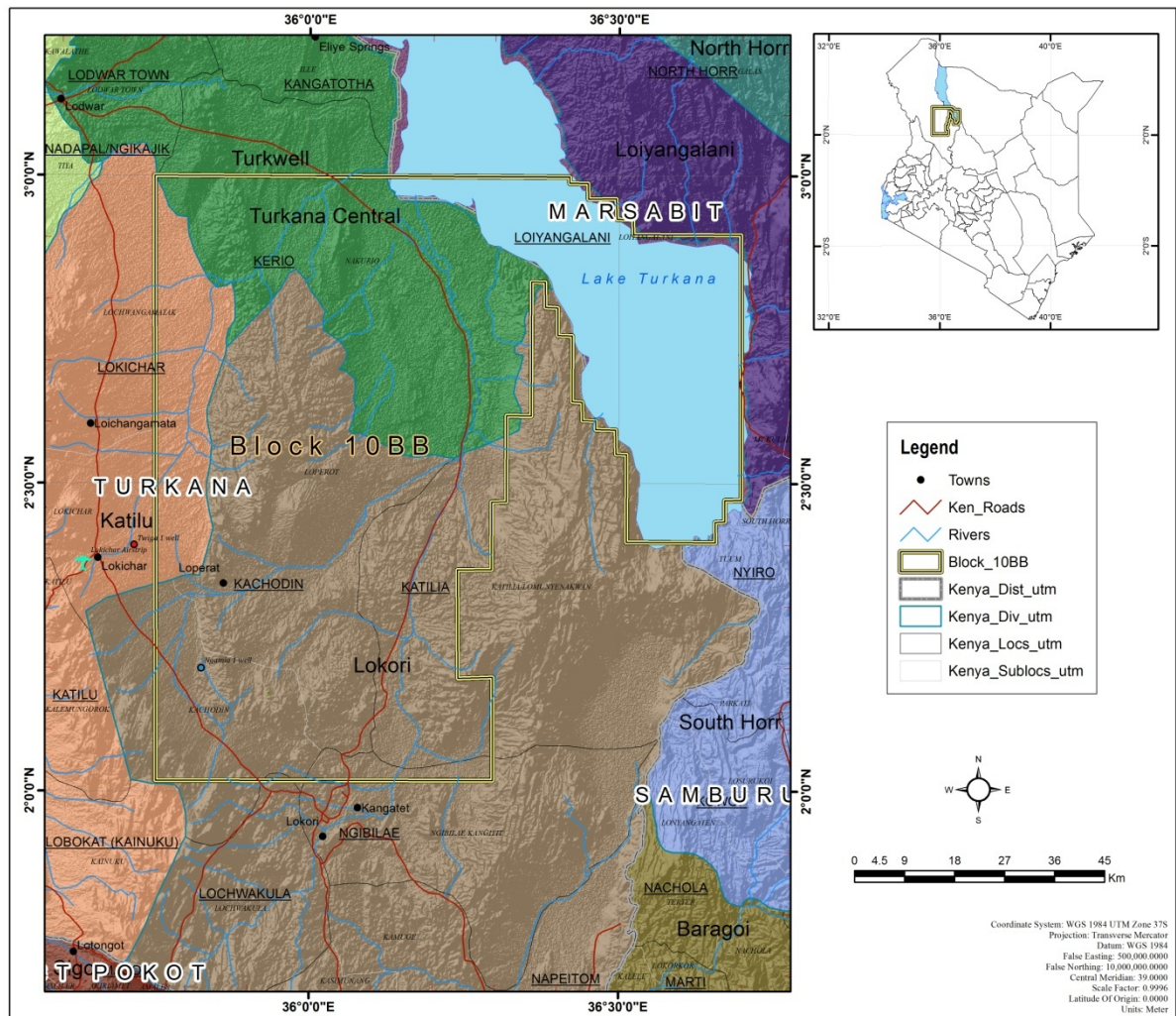


Figure 7.4: Administrative boundaries of Block 10BB

7.6.2 LAND TENURE

The land tenure system in the project area is communal. Thus, land is collectively owned by the residents and managed, on behalf of the community, by the Turkana County Council. Pasture and settlement lands have no land ownership documents.

7.6.3 EXISTING INFRASTRUCTURE

The project area has gravel or/ and earth roads, that are in state of disrepair. The main Kitale - Lodwar road leading to the project area is constructed to bitumen standard, however, a large part of the road is in a sorry state of disrepair and require urgent attention from the relevant authorities. The minor earth roads and tracks within the project area transverse *luggas* that are impassable during rains.

Mobile telephone connectivity is widespread in trading centres and scanty in the rural parts of the expansive districts.



Plate 7.19: An access road to Nakukulas village

7.6.4 WAGE EARNING ACTIVITIES

The wage earning activities carried out in the project area include:

- Businesses such as; Jua Kali (artisanship), retail, wholesale, catering, distribution and commercial rental housing. Others are kiosks, hardware, bars, private clinics and chemists, entertainment establishments (pool games and videos), carpentry and tailoring workshops.
- Services such as;
 - ✓ Rendering services as housemaids;
 - ✓ Fetching water for other people; and
 - ✓ Construction work.

The entrance of TKBV in the project area for oil exploration has also led to an alternative source of income particularly for the youth.

7.6.5 SETTLEMENTS, HOMESTEADS, BUILT ENVIRONMENT

The proposed project area cuts across Turkana South and Turkana East districts in Turkana County. These are sparsely populated districts with an average of 6.7 persons per square kilometre. The area is vast with harsh climatic conditions thus most of the population is found in town centres with basic social amenities like potable water, health care facilities, schools and security. According to the Kenya National Bureau of Statistics, Turkana South District had a population of 226,379 and a population density of 12 persons in 2009. The population of Turkana East is estimated at 90,466 persons and a population density of 17 persons.

Table 7.2: Demographic data by district

Districts	Male	Female	Total population	Total household	Area in sq. Km.	Density
TURKANA EAST	-	-	90,466	-	-	-
TURKANA SOUTH	121,022	105,357	226,379	28,437	1,8670.8	12

Source: 2009 Kenya population and housing census, KNBS.

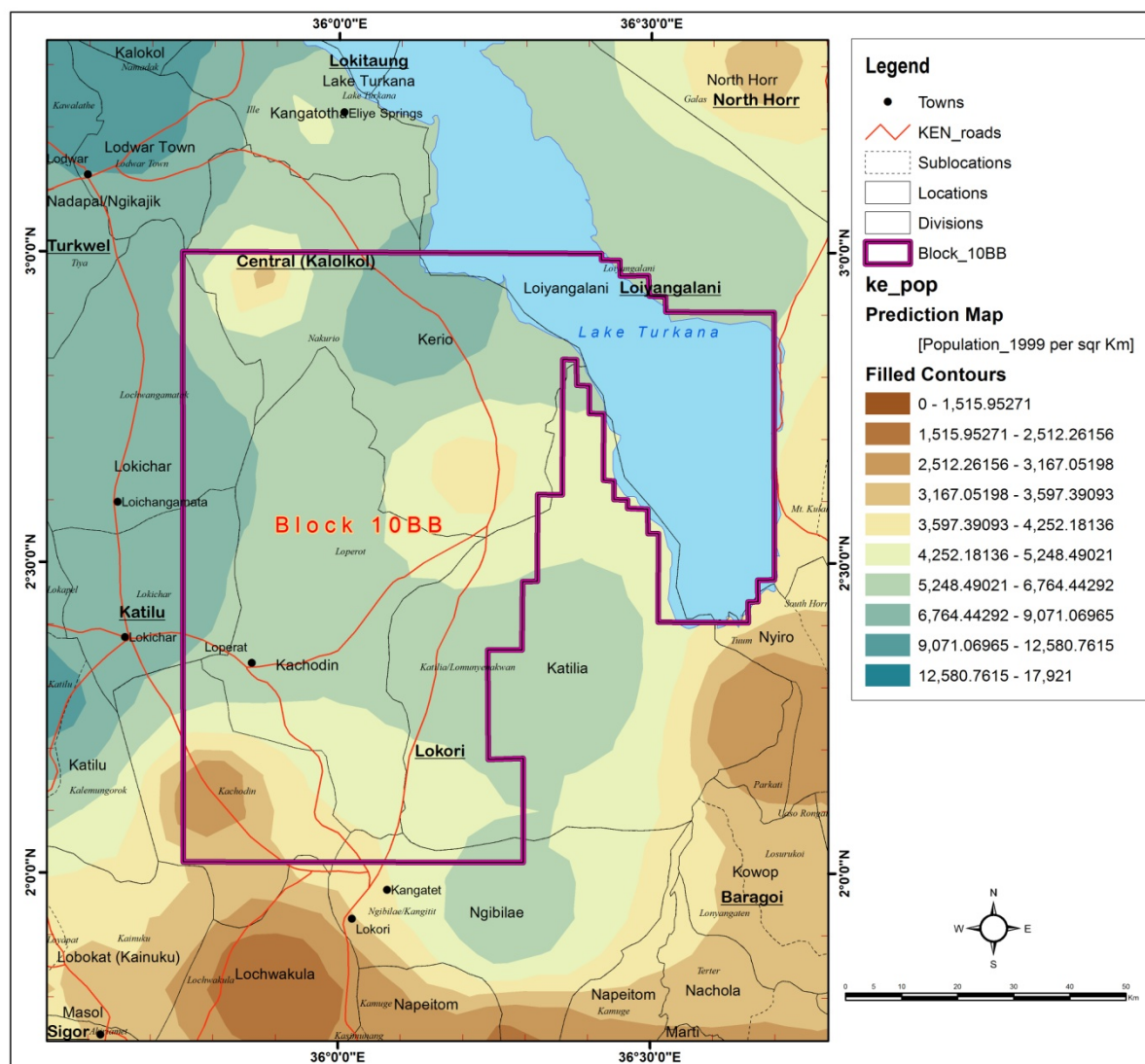


Figure 7.5: Population distribution in the project area

The built environments in the project area visited by the consultant are as shown in Table 7.1 below.

Table 7.3: Built areas in the project area

KACHODIN SUB-LOCATION	
SITE NAME	COORDINATES
Nakukulas Primary School	N 02.38508 ⁰ E 035.64236 ⁰
Water Borehole 1 (by TKBV)	N 02.20593 ⁰ E 035.81542 ⁰
Water Borehole 2 (by TKBV)	N 02.21909 ⁰ E 035.82141 ⁰
Kachodin Chief's Area	N 02.20316 ⁰ E 035.81371 ⁰
Nakukulas Meeting Point	N 02.20150 ⁰ E 035.81558 ⁰
KALAPATA LOCATION	
SITE NAME	COORDINATES
Loperot Well (Not working)	N 02.33446 ⁰ E 035.83822 ⁰
Kalapata Chief's Area	N 02. 20316 ⁰ E 035.83492 ⁰
Reformed Church	N 02.33443 ⁰ E 035.83824 ⁰
Catholic Church	N 02.33429 ⁰ E 035.84455 ⁰
Loperot Dispensary	N 02.33763 ⁰ E 035.83276 ⁰
New Loperot Bore hole (by TKBV)	N 02.33220 ⁰ E 035.81922 ⁰
EkalelKamar Water pan	N 02.38684 ⁰ E 035.78593 ⁰
Kalapata Primary School	N 02.33639 ⁰ E 035.83492 ⁰

Though enrolment is still low, key trading centres and villages in the project area have at least a primary school. TKBV has assisted Nakukulas primary school in the project area through construction of two classrooms. During the EIA study the team visited some of the schools and noted their respective coordinates noted as shown in the table above.



Plate 7.20: Nakukulas and Kalapata primary schools

7.6.6 MAIN CROPS

Irrigation as well rain-fed agriculture is undertaken on a very small scale around Lokori area and along the Kerio River. There are no major cash crops grown in the area, only food crops. Food crops grown along the river include maize, beans, green grams, millet, sorghum, and cassava.

7.6.7 GRAZING AREAS

Land is significant in perpetuating the nomadic livestock husbandry which is the major economic activity in the area. Vegetation that includes *Acacia spp.*, *Balanities aegyptiaca* and *Commiphora Africanas*, *Cadaba farinosa* and *Indigofera spinosa* dwarf shrub are useful browse for livestock. Some grazing areas observed include; Nakukulas Area, Kamonukwee and Nakipomea.



Plate 7.21: Livestock at a water pan in Nakukulas

7.6.8 OTHER INDUSTRY

The activities carried out in the wider north-western Kenya area include, besides livestock keeping; small scale horticultural farming and mining. Horticultural products grown in the region, such as along the upper reaches of the Turkwel River, range from kales, cabbages, tomatoes to bananas which are sold in the market centres. Small scale mining of gold (e.g. in Todonyang area), and quarrying of sandstones and other industrial minerals are undertaken.

7.6.9 SUBSISTENCE ACTIVITIES

Residents in the area are mainly pastoralists and the main livestock types are camels, goats, donkeys and sheep. In the project area, pockets of subsistence irrigation agriculture practised along the river areas during rainy seasons.

7.6.10 COST OF LIVING

The cost of living in terms of monthly expenditures on various items such as food, medical treatment, education, and clothing is very low, over 75% of households in the area do not spend any money on housing this is not a surprise as most houses are manyattas and are built with local materials. Generally most households spend KES

2,000 to 4,000 in a month. Lokichar being a trading centre, a significant number houses may be rented at around 1000 per month majority of community members spend between KES 1,000 to 3,000 per month on medical treatment, it was noted that a good number of the community do not spend much on health as health facilities are inadequate. An average person in the project area per capita expenditure averages to 50 KES per day for men to 60 KES per day for women. (Kenya Open Data, 2012)

7.6.11 UNIONS, CO-OPERATIVES, FARMING ASSOCIATIONS

Groups within the project area include;

- Morulem Water Users Association (MWUA) and
- Kaputir Resource Management Association (KARMA) which through community livelihoods enhancement, attempts to involve the agro pastoralist community in alternative aspects that can improve their lives and grow out of the shocks generated by any loss of livestock.

7.6.12 VALUE CHAINS

There are livestock (sheep and goats) value chains from the project area to terminal markets in Nairobi. The value chain starts from the producer in the pastoral areas selling straight to a trader from the main market, who then sells the animals to a trader that brings the animals to the terminal market in Nairobi where they are sold for an average price of KES 3,500 for one goat and KES 3,000 for one sheep.

7.6.13 CULTURAL PROPERTY

There are no significant cultural, historical, archaeological or protected resources or areas on or near the project site. Individual villages and households have their own revered areas such as burial sites and/ or public meeting areas. The burial sites can be identified as they are marked by stacking stones on the grave. Most residents are Christians though in the main town centres like Lokichar and Lodwar there are Muslims. The main Christian denominations in the area include Catholic, Anglican Church and Reformed Church of Africa among others.

7.6.14 ECOSYSTEM SERVICES

The vegetation in the area is a source of various items which include;

- Domestic fuel especially the more hard wooded Acacias (*A. Tortilis*),
- Gums and resins sources including Gum Arabic (*Acacia senegal* and *Acacia seyal*), Myrrh (*Commiphora myrrha*), Hagar (*Commiphora holtziana*),
- Other dyes, various ingredients in the soap industry,
- Medicinal plants (*Aloe secudiflora*, *Acacia reficiens* seeds, *Caraluma acutangula*)
- Direct values of foods (*Acacia reficiens* backs are used to curdle milk),
- Fruits (*Balanites aegyptiaca*)
- Forage for people and their livestock (*I. spinosa* and *Grass spp.*).
- Building of houses known as *manyattas* (*Acacia reficiens*), and the branches are used for fencing livestock yards.
- Ear piercing *Acacia reficiens* thorns
- Source of tooth brushes *Salvadora persica*

There are several luggas which are a source of water for domestic use and for the livestock during rainy seasons.

7.6.15 DESIGNATED LANDS

There are no major designated lands on or near the project site but public meetings are typically held under trees, which are considered important locations in the society.

7.7 PUBLIC CONSULTATIONS

The public consultation meetings that involved verbal presentation of the key project elements, potential environmental and social impacts, and key mitigation strategies, were held in Nakukulas and Loperot Villages in Turkana East and South Districts respectively, on 27th November 2012 (Table 7.1). The stakeholders included local residents and their leaders. In addition to these meetings, the wider community was reached through administration of formal questionnaires and interviews with interested parties, and at household level during the entire ESIA process. This section presents the deliberations (outcomes) of these consultations from the stakeholders point of view.

Table 7.1: Order of Key Meetings Held in Block 10BB

Days & Dates	Time (Start/End)	Areas Covered	Districts	GPS Coordinates
27.10.12	09.30 – 11.30 hrs	Nakukulas Village	Turkana East	N 02.20150 ⁰ E 035.81558 ⁰
27.10.12	12.00 – 14.00 hrs	Loperot Village	Turkana South	N 02.33413 ⁰ E 035.83689 ⁰

The findings from public consultations indicate that there is low possibility of disruption of the social fabric of the Turkana residing within Blocks 10BB, provided that change and development are properly managed, in a manner consistent with the provisions of the law, the Constitution and Vision 2030. Given that the main source of livelihood in Turkana – livestock, has been depleted due to many factors including weather, markets and raids, and that property is in some cases related to influence, even the elders may not have as much influence if they do not have the means to back that influence. Hence the decisions that are made by elders should be those that reflect the immediate and long term community and national benefit – not based on immediate basic needs. One way to ensure that this is possible is through engagement with other stakeholders and policy makers.

The proposed project has largely been accepted by both the community and the stakeholders, although there were concerns that were raised including equitable employment opportunities to the youth, access to water, public security, improved road and school infrastructure, provision of essential drugs to health facilities, community linkage, consultation and engagement as well as profit sharing. However there are specific areas that may need consideration as the proposed project moves forward. These are listed below:

1. Engagement with the community

There already are community liaison officers (CLOs) in some parts of the project area, but it appears that the level of engagement/information they provide to the community is inadequate. Some of the issues raised by the community could not have been raised had there been sufficient and adequate information provided to the communities. In addition, CLOs will need to be recruited for the areas that still do not have them.

2. Provision of basic services/amenities/infrastructure

It was clear that certain services are needed in the areas covered by the blocks under review, and these could be provided in a phased manner, in collaboration with relevant government authorities. The most immediate and critical as raised by the community is water. Given the semi-arid nature of the area, and the perceived constant risk of attack by neighbouring communities when they search for water outside their safe environments, it would be prudent to consider planning for permanent sources of water in the areas under consideration.

The Health facilities in the area were reported to suffer from acute shortage of essential commodities. The provision of essential commodities, upon liaison with the relevant arms of government would be beneficial both to the communities and the project. While the community appreciates the education bursaries provided so far, they are concerned about the amount and the manner in which these are provided. One possible strategy to ensure there is no dissatisfaction is to ensure that the lists of potential beneficiaries that are sent from the location/grassroots level are not interfered with in any way as these move up the levels. In other words, the local community would want to have the first, only and final say regarding the amount earmarked for education and to whom it is allocated to. Additionally where possible and viable, support for infrastructure related to construction and rehabilitation of existing schools also should be considered.

3. Transparency in employment of locals

This is a contentious issue and mostly, in our assessment, results from perceived lack of transparency. An improved and clearly understood method of employing locals is needed so that the community is aware of and accepts the method. The main complaint has been lack of equity – where they feel that people from certain areas benefit more than others.

4. Preservation of residential structures and communal sites

While there are no specific burial sites identified, villagers were clear that homesteads, water points and meeting points should not be interfered with, as much as possible. Natural vegetation including trees and related vegetation of shrubs should also be preserved since their animals depend on these.

The consultant held meetings with District level representative within Lokichar town. The participants included representatives [from Ministry of Water, National Drought Management Authority, Kenya Wildlife Service, Mt. Kenya University, National Registration Bureau, Ministry of Planning & Vision 2030 and World Vision Kenya](#). The findings from discussions with the participants were as follows;

- **Anticipated effects of the proposed 3D seismic survey on the operations of organizations/communities**
 - Complementing efforts in economic empowerment/reduction in competition over scarce resources
 - Improvement in educational levels
 - Human displacement/overpopulation though influx of “aliens”
 - Infrastructural improvement
 - Reduction in grazing land
- **Main concerns regarding the proposed 3D seismic survey**
 - Public health concerns including diseases resulting from pollution, from influx of non-locals
 - Population explosion
 - Water scarcity/quality
 - Environmental pollution/degradation/disasters/waste and effluent
 - Depopulation of and/or reduction in quality of fish and wildlife

- Political concerns/exploitation/ethnic conflict
- Reproduction of inequalities, benefits go to a few elites, distribution of profits
- Conflicts related to resource management
- Public security
- Change in livelihood resulting from reduced grazing land

• **Measures proposed by the stakeholders to address these concerns**

- Continuous monitoring and management/risk analysis/EIA
- Transparency
- Equitable resource distribution
- Strengthen existing livelihood systems
- Rehabilitate available water sources/build water points
- Provision of basic amenities
- Community consultation throughout the project duration using transparent and clear communication.
- Grievance mechanism should be put in place. Engagement is key to managing impacts and keeping communities informed

Anticipated positive impacts	Measures for enhancing the anticipated positive impacts
- Possibility of discovery of more oil deposits	- Proper planning and complete social and EIA
- The 3D seismic survey images will help further research and study	- The proposed seismic survey environmental impact assessment reports should be well completed and kept safe for further studies and research.
- Improved economy resulting from short-term employment, ancillary business	- Equitably employ locals whenever possible
- Improved infrastructure in project areas such as roads	- Roads should be upgraded such that they last as long as possible
- Availability of certain essential services, e.g., security	- The proponent should intensify and improve security level in the area by employing more KPRs and liaise with the local police departments to enhance security;
- Construction of water points	- Drilling of more bore holes to increase water points in the area
- Educational facilities' improvement	- Transparent and complete partnership with stakeholders - Building more classrooms

Anticipated negative impacts	Mitigation measures
- Destruction of grazing fields thus threatening livestock	- Enforce environmental management laws - Introduction of modern livestock breeding methods - Introduction of environmental conservation projects, such as

Anticipated negative impacts	Mitigation measures
	afforestation alongside with the proposed project to avoid environmental degradation and provide locals with seedlings.
– Exploitation by “non-natives”	<ul style="list-style-type: none"> – Ensure campsites are located at a distance from residential areas – Ensure minimal interaction with community members by staff.
– Slum creation due to overpopulation	– The proponent should liaise with community leaders and make consultations with the communities who own the land in the project area prior to commencement of works and discuss ways of reducing influx of people in the proposed project area;
– Public health risks/disease outbreaks/introduction of diseases by “foreigners”	<ul style="list-style-type: none"> – Provision of health commodities – Waste/effluent management
– Resource use conflict	– Wider consultations and involvement in decision-making between employ and locals

7.8 HEAD-LINE ISSUES

The key sensitive areas in terms of the seismic project include interference with water ways (luggas), built up areas such as schools and homesteads, soil and surface and ground water resources.

The key socio-economic issues detailed in Section 7.7 above are; engagement with the community in project activities, provision of basic services/amenities/infrastructure, transparency in employment of locals and preservation of communal sites

Environmental and social baseline features	Key Issues	Receptors
1. Physiography	<ul style="list-style-type: none"> Damage to pristine landscapes 	Physical Receptors
2. Surface water resources	<ul style="list-style-type: none"> Diverting of lugga course Obscuring the waterways 	Soil, ground- and surface water receptors
3. Ground water resources	<ul style="list-style-type: none"> High abstraction of groundwater Spillage of oil of hazardous compounds which due to seepage contaminate aquifers 	Soil, ground- and surface water receptors
4. Terrestrial Environment	<ul style="list-style-type: none"> Interference with biodiversity(plants along cut lines, birds and small mammals) 	Biological Receptors
5. Socio-economic features	<ul style="list-style-type: none"> Employment opportunities Improvement of infrastructure (waste management systems, roads) preservation of residential structures and communal sites Interference with grazing lands 	Human Receptors

7.9 SPATIAL AND TEMPORAL CONSTRAINTS

The 3D seismic survey project activities will be constrained by inaccessibility of specific sites during rainy seasons due to flooding of *luggas*, poor terrain in uplands and ridges, and issues insecurity in some areas (banditry and tribal conflicts).

8. ASSESSMENT OF IMPACTS

8.1 GENERAL METHODOLOGY

The impact assessment entails identification of activities from the project description detailed in Chapter 3 that could interact with the environment. In addition a focused identification key environmental and social features from the baseline information detailed in Chapter 7 is conducted with the aim of identifying biological, physical and human components of the project area.

The potential positive and negative changes resulting from the defined project activities are then predicted for the study area and for the entire project lifecycle. These predicted changes (impacts) are then evaluated using a significance ranking process.

An outline of the impact assessment procedure is as follows:

- Identification of the key project activities;
- Identification of the environmental components;
- Impact identification;
- Impact evaluation; and
- Significance ranking

8.2 ENVIRONMENTAL AND SOCIAL ASPECTS AND IMPACTS IDENTIFICATION FOR THE SEISMIC SURVEY

The components of the 3D seismic survey and survey-related activities that have been outlined in Chapter 2 and that could result in environmental and social impacts are indicated in Table 8.1 below.

Table 8.1: 3D Seismic survey project environmental and social aspects and impacts.

	Environmental or Social Parameter	Impact Source	Predicted Impacts
1.	<ul style="list-style-type: none"> ▪ Physiography and Geology 	<ul style="list-style-type: none"> • Vibroseis associated equipment and ▪ Bulldozer 	<ul style="list-style-type: none"> • Cut lines leave long-lasting residual impacts (tracks, and/or scarring on surface rocks) • Vibrators/bulldozers and dynamite used near steep slopes may lead to minor landslips and rock topples
2.	<ul style="list-style-type: none"> ▪ Soils 	<ul style="list-style-type: none"> • Vibroseis associated equipment and ▪ Bulldozer ▪ Transport Vehicles ▪ Oil or chemical leaks from vehicles and machinery, garage and storage areas 	<ul style="list-style-type: none"> ▪ Compaction of degraded soils along cut lines ▪ Disturbance of soil along cut lines ▪ Cut lines may enhance gulleying and erosion (wind and water) ▪ Rutting in loose soils ▪ Contamination of soils ▪ Potential landslips
3.	<ul style="list-style-type: none"> ▪ Climate 	<ul style="list-style-type: none"> ▪ None 	<ul style="list-style-type: none"> ▪ None
4.	<ul style="list-style-type: none"> ▪ Air Quality 	<ul style="list-style-type: none"> ▪ Vehicles and machinery 	<ul style="list-style-type: none"> ▪ Pollution from exhaust emissions ▪ Fugitive dust generation from traffic

	Environmental or Social Parameter	Impact Source	Predicted Impacts
		<ul style="list-style-type: none"> Sanitary systems Waste disposal points 	<ul style="list-style-type: none"> Offensive odours Health risks
5.	Surface and Groundwater Resources	<ul style="list-style-type: none"> Water supply source for the camp Heavy vehicles and machinery Drilling of shot holes & upholes 	<ul style="list-style-type: none"> Conflict with neighbouring communities if water source is shared Compaction of near-surface aquifers such as springs, reducing yield Downward draining of groundwater through drill holes, reducing yield at springs
6.	Water Quality	<ul style="list-style-type: none"> Liquid effluent discharges from sanitation systems at the campsite Oil or chemical leaks from garage and storage areas, vehicles and machinery 	<ul style="list-style-type: none"> Contamination of water supply source for the camp Contamination of underlying aquifers
7.	Terrestrial Environment (Habitats, Flora, and Fauna)	<ul style="list-style-type: none"> Vibroseis and associated equipment Mulchers Bulldozer Transport vehicles 	<ul style="list-style-type: none"> Cutting of vegetation along cut lines Disturbance of wildlife (physical presence and noise) Introduced weeds and pests
8.	Land Resources	<ul style="list-style-type: none"> Vibroseis, mulchers and associated equipment Vehicles Presence of humans 	<ul style="list-style-type: none"> Cut lines affect pastoral resources Disturbance of animals and resources
9.	Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> Vibroseis and associated equipment Vehicles 	<ul style="list-style-type: none"> Compaction by heavy vehicles and machinery may damage soils and rocks on cultural sites Vibrations and drilling of shot holes may disturb graves and cultural sites Social friction between local communities and seismic crew workers
10.	Visual Aesthetics	<ul style="list-style-type: none"> Campsite design Cut lines 	<ul style="list-style-type: none"> Poor campsite design does not blend in with the environment Cutline footprints and vegetation cover removal lower aesthetic value of landscape
11.	Noise and Vibrations	<ul style="list-style-type: none"> Vibroseis and associated equipment Vehicles traversing the area 	<ul style="list-style-type: none"> Disturbance to humans, animals and livestock Disturbance to workers Health risks
12.	Solid and Liquid Wastes	<ul style="list-style-type: none"> Campsite Workplaces in the field 	<ul style="list-style-type: none"> Pollution of surface soils, waters and groundwater Offensive odours Health risks
13.	Social Characteristics	<ul style="list-style-type: none"> Workforce influx Activities along 	<ul style="list-style-type: none"> Possible increase in number of students dropping out of school in

	Environmental or Social Parameter	Impact Source	Predicted Impacts
		the seismic survey lines	search of jobs ▪ Erosion of culture and social values as a result of intercultural association. ▪ May interfere with grazing lands and watering points ▪ Friction between local communities and migrant workers
14.	▪ Economic Characteristics	▪ Employment opportunities ▪ Tenders and supplies	▪ Improved livelihood ▪ Improved short-term business opportunities for the locals ▪ Potential social investment activities benefits ▪ Influx of cash into low-cash rural economies may lead to boom and bust phenomenon ▪ Conflicts/ Third party agitations over employment issues ▪ Traditional occupations (livestock husbandry and farming) adversely affected
15.	▪ Occupational Health and Safety	▪ Campsite and fieldwork environment	▪ Injuries to workers, visitors and area residents arising from project operations ▪ Fire hazard ▪ Exposure to nuisance in the form of noise, dust, vibrations and emissions ▪ Other health risks
16.	▪ Security and Public Safety	▪ Workforce security needs	▪ Improvement in security due to security enhancement for project activities ▪ Community feeling exposed due to hiring of KPR to guard seismic survey crew and base camp leaving the villages vulnerable

8.3 IMPACTS ASSESSMENT AND MITIGATION FOR THE SEISMIC SURVEY

8.3.1 PHYSIOGRAPHY AND GEOLOGY

The risk of subsidence due to passage of heavy vehicles is negligible due to the geology, but localised compaction of surface soils may occur in some places. There are few existing roads in the area and the hilly regions of the project area will pose a challenge in access and crossing over.

Mitigation:

- Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country;
- Minimise to the extent possible, the use of bulldozers to open up cut lines and access roads to minimise landscape scarring;
- Avoid cut lines on slopes steeper than 40° to minimise risk of landslips and rock topples;
- Optimise source energy to achieve the survey objectives to minimise risk of landslips and rock topples;

- Buffer zones should be maintained from areas posing landslide and topple hazards; and
- Decommissioning will be carried out according to the Tullow Site Restoration Plan.

The potential residual impacts would be related to landscape scarring along cut lines in the ranges, and displaced soils and boulders that may arise from landslips and rock topples related to use of the vibroseis.

8.3.2 SOILS

The impact sources from the project operations will include Vibroseis and associated equipment, bulldozer, and transport vehicles. Other sources will be oil leaks from vehicles, machinery, garages and storage areas.

Mitigation:

- Machinery and equipment should use existing routes as much as is practicable to avoid compaction of the surface soil;
- Vehicles should steer away from natural drains and waterways as is practicable, but a buffer zone should be maintained except at crossing points;
- Minimize vegetation and grassland clearance as much as possible when cutting the survey line transects;
- Use only essential vehicles and low pressure/low impact tyres in areas with wet soils or that are susceptible to ponding or are prone to erosion;
- Ensure that all vehicles and machinery operating in the field and in the campsite are properly maintained so as not to have oil leaks that could contaminate the soils;
- Ensure that any in-field refuelling or maintenance is performed while using a drip tray with a spill-kit available;
- All fuels and other non-aqueous fluids to be stored in suitable bunded enclosures;
- Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks; and
- Line surveyors to keep a record of any and all hazards encountered e.g. wet/soft ground, and to inform seismic operatives of these.

The potential residual impacts would be enhanced gullying and erosion due to altered runoff and drainage patterns at local scales, necessitating the implementation of mitigation measures to eliminate any long term negative impact.

8.3.3 AIR QUALITY

On meso- to micro-scales, air quality variation relates primarily to changes in the wind-speeds in the area, particularly in the sparsely vegetated and dry northern sector, and the associated particulate dust that it transports from one place to another. These winds can raise substantial quantities of dust. Dust raised by construction activities (e.g. preparation of seismic cut lines, and building of the base camp and access ways) as well

as that raised by moving vehicles and equipment, will likely contribute to transient airborne dust. Further, the disturbed surface with fine textured soils as a result of site clearance for seismic survey transects would be susceptible to wind erosion. On a micro-scale, air quality may also be affected by exhaust emissions from vehicles and machinery, but this is also of a transient and insignificant nature. Sources of offensive but localised odours would include exhaust emissions from vehicles and other equipment, as well as poorly managed waste disposal and sanitary facilities at the camp site.

Mitigation:

- Limit traffic speed and restrict movement of vehicles as is reasonable to minimize dust generation;
- Field vehicles, trucks and any other machinery should be switched off when not in use;
- Regular servicing of all trucks, service vehicles, and any other machinery powered using fossil fuels to ensure efficient combustion and minimisation of exhaust emissions ;
- Use low sulphur fuels if available and where suitable;
- Employees working in dusty conditions must use appropriate PPE; and
- Installation and proper management of camp sanitation facilities.

There shall not be any residual impacts.

8.3.4 SURFACE AND GROUND WATER RESOURCES

Water is a key resource in the project area. It is sourced from shallow wells, shallow to deep boreholes and luggas. It is patchily distributed and generally scarce, particularly within the project area. The seismic crew will need to access safe potable water. Effluents generated at the campsite(s) will also need to be managed so as not to contaminate any underlying shallow, unconfined aquifers and luggas. Shallow groundwater aquifers occur in the low-lying parts of the project area, and could potentially be compacted by Vibroseis and other equipment, thereby reducing yields. It is highly improbable that the upholes could penetrate artesian aquifers.

Mitigation:

- It is recommended that an efficient and monitored water-use policy be adopted by the project proponent at the camp sites and other work areas ;
- An efficient sanitation system should be put in place in the campsite(s) to handle effluents ;
- Hazardous and toxic waste material should be managed according to OGP practices and in compliance with Kenyan legislation, specifically the Environment Management and Coordination (Waste Management) Regulations;
- All spills and splashes should be cleaned immediately using absorbent material;
- Vehicle washing bay in the camp will be typically of concrete and will be designed for drive-in-drive-out ability and will allow waste water capture. The water will be drained through a grit trap and an oil-water separator and discharged off-site in a manner that does not cause water to pool or run unabated into luggas or other surface water features;

- Only emergency repairs and maintenance will be completed in the field. Routine, planned preventative maintenance in line with the manufacturer's recommendations will be completed offsite at base camp workshops;
- Buffer zone distances between seismic lines and water sources will be established through extensive in-field ground vibration testing. Distances may vary between seismic source types, as per IAGC Guidelines.
- When water is encountered during uphole drilling, bentonite, or a tapered concrete (or other suitable material widely accepted in the industry), can be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface;
- Ensure that any in-field refuelling or maintenance is performed while using a drip tray with a spill-kit available; and
- Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks.

Residual impacts on surface and groundwater resources are not expected if the mitigations outlined above are effected.

8.3.5 WATER QUALITY

Liquid effluent discharges and oil or chemical leaks at the campsite, if not properly managed, can potentially lead to pollution of an underlying shallow groundwater source. Along the cut lines, subsurface detonation of charges could leave localized small residuals of gases and solids (e.g. water/stream carbon-dioxide gas, nitrogen gas, calcium carbonate solid, and sodium carbonate gas). Oil leaks from vehicles operating in the field and parked at the campsite can also potentially pollute underlying groundwater.

Mitigation:

- Refuelling areas should be underlain with spill-proof hard standing or bund, with spill-kits readily available and operatives trained in their use;
- All fuels and other non-aqueous fluids to be stored in suitable bunded enclosures;
- All refuelling operations to be carefully overseen and managed;
- Buffer zone distances between seismic lines and water sources will be established through extensive in-field ground vibration testing. Distances may vary between seismic source types, as per IAGC Guidelines;
- Spill-kits to be carried with vibe truck service vehicle, refuelling bowser vehicles, drill crews. All staff to be briefed on use of these;
- When water is encountered during uphole drilling, bentonite or a tapered concrete plug may be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface;
- Ensure that all vehicles and machinery operating in the field (and in the campsite) are properly maintained so as not to have any oil leaks that could contaminate the soils;
- Ensure that any in-field refuelling or maintenance is performed in a well-lit bunded area or while using a drip tray with a spill-kit available; and
- Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks.

Residual impacts on water quality are not expected if the mitigations outlined above are effected.

8.3.6 TERRESTRIAL ENVIRONMENT (HABITATS, FLORA, AND FAUNA)

Some of the waste that could be generated during campsite construction and/or operations is solid and industrial waste. Much of the solid wastes would be expected to be non-hazardous in nature; consisting of containers and packaging materials, miscellaneous wastes from equipment assembly and presence of construction crews (food wrappers and scraps), and woody vegetation. Industrial wastes would include minor amounts of paints, coatings, and spent solvents. Most of these materials would likely be transported off-site for disposal.

Mitigation:

- The mitigations related to soils (see above) apply;
- Trees with trunk diameter greater than 20cm should not be cut;
- Seismic survey activities to be undertaken during daylight hours only;
- Any planned lines that are considered to be a threat to the ecosystem integrity especially ecologically sensitive site such as luggas and trees serving as nesting spot for birds should be relocated;
- Hunting, trapping and gathering of food resources by workers, when on and off duty should be strictly prohibited. All workers to be briefed regularly on this issue; and
- All waste material from field / fly camp operations should be brought back to the base camp for proper disposal.

The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years. Given the small scale of the project, combined with implementation of the suggested mitigation measures, this impact is not considered significant.

8.3.7 LAND RESOURCES

Pasture land and shrubs are a significant land resource in the project area and support the pastoral livelihood of the local community. Cutting of seismic survey lines and construction of access roads to the project site will lead to clearance of minimal vegetation. This will have no impact on land resources in the project area. The larger project area has two protected area the Nasolot and Turkana South National Reserves, which are tourism resources. The proposed 3D Seismic survey shall not be conducted within or near the protected areas.

Mitigation:

- As for sections 7.3.1 (Physiography and Geology), 7.3.2 (Soils), 7.3.7 (Terrestrial Environment) above;

- The base camp location should be identified considering distances to site, local community sensitivities and the presence of existing camps and infrastructure that can be used in lieu of building a new camp;
- In addition to the above clearing of vegetation should be limited to the minimum area required for seismic survey work; and
- Where valuable trees/ plants are cut down fair compensation should be paid as per the Tullow compensation operating procedure, but this can be largely minimized if the Community Liaison Officers continually engage with the community in advance of seismic operations.

8.3.8 ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

The project area has no known archaeological sites while cultural sites like meeting points and graves are found in residential neighbourhoods. The seismic survey team may, however, come across an archaeological find during the course of their work. Impacts to such sites can occur because of vehicles driving over the surface, compression from the Vibroseis pad on the surface, vibrations resulting from the Vibroseis testing or dynamite charges in shot holes, and the drilling of shot holes. Vibrating pads would only compress the soils up to a few inches, so archaeological and cultural material that is not very close to the soil surface will likely remain intact.

Mitigation:

- Tullow should adhere to their Cultural Heritage Management Procedure where relevant.
- As much as is practical the proposed 3D seismic survey should not be undertaken within or near residential neighbourhoods;
- Consultations should be undertaken in a culturally appropriate and transparent manner as per the procedure set out in the Tullow stakeholder engagement plan for the project are to help in identifying and avoiding any sensitive cultural sites during the seismic survey in order to avert possible conflict with the community;
- Use of shot point rather than Vibroseis is recommended for such areas;
- All such sites will be flagged for avoidance;
- If archaeological materials are found during the operations, they should be left undisturbed, and the National Museums of Kenya personnel should be contacted to advise further on how to proceed; and
- All project field workers must be informed, before commencement of operations, that any disturbance to, defacement of, or removal of archaeological, historical, or sacred material will not be permitted.

No residual impacts are expected.

8.3.9 VISUAL AESTHETICS

It is anticipated that there will be minimal impacts on the aesthetics of the pristine environment. Interferences will result from buildings constructed within the base camps,

as well as from the creation of geophysical survey traverse lines and access ways. The base camp will be temporary thus the impact is negligible.

Mitigation:

- Use of modern line cutting technology, preferably mulchers (in areas with dense bushland) for clearing of the geophysical survey transects will ensure that minimal vegetation is removed, hence ensuring that re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote faster re-growth;
- Campsite design should take into consideration the aesthetic value of the selected area;
- Minimise use of bulldozers on sensitive landscapes; and
- The built up areas already identified should be avoided.

8.3.10 NOISE AND VIBRATIONS

The use of heavy road construction equipment, Vibroseis acoustic energy sources, dynamite charging, and power augers for shallow drilling are potential sources of noise and vibrations that may affect the survey crew, neighbouring communities and their livestock. The base camp site can also be a source of noise pollution especially if generators are used for electricity generation.

Some noise sensitive areas (e.g. schools, hospitals and residences) are found in the project area. However, no significant impact is anticipated due to the localized and temporal nature of this project and its expected noise levels. The length of time the seismic crew spends in any one location is short, with up to 20 to 50 km per day of acquisition possible in good weather conditions. This will reduce the overall noise impacts on localised residential receptors to less than one day of actual disturbance.

Mitigation:

- Built up areas such as schools, places of worship should be avoided as much as is practical;
- All seismic operations should be carried out only during daylight hours;
- Ensure that Vibroseis and other vehicles have working silencers to muffle noise;
- Workers should be sensitized on hazards likely to be encountered in such a work environment, and trained accordingly;
- Local communities in the vicinity of the seismic operation areas should be sensitised about the project and its possible noise and vibration impacts before commencement;
- Use generators with minimal noise levels (silent pack enclosures) at camp sites and effect a noise mitigation policy for all operations in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations; and
- Use of personal protective equipment such as ear muffs will be enforced, and setting up of buffer zones in areas of active seismic survey to keep away unauthorized personnel.

No residual impacts are expected if the mitigations outlined above are enforced.

8.3.11 SOLID AND LIQUID WASTES

Solid and liquid wastes that could be generated from the construction works include wood chippings, cement bags, PVC pipes, plastics, paint cans, lubricants, fencing sheets off cuts, domestic waste and plumbing accessories among others. Plastic waste is of particular concern especially if ingested by livestock, and for its environmental pollution effect. Waste oils and petroleum used in vehicles and exploration machinery may spill or leak on/into the ground, hence polluting the soil or water system within the project area. This may degrade water quality and affect livestock and domestic water users in the project area.

Mitigation:

- It is recommended that segregation of solid wastes at source is appropriately carried out and consideration given to re-use, recycling, or disposal as appropriate;
- A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations;
- Hygienic sanitation and disposal of grey and black water will be covered in the waste management plan in order to protect the general health of the workers and the general public;
- Effluent water from treatment will be discharged in a manner, subject to topography, that will not allow water to flow unabated into any water-course or allow pooling of water;
- Off-specification water will be returned to the system for additional treatment before release;
- Kitchen waste water will be drained through an interceptor to remove fats oils and grease (FOG) with the resultant water being processed through the waste water treatment plant;
- The slaughter house in the base camp will be built on a bunded hard-standing with a drain leading to the domestic waste water treatment plant. Blood and unused offal from the slaughterhouse will be contained and co-mingled with the kitchen waste. The slaughterhouse procedures include a wash down after each use; waste water will be treated in the waste water treatment plant;
- Ensure that solid waste is removed from site for recycling/disposal only by an authorised waste handler, ideally a handler licensed under the Waste Management Regulations, 2006;
- Fuel and other non-aqueous liquid storage areas should be bunded; and
- Servicing of equipment should be carried out in a designated garage area which has regularly maintained oil drainage traps and readily available spill-kits. Workers in this area will be regularly briefed on spill prevention.

8.3.12 SOCIAL CHARACTERISTICS

The local communities are conservative with respect to their culture. Nomadic livestock husbandry is the major means of livelihood in the project area thus the communities depend largely on land resources for their livestock survival. Due to the on-going oil exploration activities in the project area there is a lot of expectations for employment opportunities and eventual improvement in income levels. Tullow has undertaken social investment projects in parts of the project area with great success. These include digging and equipping of water boreholes, provision of school bursaries to needy students and construction of classrooms. These projects have not gone unnoticed by other parts of the project area and pressure may be on the company to assist other parts of the project area that have not yet benefited from the Tullow social investment activities. The residents are, however, aware that the company cannot meet all their needs at once and are appreciative of what the company has done this far.

Mitigation:

- Employ more Community Liaison Officers and provide training/information to them in advance in order to keep communities informed prior to project mobilisation and on an on-going basis to ensure sensitization of the community and stakeholders *vis à vis* the project objectives, activities and scheduling, potential impacts;
- The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location using appropriate wide-penetration communication media;
- Awareness campaigns can be undertaken to inform/educate both the local communities and project employees; and
- Provision to be made to compensate local property and landowners for any loss or damage caused by seismic operations. Compensation should be based on Tullow's compensation operating procedure.

8.3.13 ECONOMIC CHARACTERISTICS

The proposed project is in a rural environment with minimal job opportunities and employment. Activities being undertaken by Tullow in the area have offered limited, short-term, unskilled and semi-skilled employment opportunities to the locals. It is expected that the proposed project will offer more opportunities to the local people. During our public consultations meetings some residents observed that there was not equity in employment opportunities for all the regions of the project area. It is therefore imperative that recruitments for the available job slots be done transparently.

Mitigation:

- Liaise with local community leaders during the recruitment process;
- Employment policies to be strategically managed to avoid intra-community conflict and similar problems caused by migrant labourers;
- Unskilled and semi-skilled manpower to be sourced locally as far as possible;
- Gender should be factored into the employment criteria;
- Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan; and
- As much as is applicable Tullow should source daily consumables like beef from the local communities.

The residual impacts in this instance would mostly be positive, including short-term employment opportunities and infrastructure improvements if access roads are designed in such a manner that they would be useful to the communities post-project.

8.3.14 OCCUPATIONAL HEALTH AND SAFETY

During the seismic survey, the workers, visitors and the local community may be exposed to occupational and health hazards. Work place hazards in the field like accidents and incidences as a result of use of vehicles may occur. The project area is also prone to livestock rustling and highway banditry and workers may be caught in the crossfire.

Mitigation:

- All operations will be conducted in compliance with Tullow's EHS policy, international best practices and Kenya Government requirements (as set out in the Occupational Health and Safety Act and the Public Health Act);
- Appropriate and well-stocked first aid kits and fire fighting equipment should be available to all crew, and specific crew members should be trained on first aid administration and handling of fire fighting equipment;
- Job-specific personal protective equipment to be provided to the workers, training should be given, and their use made mandatory in designated areas;
- Environmental safety and health regulations and policies/plans must be adhered to Health Policy, Energy Act, Public Health Act, Local Government Act, Physical Planning Act, NEMA Regulations;
- A Base Camp Clinic is to be provided, manned by suitably qualified field medical staff, licensed as appropriate to operate in-country, equipped with equipment and medication as appropriate, including ambulance vehicle(s);
- Adequate warning or cautionary signage will be posted as required;
- All electrical equipment shall be properly installed, earthed and regularly inspected, and where practicable will comply with IEE 17th edition regulations;
- Only properly trained and authorised employees shall operate equipment or machinery;
- Tullow driving policy and all other project-specific driving policies and journey management plans to be strictly adhered to and enforced;
- Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place; and
- Personnel on seismic survey operations and those on transit around the project area to be provided armed escort.

No residual impacts are expected in this case.

8.3.15 SECURITY AND PUBLIC SAFETY

Security concerns are a priority in the project area as livestock rustling and highway banditry often occurs. During the project course, security may escalate due to free movement of people. The increase in human activity, including vehicle and seismic exploration activity, could increase security concerns thus there is need to provide heightened security and surveillance along the seismic survey lines and at the base camp.

Mitigation:

- Ensure that all workers can be identified by staff uniform and badges at the seismic survey operation areas as well as at the base camp;
- Adequate security measures should be provided, e.g. perimeter fencing, safe havens and security manning at the campsites and whilst on line utilising Administration Police (APs) and Kenya Police Reservists (KPRs);
- The company should liaise with the Provincial Administration, the Kenya Police, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation;
- Barriers and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity;
- Site lighting will be configured not to spill into community areas or into oncoming vehicles;
- Camp population will be forbidden from interacting with the local populace;
- Camp will be located at a significant distance from any local communities;
- Journey management policy and monitoring to be enforced; and
- No cooking on site and no fires other than at base camp; smoking will only be permitted in designated areas; no litter will be left on site; there will be no collecting of vegetation or firewood, and no hunting and trapping of wildlife; and vehicle speed will not exceed 40 km/h, with all vehicles fitted with vehicle tracking and monitoring systems.

A positive residual impact is the presence of contingent of security officer along areas of operation and at the base camp will enhance security not only for the workers but for local communities. Kenya police reservists in the communities will also benefit by getting some allowance for their services.

8.3.16 CONSTRUCTION OF THE CAMPSITE

Tullow and its subcontractors' staff will reside in a base camp. Minimal vegetation clearance is expected to give room to the camp construction. The camp will be located away from residential areas and trading centres. The camp will be constructed by a professional civil and building contractor with experience in setting up such camps. Issues such as sanitation, camp security, water provision and waste water management, accommodation, material storage and parking lot among others shall be incorporated in the camp design.

Mitigation

- Construction of the campsite shall be undertaken during daylight hours only;

- Mitigations in sections 7.3.1 (Physiography and Geology), 7.3.2 (Soils), 7.3.4 (Surface and Groundwater) and 7.3.6 (Terrestrial Environment), 7.3.11 (Noise and Vibrations) 7.3.15 (Occupational Health and Safety) and 7.3.16 (Security and Public Safety) apply;
- Excavated soil should be used in landscape design of the campsite rather than stockpiling;
- Use of T-card system or similar for access control within the campsite shall be enforced
- Campsite will be erected by a qualified and licensed civil and building contractor with workers who are qualified to carry out assigned tasks;
- Use of appropriate Personal Protective Equipment to be enforced
- Adequate temporary housing and sanitation facilities shall be provided for the construction workers;
- Construction equipment and vehicles shall be well-maintained, checked and promptly repaired to ensure no spillage of oils and fuels and to minimise gaseous emissions;
- Company employees shall comply both with the relevant national legislation, and its own in-house environmental health and safety (EHS) policies; and,
- Adequate warning signs and fire extinguishing equipment will be visibly and appropriately posted.

8.3.17 FUELLING STATION

A parking bay for vehicles will be demarcated within the campsite area, and it will have a fuelling station.

Mitigation:

- The fuelling station will have a concrete base;
- The fuel storage area will be set at one end of the parking bay area, and will be bunded. The bunds should have the capacity to contain all the fuel stored inside the fuel bladder in case of leakage;
- The fuel storage area will have a tarpaulin covering to protect it from extremes of weather, and should be well aerated;
- The fuel storage floor shall be concrete-based, and canvas-lined to capture minor spillages;
- The bladder will be charged with fuel ferried by tankers, and will be conveyed to the pump via an outlet hose;
- Clearly marked spill kits will be placed adjacent to the refuelling area, and all staff involved in vehicle maintenance and refuelling will be trained in their use. Clear 'no smoking' signage shall be posted in this area;
- Fire-fighting equipment will be placed at strategic places within the fuelling station and in other areas of the campsite; and
- All workers will be trained in the use of the installed fire-fighting equipment.

8.3.18 CAMP CLINIC

A fully equipped and staffed ambulance will be on standby in case of accidents or emergencies, and will be supported by a fully equipped and staffed clinic that will be located in the base camp. There will also be an on-call helicopter for crew movement and emergency evacuations should the need arise.

Mitigation:

- Biomedical wastes generated at the facility will be handled as per NEMA Waste Management Regulations, 2006;
- The wastes will be segregated, and disposed of in the waste disposal facility as provided for by the relevant Local Authority; and
- Biomedical waste will not be stored above 0°C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.

8.3.19 WATER BOREHOLE DRILLING

The groundwater in the project area is exploited mainly through boreholes and shallow wells excavated in luggas, and tend to have widely variable quality, from human-potable through livestock-potable to saline and non-potable. Tullow will drill a water borehole to meet its water needs.

Before the borehole drilling, a hydrogeological survey will need to be carried out. It will involve: study of the geology of the area (no environmental impact), and resistivity sounding and profiling using a Terrameter with connecting cables, stainless steel non-polarising current electrodes and copper potential electrodes (minimal clearing of low-level vegetation along a transect about 30cm wide and a maximum of 800m long) to identify the water-bearing stratum. The resistivity sounding is a passive technique with no environmental impact. The hydrogeological report will be submitted to the Water Resources Management Authority (WRMA) as a pre-condition for obtaining a drilling permit. Boreholes may be drilled with either percussion (cable-tool) or rotary plant.

Mitigation:

- Minimise soil disturbance and vegetation clearance as is practicable;
- Well development must be done with the Airlift method for at least 30 minutes or until the water is clear of drilling cuttings;
- Great care should be taken that the water quality of the different aquifers is accurately determined. Upon the first strike, drilling fluids should be effectively flushed, and after sufficient time, a water sample should be taken of the air blown (rotary) or bailed (percussion) yield;
- On-site analysis using an EC meter, and preferably a portable laboratory, is recommended;
- Screen-off non-targeted aquifer(s);
- The services of an experienced hydrogeologist should be engaged during the drilling, design, installation, and testing of the borehole;
- Drill cuttings from the borehole should be buried in clay or other suitably lined pit in the event that the borehole is successful, but if not successful, the drill hole should be refilled with the drill cuttings;
- Drilling should be carried out at a diameter of not less than 6" using either a rotary type or percussion machine, to allow for casing, gravel packing and pump installation;
- The borehole should be cased to the bottom using suitable non-polluting material, with screens at the aquifer position and plain casings at non-aquifer position;
- The borehole should be bottom-plugged in loose formations;
- The annular space must be gravel packed at the screen and aquifer position with durable and suitably sized material with respect to the size of the aquifer materials;

- Grouting should be done by placing a concrete mixture up to 6m depth from ground surface; and,
- Any drilling additives to be used (e.g. foam or polymer) must be non-toxic and bio-degradable. Bentonitic additives should not be acceptable, as they may plug the aquifer zones and are extremely difficult to remove during development.

Table 8.2: Existing environmental pressures and potential impacts of onshore (land) project operations on environmental and social factors in the project area (see Chapter 4, section 4.5 for impact assessment criteria and rating)

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Physiography and Geology	Baseline (Pre-project)	<ul style="list-style-type: none"> Active sand dune building and degradation Periodic ponding of the piedmont plain in low lying areas 	Medium	Regional	Permanent	Definite	Neutral	High	Low	Low
	Project Operations	<ul style="list-style-type: none"> Cutlines and access roads to the sites leave long-lasting residual impacts (tracks and/or scarring on surface rocks) 	Low	Site-specific	Long-term	Highly probable	Negative	High	Low	Low
Climate	Baseline (Pre-project)	<ul style="list-style-type: none"> Climate change leading to higher frequency and intensity of droughts and floods 	Medium	Regional	Permanent	Definite	Negative	Medium	Low	Low
	Project Operations	<ul style="list-style-type: none"> None 								

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Air quality	Baseline (Pre-project)	<ul style="list-style-type: none"> Dust generated by wind and enhanced by low vegetation cover Natural wind and water erosion Offensive odours from point sources e.g. pit latrines and garbage dumps 	Medium	Local	Short-term	Definite	Negative	Low	Low	Low
	Project Operations	<ul style="list-style-type: none"> Dust generated and enhanced by machinery and vehicular movement Offensive odours from point sources e.g. pit latrines and garbage dumps Air pollution from exhaust fumes all lowering the air quality 	Medium	Local	Short-term	Definite	Negative	Medium	Medium	Low
Surface and Groundwater	Baseline (Pre-project)	<ul style="list-style-type: none"> Freshwater shortage Uneven distribution of resource High demand for water resources 	High	Regional	Permanent	Highly probable	Negative	Medium	Low	Low
	Project Operations	<ul style="list-style-type: none"> Compaction of near-surface aquifers such as springs, reducing yield Contamination of water supply source for the camp 	Low	Local	Short-term	Improbable	Negative	Medium	Medium	Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Soils	Baseline (Pre-project)	<ul style="list-style-type: none"> • Soil particulates erosion and deposition generated by wind and enhanced by low vegetation cover • Water ponding and erosion via runoff • Soil compaction by grazing animals and livestock 	Medium	Regional	Long term	Highly probable	Negative	High	Medium	Low
	Project Operations	<ul style="list-style-type: none"> • Dust generated by vehicles/machinery movement • Soil compaction by vehicles/machinery • Soil erosion via wind and water through runoff 	Medium	Local	Medium	probable	Negative	High	Medium	Low
Terrestrial Environment	Baseline (Pre-project)	<ul style="list-style-type: none"> • Land degradation from overgrazing • Desertification • Local extinction threat of species 	Low	Local	Permanent	Probable	Negative	Low	Low	Low
	Project Operations	<ul style="list-style-type: none"> • Clearing of vegetation, thereby modifying habitats • Fauna behavioural change 	Medium	Local	Long-term	Probable	Negative	Medium	Medium	Low
Water Quality	Baseline (Pre-project)	<ul style="list-style-type: none"> • High sediment loads in luggas • Point-source pollution wells from stock and locals 	Low	Site-specific to local	Permanent	Probable	Negative	Medium	Low	Low
	Project Operations	<ul style="list-style-type: none"> • Contamination of water supply source for the camps 	Low	Site-specific to local	Short-term	Probable	Negative	Medium	Low	Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Land resources and National Reserves	Baseline (Pre-project)	<ul style="list-style-type: none"> Overgrazing 	Medium	Regional/Local	Long-term	Probable	Negative	Medium		
	Project Operations	<ul style="list-style-type: none"> Cut lines affect pastoral resources 	Negligible	Site-specific Local	Medium-term	Improbable	Neutral	High	Low	Low
Archaeological, Historical and Cultural Sites	Baseline (Pre-project)	<ul style="list-style-type: none"> Erosion 	Low	Local	Long-term	Probable	Negative	Medium		
	Project Operations	<ul style="list-style-type: none"> Compaction by heavy vehicles and machinery may damage fossils and/or cultural artefacts buried in shallow soils Vibrations and drilling of shot holes may disturb cultural sites 	Low	Site-specific	Permanent	Probable	Negative	Medium	High	Low
Visual aesthetics	Baseline (Pre-project)	<ul style="list-style-type: none"> On aesthetic value assigned to the project area Land degradation 	Low	Local	Long-term	Probable	Negative	Medium	Low	Low
	Project Operations	<ul style="list-style-type: none"> Poor campsite design not blending with the environment Cutline footprints and vegetation cover removal lower aesthetic value of landscape 	Low Low	Local Site-specific	Short-term Medium-term	Probable Probable	Negative Negative	High Medium	Medium Medium	Low Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Noise and vibrations	Baseline (Pre-project)	<ul style="list-style-type: none"> Noise from strong winds Anthropogenic (but not excessive) noise localised in small townships and trading centres 	Low	Local	Permanent	Definite	Neutral	High		
	Project Operations	<ul style="list-style-type: none"> Disturbance to local residents and livestock Disturbance to workers Health risks 	Low	Local	Short-term	Definite	Negative	High	Medium	Low
Liquid and Solid Wastes	Baseline (Pre-project)	<ul style="list-style-type: none"> Poor liquid and solid waste management in trading centres 	Low	Local	Short- to long-term	Probable	Negative	High		
	Project Operations	<ul style="list-style-type: none"> Land degradation Pollution of ground water Offensive odours Health risks 	Low	Local	Short-term	Probable	Negative	Medium	Medium	Low
Social Characteristics	Baseline (Pre-project)	<ul style="list-style-type: none"> Low literacy levels Inadequate social amenities 	High	Local /Regional	Long-term	Definite	Negative	High		

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	<ul style="list-style-type: none"> • Possible of boom and bust phenomenon • Increase in social decadences • Possible increase in number of students dropping out of school in search of jobs • Erosion of culture and social values as a result of intercultural association 	Low	Local	Short-term	Probable	Negative	Medium	Medium	Low
Economic factors	Baseline (Pre-project)	<ul style="list-style-type: none"> • Few job opportunities • Poor access to markets • Slow economic growth rate 	High	Regional	Long-term	Definite	Negative	High	Medium	Low
	Project Operations	<ul style="list-style-type: none"> • Improved cash income in the short-term • Improved short-term business opportunities for the locals • Potential Social Investment benefits 	Medium	Local	Short-term Short-term Long-term	Probable	Positive	Low	Medium	Low
Occupational Health and Safety	Baseline (Pre-project)	<ul style="list-style-type: none"> • Low occupational health and safety issues 	Low	Local	Short-term	Probable	Negative	High		

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	<ul style="list-style-type: none"> Injuries to workers, visitors and area residents arising from project operations Fire hazard Other health risks 	Low	Site-specific	Short-term	Improbable	Negative	High	High	Low
Security and public safety	Baseline (Pre-project)	<ul style="list-style-type: none"> Frequent cattle rustling Illegal guns Resource conflicts Highway banditry 	High	Regional	Long-term	Highly probable	Negative	High		
	Project Operations	<ul style="list-style-type: none"> Improvement in security due to deployment of security officers at the project site and camp site activities 	High	Local	Short-term	Probable	Positive	Medium	Low	Nil

8.4 CUMULATIVE IMPACTS IN THE PROJECT AREA

Cumulative impacts are those impacts which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The impact on geology soil and floral resources can be accurately characterised and for the most part mitigated through the proposed line preparation activity using bulldozers and mulchers where necessary, which help to preserve their stability, and significantly raise the probability of regenerating the indigenous vegetation *in situ* from the existing seed base. In addition, potentially enhanced erosion from cut lines and access roads construction at site-specific areas such as where pre-existing gulley formation has been determined can be mitigated by good cut line and access road design so that these constructs will not interact cumulatively with natural processes to enhance erosion.

The cumulative impacts on the biodiversity of the area are considered insignificant. The temporary modification of the land area to permit the conduction of the seismic survey is considered a minor impact due to the homogeneity of the vegetation across the project area. The vegetation is recognized as being sensitive to disturbance due to the harsh climatic setting and poor soils. The direct impact of the activity on threatened species of fauna is considered insignificant as there are no threatened species within the project area. The scale of fugitive particulate material generation and their impacts on the surrounding environment is generally negligible, particularly because the naturally strong winds have a much greater impact in this regard. Adequate mitigation measures are, however, available during the operations phase to limit the generation of dust in the localised area and where the activity creates greater than normal levels of traffic.

Positive cumulative benefits for the local business community are an expected result of the proposed activity. Semi-skilled workers who may be employed in the project will likely acquire new and lifelong skills that may prove useful in other sectors of the Kenyan economy. It is not expected that communities will be moved from the areas they are staying and thus no long term/ indirect impacts.

8.5 SIGNIFICANCE OF IMPACTS

The seismic survey will utilise state-of-the-art equipment and experienced personnel to carry out the work. They will also adhere to the international best practices regulations of OGP, IFC and IAGC and the applicable national legislation and regulations. As mentioned earlier, seismic survey operations are regarded, from an industry standpoint, as being of a small scale in both effort and the time to be taken to complete. In addition the majority of operations will be conducted a long distance away from any habitation, town or workplace so that the inhabitants will be largely insulated. The short-term duration of seismic survey activity and of impacts will result in negligible cumulative impacts for most environmental and social factors, and no long-term cumulative impacts following cessation of the proposed seismic survey project. Overall, the impacts of the proposed project are classified as "low" (see section 3.5). The relationship between the significance rating and decision-making is also classified as "low" (see section 3.5), provided that the recommended measures to mitigate the impacts are implemented.

9. ALTERNATIVES

9.1 INTRODUCTION

Alternatives to the project are defined as functionally different ways of achieving the same end (CEA Agency, 1997). Currently, seismic testing, both on land and in marine settings, is a critical and proven technology for refining knowledge about geological formations with a relatively high potential for containing petroleum hydrocarbons in commercial quantities. There are no functionally different alternatives for defining potential for hydrocarbon resources that are not cost prohibitive.

Under the “no-go” or “no-action” alternative, the project does not go ahead, thus the status quo remains. Oil and gas production, however, cannot occur in the absence of exploration activities. It should be noted that this project is a data acquisition project that will enable evaluation of the newly acquired data to identify potential oil and gas prospects. If no oil and gas prospects can be delineated based on the data acquired, then the project will end at that point. If, however, the data indicates that potential oil and gas prospects are likely, then the project would move on (with a time interval of several months during which the seismic data will be processed and analysed, and likely prospects delineated) to an exploratory drilling phase to determine actual presence and amounts of oil and/or gas. In this case, a new EIA would have to be carried out. As a precursor to the drilling of petroleum exploration wells, seismic acquisition is an accepted and well-developed method of petroleum reservoir delineation. While surface mapping, gravity, magnetics, and other forms of geophysical exploration are commonly employed to further understand the geological character of a sedimentary basin, they are generally considered complimentary techniques rather than stand-alone methods of data collection and interpretation. It is, therefore, considered that the proposed seismic acquisition activity is the only viable means to assess the hydrocarbon prospects of the 10 BB licence area. If the project does not go on at this stage, then the potential benefits that have been outlined in Chapter 1, section 1.5.3, will be foregone.

9.2 PROJECT SITE ALTERNATIVES

One alternative to the project is to leave the assigned project area. The Kenyan Government through previous exploration work by various companies has identified a number of ‘blocks’ with potential for oil and gas. These blocks are found in the Coast, Eastern, North-Eastern and Rift Valley Provinces (including their inland waters) and Kenya’s territorial waters and exclusive economic zones in the Indian Ocean. Tullow has been granted the exploration licence for Block 10BB in the Kenya Rift Valley; therefore, the concept of ‘alternative site’ does not apply as each block within the country is agreed upon by the Government of Kenya and the interested party and subsequently licensed. Other blocks have been licensed to other companies under the terms of the PSC, and some of these have already been approved and licensed by NEMA to carry out onshore (land-based) and offshore (marine) seismic surveys. Previous onshore 2D seismic work by Tullow in the proposed site reported no adverse environmental impacts.

9.3 SURVEY DESIGN ALTERNATIVE TECHNOLOGIES AND RECOMMENDATIONS

The technology to be employed for the seismic survey is the latest state-of-the-art for activities of this nature, and has been outlined in Chapter 2. Approximately 382 square kilometres of seismic data acquisition will be carried out in the project area. The company will construct a number of seismic survey lines (track lines) along which seismic data will be collected. The seismic survey operations and related activities will be constrained to the seismic survey lines once they are confirmed, and to the base camp, fly camps and access roads to these areas within the block 10BB. On an area-wide survey such as this, there is considerable scope to adjust line placements and program size to bypass habitations or areas of particular sensitivity. A detailed evaluation of each line will be carried out as work progresses and line placements will be adjusted to achieve the survey objectives (see section 2) with minimum disruption and impact to the environment and resident communities. Thus, the actual coordinates of the proposed survey lines on land shall be based on analysis of pre-existing data and the information acquired on the area through this EIA study, and will be subject to adjustments based on specific issues or conditions encountered when the operation is ongoing. For this project, two methods will be used to generate the seismic waves (1) Truck mounted Vibroseis units, and (2) dynamite charged shot-holes for land-based seismic data acquisition; with the latter being used for upholes.

The following equipment which will be dedicated solely to the proposed seismic survey activity that will be carried out in Block 10BB:

- Seismic source generators (Vibroseis, dynamite charges for land-based data acquisition);
- Data recording truck;
- Transport equipment: e.g. trucks, pick-ups, 4WD vehicles;
- Communication equipment including handheld satellite phones, and vehicle-mounted VHF radio, and will also establish a communication base station at the main camp site;
- Mulchers, Bulldozers, and light-cutting hand-held equipment for clearing of seismic lines;
- Surveying equipment;
- GPS equipment;
- Associated electronics, data processing and printing equipment; and
- Ambulance.

Additional equipment and facilities that will be available will include:

- Fully serviced and self-contained base camp for all personnel and equipment;
- Adequate fire-fighting equipment, and first-aid kits;
- Fully equipped clinic for medical care of the personnel; and
- Emergency trained paramedic(s).

9.3.1 ACOUSTIC SOURCE TECHNOLOGIES

9.3.1.1 VIBROSEIS

In this case, truck-mounted “vibrators” provide the primary source.

- **Alternative Technologies**

The Vibroseis technology (see section 2.3) is a state-of-the-art technology that is widely used to carry out seismic surveys around the world. The only other alternative to Vibroseis is using a dynamite shot-hole (discussed in section 6.3.1.2 below). Vibroseis is generally preferred over dynamite shot-holes for the following reasons: lower cost than dynamite operations; vibrator settings can be adjusted in the field and hence can greatly improve the results of a survey; and Vibroseis source points can easily be recorded again if for some reason the reflected signals are not of the required quality.

- **Recommendations**

Vibroseis units have the advantage of not requiring shot-hole drilling crews or explosives. However, in wooded areas these large vehicles require much wider lines to be cut or mulched and in water-logged soil the tyres may cause surface damage. Vibroseis will accordingly be restricted to dry, sparsely vegetated areas. Given the semi-arid to wooded conditions of the project area, and the fact that, other than in the Turkwel River floodplain and Turkana plain areas, most of the area is hilly, Vibroseis is the preferred option for seismic survey in the flat-lying or gently undulating areas, while dynamite shot-holes would be preferred in the more rugged and steep hilly ridge areas.

9.3.1.2 DYNAMITE SHOT-HOLES

In this case, a small charge of explosive is placed in a narrow-diameter hole drilled five to fifteen metres into the ground, before being detonated remotely. Depth of hole, charge size, and type of explosives can affect the final quality of seismic data.

- **Alternative Technologies**

The only other alternative to dynamite shot-holes is Vibroseis (discussed in Section 6.3.1.1 above). Dynamite shot-holes are normally used in cases where Vibroseis method cannot be utilized, such as areas with steep slopes or rough terrain.

This method has some constraints. As earlier mentioned, shot-hole depth, charge size, and type of explosive must be predetermined prior to the actual survey: none of these variables can be easily adjusted to improve data recovery, while Vibroseis field testing is easily conducted to determine optimum sweep frequencies and sweep lengths.

- **Recommendations**

This technique will be useful and effective in hilly, rugged and steep terrain, in dry or water-logged terrain, as well as in sensitive areas such as archaeological sites.

Both hand-powered and machine-powered drill units will be used according to the hardness of the ground and depth of hole. There will be man-portable units in areas where access is very limited and a low-impact technique is required. In most areas, however, drill units will be mounted on wheeled or tracked vehicles as the terrain requires. The drilled “shot” holes are usually destroyed by the detonations and will be backfilled on the surface after use. With this form of acquisition, seismic lines need only to be around two metres wide and can be meandered to avoid mature vegetation.

A flexible approach will be taken in the technique employed for shot-hole drilling. Either a tractor or man-portable rotary type rig capable of drilling up to 20m deep holes will be employed. A small tractor would be able to traverse the reasonably dry sections of line cleared by the Mulcher. In wet areas (such as in river flood plains or water-logged areas), a low-impact man-portable shallow shot-hole drill rig, which could either be rotary or of a flush nature, could be used providing that the underlying rock is not close to the surface and a source of water is close by. In wet areas, the depth of the achievable hole will depend on logistics and subsurface geology.

In some areas, the near surface geology consists of a thin soil cover over hard rocks that may in turn overlie loose unconsolidated materials beneath. To ensure that majority of the energy from the shot is focused downwards it will be necessary to employ a drilling technique capable of penetrating the overlying hard layer of rock and passing through the unconsolidated layers beneath to place the charge at a suitable depth. In such drilling conditions, a sonic drill would be ideal: however, it may well be possible to achieve the desired depth by using a drill with a combination hammer bit and rotary head, with a compressed air-lift or pumped water-lift technique.

9.3.2 LINE CUTTING TECHNOLOGIES

- **Alternative Technologies**

A few decades back, the lines used to be cut using bulldozers: this was not considered environmentally friendly because they removed vegetation entirely, as well as scraped off surface soils. The current state-of-the-art technology is the use of mulchers. The mulching units are self-powered vehicles mounted on low ground pressure tracks or wheels exerting only 3-3.75 *psi* pressure on the surface. These machines cut low-lying vegetation and leave behind fine, rapidly bio-degradable nutrient-rich mulch in their wake with seeds intact. Soil structures and root systems are also left intact. Regeneration of mulched vegetation is rapid and even in arid areas vegetation returns to its pre-cut state in one to two years.

- **Recommendations**

Line cutting will not be necessary in some parts of the project area on account of the bare or sparsely vegetated surface with thin soil cover overlying hard rock beneath. In areas where line cutting will be necessary, the method used will range from bulldozers, to the use of mulchers to clear areas with relatively dense vegetation and areas where farming takes place. The mulchers will cut a track of 2.5 metres in width without disturbing the top mat of soil

9.3.3 ACCESS ROAD TECHNOLOGIES

As far as is practicable, existing routes will be used to reach the seismic line acquisition areas. Where this is not possible, access roads may have to be constructed. These are typically done using a bulldozer (e.g. Caterpillar D8R or equivalent) and light hand-cutting of vegetation using machetes. Some lines may have to be bulldozed to allow access for the Vibroseis vehicles. Such routes should also be planned in liaison with the area authorities and community leaders, and there should be a win-win approach to this so that such access roads can benefit the local communities once the project is over.

9.3.4 SEISMIC DATA RECORDING EQUIPMENT

This will include a recorder and computer workstation mounted in a truck, cables with attached geophones (cables can be several kilometres long), and telemetric data encoding units.

9.3.5 COMMUNICATIONS EQUIPMENT

The area has an unreliable and variable quality communications network. Communications equipment that will be required include VSAT, hand-held satellite phones, vehicle mounted VHF radios, HF radios and mobile phones. Communications will be coordinated through a central communications base station that will be set up at the base camp. There are several technological options offered by communications equipment supplies companies. The options selected should be based on assessment of the peculiar requirements in the project area.

9.3.6 SURVEYING EQUIPMENT

Once the seismic line coordinates have been determined, it will be necessary to carry out a survey before line cutting commences. Typical survey instruments would include, for example, the survey instrument itself (e.g. DGPS- Differential Global Positioning System), hand-held GPS, and plotters to print out the survey line maps. There are several state-of-the-art technological options that Tullow can choose from.

9.3.7 TRANSPORT EQUIPMENT

This could include the following: normal saloon/station wagon 4WD cars, pickups, water tanker, fuel tanker, personnel carrier, Vibroseis service truck, recording truck, line equipment layout truck, food transport truck and ambulances. Selection of the appropriate make and type of this equipment will be carried out later by the seismic contractor, based on a consideration of the environmental setting and challenges posed to vehicles. Crew personnel changes will usually take place via small aircraft

Seismic surveys are a specialised technical area, and alternative methods and technologies are limited. The survey technique and equipment specifications for the

proposed seismic programme are considered to be necessary for the acquisition of quality data to allow geological evaluation and the safe and optimal development of the Block. It is estimated that the time period in which the seismic survey will take place is within three to four months and therefore minimum disruption to local activities will be envisaged. Impacts that are associated with the seismic activities will be minimal and measures have been put in place in the EMP to mitigate any potential impact that may occur during the exercise.

10. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 INTRODUCTION

The environmental and social aspects identified in this impact study concerns in the EIA must be properly managed. The tool for achieving this is the incorporation of an Environmental and Social Management Plan (ESMP) into the EIA to ensure adherence and future compliance with legislation, good environmental and social performance, and integration of environmental and social issues into the project decision. The ESMP provides the means of assessing the accuracy of the predicted project impacts and the monitoring of the effectiveness of the proposed mitigation measures contained in the EIA study report. The EMP should therefore indicate how the environmental and social concerns highlighted in the EIA would be managed. Tullow will monitor the implementation of key contractor parties and assess compliance with the provisions of the ESMP through its contractual mechanisms and management.

Tullow is committed to provide resources essential to the implementation of the EMP. The EMP outlined below provides all the details of project activities, impacts, mitigation measures, time schedules, responsibilities and commitments proposed to minimize environmental and social impacts of the project, and includes monitoring and evaluation for the implementation, operational and decommissioning phases of the project.

Tullow is also committed to identifying and mitigating against any environmental and/or social aspects which may arise during the project implementation which may have not been identified during the study.

10.2 OBJECTIVES OF THE ESMP

The objectives of the ESMP are to:

- Adhere and address necessary legal frameworks and other requirements;
- Promote environmental management and communicate the aims and goals of the project ESMP to all stakeholders;
- Incorporate environmental management into project design and operating procedures;
- Ensure all workers, contractors, sub-contractors and others involved in the project meet all legal and institutional requirements with regard to environmental management;
- Address issues and concerns raised in the project stakeholders' consultation process;
- Serve as an action plan for environmental and social management;
- Provide a framework for implementing commitments of the project (i.e. mitigation measures identified in the EIA);
- Prepare and maintain records of project environmental performance (i.e. monitoring, audits and compliance tracking); and
- Prepare an environmental monitoring plan whose aim is to ensure that the negative environmental impacts identified in Chapter 7 of this EIA are effectively

mitigated by way of design, construction, operational and decommissioning stages of the project.

10.3 PROJECT DESCRIPTION

Tullow will acquire 382 Sq Km of 3D seismic data over a projected time period of 250 to 360 days. Line clearance along the pre-determined and pre-surveyed transects on land will be done by use of bulldozers and mulchers, and where access roads are required, by bulldozers. Support vehicles such as for personnel movement, carrying of data recording equipment, etc., will be available. The workforce, who will reside in a fully equipped base camp, will be locally sourced and number between 400 and 500 people's resident on camp. The health and safety of the crew and the general public at large will be ensured by the company complying both with the relevant national legislation, its own in-house environmental health and safety (EHS) policies which embrace the international best practices for such activities, and this EMP. A close working relationship will be fostered with the local communities, and as far as is practicable, unskilled and semi-skilled workers shall be recruited locally.

10.4 APPLICABLE LEGISLATION AND REGULATIONS

The spectrum of legislation and regulations that apply to the seismic survey project has been detailed in Chapter 2. Some of the key legislation that relate to the activity are:

- Environmental Management and Co-ordination Act, 1999 and associated regulations and guidelines;
- Petroleum (Exploration and Production) Act, Cap. 308;
- Energy Act, No. 12 of 2006;
- Explosives Act, Cap. 115;
- Wildlife (Conservation and Management) Act, Cap. 376;
- National Museums and Heritage Act, Cap. 216;
- Water Act, 2002;
- Occupational Safety and Health Act, No. 15 of 2007.

10.5 TULLOW POLICIES AND PROCEDURES

Tullow has two key policies that relate to this activity, namely, the Environmental, Health and Safety (EHS) Policy, and the Corporate Social Responsibility Policy (CSR). Through its EHS policy, Tullow commits to high standards of environmental, health and safety, and aims to conduct its business operations to the best industry standards under its CSR policy as described in chapter 2 (section 2.4.7).

10.6 ROLES, RESPONSIBILITIES AND TRAINING

Tullow will be responsible for the overall implementation, monitoring and quality assurance/quality control of this ESMP. It will be responsible for ensuring that the policies, management plans and actions to be implemented to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts are adhered to. Tullow shall develop a clear command chain framework for employee responsibilities, reporting and incident management, and shall ensure that all employees understand it.

Tullow will sub-contract the project to a seismic survey company to undertake the survey. In such a case, the contractor will be responsible for the implementation and monitoring of the ESMP in their related work contract activity (and this condition should be built into the terms of reference for tendered work and the contract document). The contractor will also be responsible for the occupational health and safety of the workers and others who may be carrying out both related and un-related activities within and around the work sites. Tullow will be responsible for periodic environmental inspections of the work and camp sites in general. The contractors will also be responsible for implementing corrective actions that may be required by Tullow as a result of these inspections.

Tullow will train its employees in order to equip them to carry out their duties under the scope of the ESMP. Contractors will likewise be required to do the same for their employees and in relation to the work component that they have been given to carry out (see the ESMP below). The workers shall be regularly informed on, and assessed for, their understanding of the various policies and plans that relate to their work environment. Tullow will constitute a competent and effective workforce, taking into account the skills required for each work component, and giving priority to local workers for employment opportunities in the semi-skilled and unskilled work categories. Suitable training and skill transfer will be provided, where required.

Specific training requirements are mentioned under the relevant sections of the ESMP below.

10.7 COMMUNICATION WITH STAKEHOLDERS AND GRIEVANCE MECHANISM

Tullow will develop and maintain a formal procedure for communication with various stakeholders to inform on the various stages of project activities, as well as to receive their views and concerns, if any. Tullow will maintain a written register of its interactions and discussions with the various stakeholders so that issues that require to be followed up are clear and well-understood, and the outputs can be assessed.

Tullow will also establish a grievance mechanism to handle complaints from the stakeholders/residents of the area, as well as for its own and contracted workers. There will be a separate and supporting, distinct compensation and verification procedure, some components of which will be established in consultation with Government Officials.

10.8 AUDITING

It is a requirement by law that any project activity being undertaken be audited after every year. The seismic survey is, however, of a much shorter duration. Auditing will, therefore, be done upon completion of the project activities. The auditing to be undertaken at the end of the project is to ensure that the project adhered to the ESMP as outlined in this project report and that corrective measures were put in place in cases where impacts were identified. If the audit findings indicate that there are impacts that were not corrected, then the proponent will be required by NEMA to undertake such corrective measures before the Authority signs off the project.

Besides the regulatory framework, Tullow will conduct regular internal audits covering all aspects of the ESMP during the course of the project operations. The audits shall be performed by qualified staff and communicated to Tullow's relevant departments and NEMA.

Qualified staff' would be a local or foreign EIA individual or a firm of experts registered as such with the National Environment Management Authority under Regulation 14 of the Environmental (Impact Assessment and Audit) Regulations, 2003. However, under Regulation 34, if the project proponent's EIA report has been approved by the Authority, or after an initial audit of an ongoing project has been done, that proponent may thereafter self-audit regularly, ensuring that the criteria used to audit is based on the EMP developed during the EIA process or after the initial audit. The audit report is submitted to the Authority. The Authority is responsible for carrying out environmental audits and monitoring of these activities through an environmental inspector appointed under the Act (EMCA, section 68)

10.9 THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR THE SEISMIC SURVEY

The ESMP for the onshore survey addresses the following components that relate to the seismic survey:

- Physiography and Geology
- Soils
- Air Quality
- Surface and Groundwater Resources
- Water Quality
- Terrestrial Environment (Habitats, Flora, and Fauna)
- Land Resources and National Parks
- Archaeological, Historical and Cultural Sites
- Visual Aesthetics
- Noise and Vibrations
- Solid and Liquid Wastes
- Social Characteristics
- Economic Characteristics
- Occupational Health and Safety
- Security and Public Safety

The structure of the Environmental and Social Management Plan adopted for each of the environmental and social components addressed in it (below) is as follows:

1. Potential Impacts and Mitigations – These outline the impacts and mitigations that have been identified and that are peculiar to the project area (see Chapter 7);
2. Identification of Desired Outcomes, Objective Indicators, and Monitoring – The Desired Outcomes reflect what the project proponent and stakeholders would like to see once the operation has been completed. The Objective Indicators indicate how the Desired Outcomes can be measured, and their success determined (either qualitatively, quantitatively, or both). The Monitoring aspect is based on assessment of project operations *vis à vis* the Objective Indicators and the Desired Outcome;
3. Responsibilities and Management.

In each and every component of the ESMP, the Tullow EHS and CSR policies that are outlined in Chapter 2 apply. Other additional relevant plans (whose frameworks are outlined in later sections of this ESMP and that Tullow will need to tailor to fit into its work ethic and culture) are indicated under the applicable ESMP component(s).

10.9.1 PHYSIOGRAPHY AND GEOLOGY

The impact sources from the project operations will include the Vibroseis and associated equipment, bulldozer and dynamite charges.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Cut lines leave long-lasting residual impacts (tracks, and/or scarring on surface rocks) ▪ Vibrators/bulldozers use near steep slopes may lead to minor landslips and rock topples 	<ul style="list-style-type: none"> • Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country; • Minimise to the extent possible, the use of bulldozers to open up cut lines and access roads to minimise landscape scarring; • Avoid cut lines on slopes steeper than 40° to minimise risk of landslips and rock topples; • Optimise source energy to achieve the survey objectives to minimise risk of landslips and rock topples; • Buffer zones should be maintained from areas posing landslide and topple hazards; and • Decommissioning will be carried out according to the Tullow Site Restoration Plan.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Residual impacts of cut lines minimized to the extent possible ▪ Landslips and rock topples do not occur 	<ul style="list-style-type: none"> ▪ 100% of seismic cut lines pre-surveyed on the ground ▪ Actions taken to minimise cut line impacts are recorded ▪ No project-related landslips or rock 	<ul style="list-style-type: none"> ▪ During seismic operations 	<ul style="list-style-type: none"> ▪ The Seismic contractor will be responsible for the day-to-day monitoring and management, and will report to the Tullow Seismic Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, or immediately in case of an incident occurring. 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
	topples recorded			

10.9.2 SOILS

The impact sources from the project operations will include Vibroseis and associated equipment, bulldozer, and transport vehicles. Other sources will be oil leaks from vehicles, machinery, garages and storage areas.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Compaction and Disturbance of soils along cutlines ▪ Cut lines may enhance gullying and erosion (wind and water) ▪ Rutting in loose soils ▪ Contamination of soils 	<ul style="list-style-type: none"> • Machinery and equipment should use existing routes as much as is practicable to avoid compaction of the surface soil; • Vehicles should steer away from natural drains and waterways as is practicable, but a buffer zone should be maintained except at crossing points; • Minimize vegetation and grassland clearance as much as possible when cutting the survey line transects; • Use only essential vehicles and low pressure/low impact tyres in areas with wet soils or that are susceptible to ponding or are prone to erosion; • Ensure that all vehicles and machinery operating in the field and in the campsite are properly maintained so as not to have oil leaks that could contaminate the soils; • Ensure that any in-field refuelling or maintenance is performed while using a drip tray with a spill-kit available; • All fuels and other non-aqueous fluids to be stored in suitable bunded enclosures; • Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks; and • Line surveyors to keep a record of any and all hazards encountered e.g. wet/soft ground, and to

Potential Impacts	Mitigation
	inform seismic operatives of these.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> Minimal, (if any), compaction of soft sediments where applicable Minimal disturbance of soils along cut lines No contamination of soils 	<ul style="list-style-type: none"> Maintain inventory on length of wet/dry patches encountered along the survey routes Zero spillage of oils/chemicals. Incidents of spillage type and amount recorded and geo-referenced 	<ul style="list-style-type: none"> Continuous during survey Continuous during survey, Onetime assessment and site selection All incidents to be reported immediately to the Seismic QC Representative 	<ul style="list-style-type: none"> Seismic contractor will be responsible for the day-to-day monitoring and management, and will report to the Tullow Seismic Field Acquisition supervisor and the Tullow EHS Manager on a daily and weekly basis, or immediately in case of an incident occurring. 	Low

--	--	--	--	--

10.9.3 AIR QUALITY

The impact sources from the project operations will include vehicles and machinery, sanitary systems and waste disposal points.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Pollution from exhaust emissions; ▪ Fugitive dust-generation from traffic; ▪ Offensive odours; ▪ Health risks. 	<ul style="list-style-type: none"> • Limit traffic speed and restrict movement of vehicles as is reasonable to minimize dust generation; • Field vehicles, trucks and any other machinery should be switched off when not in use; • Regular servicing of all trucks, service vehicles, and any other machinery powered using fossil fuels to ensure efficient combustion and minimisation of exhaust emissions ; • Use low sulphur fuels if available and where suitable; • Employees working in dusty conditions must use appropriate PPE; and • Installation and proper management of camp sanitation facilities.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Minimal pollution from exhaust emissions ▪ Minimal dust generation from traffic ▪ No offensive odours ▪ No health risks 	<ul style="list-style-type: none"> ▪ Use of low sulphur versus other fuels wherever possible ▪ Adherence to equipment maintenance schedule ▪ Set speed limits are not exceeded (record exceedence incidents) ▪ No offensive odours recorded ▪ No violation of OHS requirement 	<ul style="list-style-type: none"> ▪ Malfunctioning equipment removed immediately from operations for repair ▪ Speed limit violations based on speed-tracking devices in vehicles, monitored at base camp ▪ Regular inspection of sanitary facilities and waste disposal points ▪ Regular checks on use of PPE 	<ul style="list-style-type: none"> ▪ The Seismic contractor will be responsible for the day-to-day monitoring and management of air quality issues in the field, and around the campsite. The EHS representative will liaise with the Seismic QC representative on site on any issues arising and will report to the Tullow Seismic Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, and will immediately report on health risk 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
	s for dust impact mitigation (violations recorded).		incidents.	

10.9.4 SURFACE AND GROUNDWATER RESOURCES

The impact sources from the project operations will include water supply source for the camp, heavy vehicles and machinery.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Conflict with neighbouring communities if water source is shared ▪ Compaction of near-surface aquifers such as springs, reducing yield ▪ Downward draining of groundwater through drill holes, reducing yield at springs 	<ul style="list-style-type: none"> • It is recommended that an efficient and monitored water-use policy be adopted by the project proponent at the camp sites and other work areas ; • An efficient sanitation system should be put in place in the campsite(s) to handle effluents ; • Hazardous and toxic waste material should be managed according to OGP and IFC practices and in compliance with Kenyan legislation, specifically the Environment Management and Coordination (Waste Management) Regulations; • All spills and splashes should be cleaned immediately using absorbent material; • Vehicle washing bay in the camp will be typically of concrete and will be designed for drive-in-drive-out ability and will allow waste water capture. The water will be drained through a grit trap and an oil-water separator and discharged off-site in a manner that does not cause water to pool or run unabated into luggas or other surface water features; • Only emergency repairs and maintenance will be completed in the field. Routine, planned preventative maintenance in line with the manufacturer's recommendations will be completed offsite at base camp workshops; • Buffer zone distances between seismic lines and

Potential Impacts	Mitigation
	<p>water sources will be established through extensive in-field ground vibration testing. Distances may vary between seismic source types, as per IAGC Guidelines.</p> <ul style="list-style-type: none"> • When water is encountered during uphole drilling, bentonite, or a tapered concrete (or other suitable material widely accepted in the industry), can be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface; • Ensure that any in-field refuelling or maintenance is performed while using a drip tray with a spill-kit available; and • Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No conflict over water use with neighbouring communities ▪ No compaction of near surface aquifers ▪ No downward draining of groundwater through drill holes 	<ul style="list-style-type: none"> ▪ Tullow has its own water borehole or other independent water source ▪ Identification of nearby springs and wells along cut lines during line survey exercise ▪ No violation of buffer zone limits around groundwater sources ▪ Identification of nearby springs and wells along cut lines during line 	<ul style="list-style-type: none"> ▪ Continuous, during line survey ▪ Compliance with buffer zone requirements ▪ Continuous, during line survey ▪ Compliance with buffer zone requirements ▪ Per drill hole site 	<ul style="list-style-type: none"> ▪ The seismic contractor will be responsible for the day-to-day monitoring and management of surface and groundwater resource issues in the field, and around the campsite. The EHS representative will liaise with the Seismic QC representative on any issues arising and will report to the Tullow Seismic Field Acquisition Supervisor and the Tullow EHS 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
	<p>survey exercise</p> <ul style="list-style-type: none"> ▪ No violation of buffer zone limits around groundwater sources ▪ Inventory of drill hole plugging maintained 		<p>Manager on a daily and weekly basis, and will immediately report on incidents of concern.</p> <ul style="list-style-type: none"> ▪ Tullow will seek authority from the local council to drill a water borehole. Once approval is obtained, site selection for the borehole will be done with inputs from a registered hydrogeologist. The hydrogeological report will be done in accordance with the legislation and regulations that relate to the Water Act 2002, and will be submitted to the Water Resources Management Authority (WRMA) sub-regional office in Nakuru. WRMA will then approve the report and issue a drilling permit. 	

10.9.5 WATER QUALITY

The impact sources from the project operations will include: liquid effluent discharges from sanitation systems at the campsite; oil or chemical leaks from garage and storage areas; vehicles and machinery operating in the camp and field; and subsurface detonation of dynamite charges during the field survey.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Contamination of water supply source for the camp Contamination of underlying aquifers 	<ul style="list-style-type: none"> Refuelling areas should be underlain with spill-proof hard standing or bund, with spill-kits readily available and operatives trained in their use; All fuels and other non-aqueous fluids to be stored in suitable bunded enclosures; All refuelling operations to be carefully overseen and managed; Buffer zone distances between seismic lines and water sources will be established through extensive in-field ground vibration testing. Distances may vary between seismic source types, as per IAGC Guidelines; Spill-kits to be carried with vibro truck service vehicle, refuelling bowser vehicles, drill crews. All staff to be briefed on use of these; When water is encountered during uphole drilling, Bentonite or a tapered concrete plug may be used to plug the hole up to 3m above the static water level or to a depth of 1m from the ground surface; Ensure that all vehicles and machinery operating in the field (and in the campsite) are properly maintained so as not to have any oil leaks that could contaminate the soils; Ensure that any in-field refuelling or maintenance is performed in a well-lit bunded area or while using a drip tray with a spill-kit available; and Ensure that all drivers and technicians are familiar with drip-tray and spill-kit use through daily tool-box talks.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No contamination of water supply source for the camp ▪ No contamination of underlying aquifers in the project area 	<ul style="list-style-type: none"> ▪ Camp water supply source is fit for human consumption ▪ Camp water supply source is protected ▪ Zero spillage of chemicals and hazardous material on soils that may lead to surface/groundwater pollution ▪ Waste pits and landfills are professionally sited ▪ Buffer zones are observed 	<ul style="list-style-type: none"> ▪ Physico-chemical and microbiological testing regularly. ▪ Casing and cementing of borehole and wellhead area ▪ Protocols for and conditions of oils and chemicals storage at the camp are adhered to. ▪ Compliance with buffer zone requirements 	<ul style="list-style-type: none"> ▪ The Seismic contractor will be responsible for regular monitoring and management of surface and groundwater resource issues in the field, and around the campsite. The EHS representative will liaise with the Seismic QC Representative on any issues arising and will report to the Tullow Seismic Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, and will immediately report on incidents of concern. 	Low

10.9.6 TERRESTRIAL ENVIRONMENT (HABITATS, FLORA, AND FAUNA)

The impact sources from the project operations will include: Vibroseis and associated equipment, mulchers, bulldozer and transport vehicles, and physical presence of the workforce.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Cutting of vegetation along cut lines ▪ Disturbance of wildlife (physical presence and noise) ▪ Introduced weeds and pests 	<ul style="list-style-type: none"> • The mitigations related to soils (see above) apply; • Trees with trunk diameter greater than 20cm should not be cut; • Seismic survey activities to be undertaken during daylight hours only; • Any planned lines that are considered to be a threat to the ecosystem integrity especially ecologically sensitive site such as luggas and trees serving as nesting spot for birds should be relocated where possible; • Hunting, trapping and gathering of food resources by workers, when on and off duty should be strictly prohibited. All workers to be briefed regularly on this issue; and • All waste material from field / fly camp operations should be brought back to the base camp for proper disposal.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Minimal cutting of vegetation along cut line ▪ Minimal disturbance of wildlife ▪ No weeds or pests introduced into the area 	<ul style="list-style-type: none"> ▪ Length of line where no cutting is required versus length of line where mulcher is used ▪ Number of wildlife encounters and actions taken recorded ▪ All equipment and vehicles are washed 	<ul style="list-style-type: none"> ▪ Continuous, during line preparation ▪ Continuous, during line preparation ▪ Daily ▪ Inspection and certification of the cleaning action 	<ul style="list-style-type: none"> ▪ Wildlife shall have the right of way when they are of such a size that they can be readily seen from vehicles. Hunting and feeding of wildlife shall be strictly prohibited. In wildlife areas, access roads will be used as much as possible. Employees should be made aware of the wildlife-sensitive locations. 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
	down and biofouling removed before being taken to the project area			

10.9.7 LAND RESOURCES

The impact sources from the project operations will include: Vibroseis, mulchers and associated equipment, dynamite shots, vehicles, and presence of humans.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Cut lines affect pastoral resources ▪ Disturbance of cultural site (meeting points and grave sites) leading to conflict with the community 	<ul style="list-style-type: none"> ▪ As for sections 10.9.1 (Physiography and Geology), 10.9.2 (Soils), 10.9.7 (Terrestrial Environment) above; ▪ The base camp location should be identified considering distances to site, local community sensitivities and the presence of existing camps and infrastructure that can be used in lieu of building a new camp; ▪ In addition to the above clearing of vegetation should be limited to the minimum area required for seismic survey work; ▪ Where valuable trees/ plants are cut down fair compensations should be; and ▪ Community Liaison Officers available to coordinate consultation with community members during seismic work programme and conduct grievance management procedure as necessary

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Minimal disruption to nomadic livestock husbandry activities ▪ Other desired outcomes relate to the following sections: Soils 	<ul style="list-style-type: none"> ▪ No complaints from pastoralists and communities ▪ Objective indicators for Soils and Terrestrial Environment 	<ul style="list-style-type: none"> ▪ Information outflow to the affected communities on seismic line survey schedules and exclusion time periods ▪ Adhering to the use of existing routes and 	<ul style="list-style-type: none"> ▪ The Seismic Field Acquisition Supervisor will be in charge of this in liaison with the Tullow Field Stakeholder Engagement Supervisors. All workers will be regularly briefed on this issue. 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
(10.9.2), Terrestrial Environment (10.9.6)	t are met	road network <ul style="list-style-type: none"> ▪ Enforcing policy against hunting and gathering through training and direct supervision where applicable ▪ Clearing done only on seismic survey operation area 		

10.9.8 ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

The impact sources from the project operations will include: Vibroseis and associated equipment, vehicles and dynamite shots.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Compaction by heavy vehicles and machinery may damage soils and rocks on cultural sites ▪ Vibrations and drilling of shot holes may disturb graves and cultural sites ▪ Social friction between local communities and seismic crew workers 	<ul style="list-style-type: none"> • Tullow should adhere to their Cultural Heritage Management Plan where relevant. • As much as is practical the proposed 3D seismic survey should not be undertaken within or near residential neighbourhoods; • Consultations should be undertaken in a culturally appropriate and transparent manner as per the procedure set out in the Tullow stakeholder engagement plan for the project are to help in identifying and avoiding any sensitive cultural sites during the seismic survey in order to avert possible conflict with the community; • Use of shot points rather than Vibroseis is recommended for such areas;

Potential Impacts	Mitigation
	<ul style="list-style-type: none"> • All such sites will be flagged for avoidance; • If archaeological materials are found during the operations, they should be left undisturbed, and the National Museums of Kenya personnel should be contacted to advise further on how to proceed; and • All project field workers must be informed, before commencement of operations, that any disturbance to, defacement of, or removal of archaeological, historical, or sacred material will not be permitted.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Negligible interference, if any, with the archaeological, historical and cultural sites ▪ Desired Outcomes for Soils (section 10.9.2) apply 	<ul style="list-style-type: none"> ▪ No violations of buffer zone restrictions ▪ The identified sites (if any) are flagged for avoidance ▪ Archaeologist from NMK on site with the field team when carrying out work in archaeological areas, starting from the line survey phase. ▪ Objective indicators for section 10.9.2 are met 	<ul style="list-style-type: none"> ▪ Buffer zones are adhered to ▪ Flagging is done and cleared once the work is completed ▪ Archaeological sites are not interfered with 	<ul style="list-style-type: none"> ▪ The Tullow CLOs— and in coordination with the Tullow Field Stakeholder Engagement Supervisors shall liaise with community leaders and elders on the identification and flagging of culturally sensitive areas. ▪ Such persons with good knowledge of the sites may need to accompany the seismic team to identify the various sites. ▪ The Seismic Field Acquisition Supervisor shall be responsible for ensuring that 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
			<p>such sites are not disturbed, and that all the workers are aware of the locations of the site.</p> <ul style="list-style-type: none"> An internal awareness education and training programme will be conducted to provide personnel and contractors with knowledge and an understanding of the importance of archaeological and cultural resources. 	

10.9.9 VISUAL AESTHETICS

The impact sources from the project operations will include campsite design and cut lines.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Cutline footprints and vegetation cover removal lower aesthetic value of landscape Poor campsite design does not blend well with the environment 	<ul style="list-style-type: none"> Use of modern line cutting technology, preferably mulchers (in areas with dense bushland) for clearing of the geophysical survey transects will ensure that minimal vegetation is removed, hence ensuring that re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote faster re-growth; Campsite design should take into consideration the aesthetic value of the selected area;

Potential Impacts	Mitigation
	<ul style="list-style-type: none"> Minimise use of bulldozers on sensitive landscapes; and The built up areas already identified should be avoided.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> Campsite blends well with the local environment Aesthetics value assigned to the area maintained by minimising cut line footprints and vegetation removal 	<ul style="list-style-type: none"> Camp design is aesthetic and good housekeeping practices are maintained Residual impacts of cut lines minimized in extent (sections 10.9.1, 10.9.2 and 10.9.6 apply) 	<ul style="list-style-type: none"> Camp constructed according to the engineers' design Physiography and Geology, Soils and Vegetation sections apply (sections 10.9.1, 10.9.2 and 10.9.6) 	<ul style="list-style-type: none"> Maintenance of visual aesthetics will be the responsibility of the Seismic QC Representative 	Low

10.9.10 NOISE AND VIBRATIONS

The impact sources from the project operations will include: Vibroseis and associated equipment, dynamite charges, and associated equipment and vehicles traversing the area.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Disturbance to humans and livestock Disturbance to workers Health risks 	<ul style="list-style-type: none"> Built up areas such as schools, places of worship should be avoided as much as is practical; All seismic operations should be carried out only during daylight hours; Ensure that Vibroseis and other vehicles have working silencers to muffle noise;

Potential Impacts	Mitigation
	<ul style="list-style-type: none"> Workers should be sensitized on hazards likely to be encountered in such a work environment, and trained accordingly; Local communities in the vicinity of the seismic operation areas should be sensitised about the project and its possible noise and vibration impacts before commencement; Use generators with minimal noise levels (silent pack enclosures) at camp sites and effect a noise mitigation policy for all operations in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations; and Use of personal protective equipment such as ear muffs will be enforced, and setting up of buffer zones in areas of active seismic survey to keep away unauthorized personnel.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ Ambient noise and vibration levels maintained ▪ Workers protected in area with high noise levels 	<ul style="list-style-type: none"> ▪ Seismic data acquisition design plans optimised for reduction of noise and vibrations from Vibroseis and dynamite charges ▪ Noise levels monitored in the course of the seismic data acquisition ▪ Regularly serviced and efficient vehicle engines and other machinery ▪ "Quiet" machinery e.g. generators purchased 	<ul style="list-style-type: none"> ▪ Review of design parameters, as needed ▪ Monitor ground and noise vibration during parameter testing phase ▪ Monitor installed equipment ▪ Servicing work and schedules ▪ Requirement embedded in tendering of equipment documents, inspect as needed 	<ul style="list-style-type: none"> ▪ The seismic contractor will be responsible for ensuring the monitoring and mitigation of noise and vibrations. During camp construction, noisy activities should be undertaken during normal working hours. The OHS policy regarding use of PPEs should be adhered to by the workers. Trucking operations should be avoided at night. 	Low

10.9.11 SOLID AND LIQUID WASTES

The impact sources from the project operations will include: campsite and workplaces in the field.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Pollution of surface soils, waters and groundwater ▪ Offensive odours ▪ Health risks 	<ul style="list-style-type: none"> • It is recommended that segregation of solid wastes at source is appropriately carried out and consideration given to re-use, recycling, or disposal as appropriate; • A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations; • Hygienic sanitation and disposal of grey and black water will be covered in the waste management plan in order to protect the general health of the workers and the general public; • Effluent water from treatment will be discharged in a manner, subject to topography, that will not allow water to flow unabated into any water-course or allow pooling of water; • Off-specification water will be returned to the system for additional treatment before release; • Kitchen waste water will be drained through an interceptor to remove fats oils and grease (FOG) with the resultant water being processed through the waste water treatment plant; • The slaughter house in the base camp will be built on a bunded hard-standing with a drain leading to the domestic waste water treatment plant. Blood and unused offal from the slaughterhouse will be contained and co-mingled with the kitchen waste. The slaughterhouse procedures include a wash down after each use; waste water will be treated in the waste water treatment plant; • Ensure that solid waste is removed from site for recycling/disposal only by an authorised waste handler, ideally a handler licensed under the Waste Management Regulations, 2006; • Fuel and other non-aqueous liquid storage areas should be bunded; and • Servicing of equipment should be carried out in a designated garage area which has regularly maintained oil drainage traps and readily available spill-kits. Workers in this area will be regularly briefed on spill prevention.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No pollution of surface soils, water and groundwater ▪ No offensive odours ▪ No health risks 	<ul style="list-style-type: none"> ▪ No leakages of oils, chemicals or sewage and other domestic effluents reported ▪ Sanitary systems are working and no breakdowns reported ▪ Hazardous wastes (e.g. medical and chemical wastes) are well managed and properly disposed of ▪ Appropriate use of personal protective equipment when and where mandatory 	<ul style="list-style-type: none"> ▪ Storage rooms are secure and accessed only by authorised personnel, daily ▪ Work areas are secure and accessed only by authorised personnel, daily ▪ Material storage containers checked for leaks daily ▪ Daily visual checks on sanitary systems ▪ Adherence to OHS policy and use of PPEs 	<ul style="list-style-type: none"> ▪ The Seismic contractor will be responsible for management of solid and liquid waste at the camp sites and field working areas. Systems for treating solid and liquid wastes generated in the course of rolling out the project should be properly selected, installed, managed and decommissioned according to national legislation, regulations, and international best practices in order to minimise or eliminate their potential environmental impacts. A Hazardous Materials Management Plan (HMMP) will be developed for the project (see section 10.10.3) Safety of the workers and the surrounding communities will be taken into account for all stages of materials handling during all project phases. The EHS officer shall consult with the local authorities in Lodwar to determine where and how the different types of wastes that will be generated during the project can be disposed of. 	Low

10.9.12 SOCIAL CHARACTERISTICS

The impact sources from the project operations will include: workforce influx and activities along the seismic survey lines.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Possible increase in number of students dropping out of school in search of jobs ▪ Erosion of culture and social values as a result of intercultural association. ▪ May interfere with grazing lands and watering points ▪ Friction between local communities and migrant workers 	<ul style="list-style-type: none"> • Employ more Community Liaison Officers and provide training/information to them in advance in order to keep communities informed prior to project mobilisation and on an on-going basis to ensure sensitization of the community and stakeholders <i>vis à vis</i> the project objectives, activities and scheduling, potential impacts; • The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location using appropriate wide-penetration communication media; • Awareness campaigns can be undertaken to inform/educate both the local communities and project employees; and • Provision to be made to compensate local property and landowners for any loss or damage caused by seismic operations. Compensation should be based on Tullow's compensation operating procedure.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No crime incidences as a result of the proposed project and no school drop-outs ▪ Preservation of cultural and social values ▪ No interference with grazing/pasture lands and watering 	<ul style="list-style-type: none"> ▪ No violations of Tullow CSR policy ▪ No complaints from the locals on cultural or social values concerns relating to the workers ▪ Relates to Soils (10.9.2) and Surface and 	<ul style="list-style-type: none"> ▪ Awareness of Tullow CSR policies by workforce ▪ Grievance mechanism in place and implemented ▪ Related monitoring aspects are being undertaken 	<ul style="list-style-type: none"> ▪ The Seismic contractor Community Liaison Team should ensure community involvement in establishment of recruitment and tender committees to check on recruitment procedures, gender balance and potential conflict areas. ▪ A project grievance mechanism in line 	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
points	Groundwater Resources (10.9.4) sections		with the Tullow Grievance Management Plan should be put in place	

10.9.13 ECONOMIC CHARACTERISTICS

The impact sources from the project operations will include: employment opportunities, tenders, and supplies.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Improved livelihood ▪ Improved short-term business opportunities for the locals ▪ Influx of cash into low-cash rural economies may lead to boom and bust phenomenon ▪ Conflicts/ Third party agitations over employment issues ▪ Traditional occupations (livestock husbandry and farming) adversely affected 	<ul style="list-style-type: none"> • Liaise with local community leaders during the recruitment process; • Employment policies to be strategically managed to avoid intra-community conflict and similar problems caused by migrant labourers; • Unskilled and semi-skilled manpower to be sourced locally as far as possible; • Gender should be factored into the employment criteria; • Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan; and • As much as is applicable Tullow should source daily consumables like beef from the local communities.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> Improved economy and living standards 	<ul style="list-style-type: none"> Number of locals recruited Number and type of Social Investment activities that Tullow undertakes and commits to Establishment of recruitment and tender committees 	<ul style="list-style-type: none"> As needed 	<ul style="list-style-type: none"> The Seismic contractor Community Liaison Team should ensure community involvement in establishment of recruitment and tender committees to check on recruitment procedures, gender balance and potential conflict areas. A grievance mechanism committee should be put in place Tullow would also determine fair levels of compensation (if the need arises) in consultation with relevant Government agencies (e.g. Ministry of Energy, and Provincial Administration) 	Low

10.9.14 OCCUPATIONAL HEALTH AND SAFETY

The impact sources from the project operations will include the campsite and fieldwork environments.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Injuries to workers, visitors and area residents arising from project operations Fire hazard 	<ul style="list-style-type: none"> All operations will be conducted in compliance with Tullow's EHS policy, international best practices and Kenya Government requirements (as set out in the Occupational Health and Safety Act and the Public Health Act); Appropriate and well-stocked first aid kits and fire

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Exposure to nuisance in the form of noise, dust, vibrations and emissions ▪ Other health risks 	<p>fighting equipment should be available to all crew, and specific crew members should be trained on first aid administration and handling of fire fighting equipment;</p> <ul style="list-style-type: none"> • Job-specific personal protective equipment to be provided to the workers, training should be given, and their use made mandatory in designated areas; • Environmental safety and health regulations and policies/plans must be adhered to Health Policy, Energy Act, Public Health Act, Local Government Act, Physical Planning Act, NEMA Regulations; • A Base Camp Clinic is to be provided, manned by suitably qualified field medical staff, licensed as appropriate to operate in-country, equipped with equipment and medication as appropriate, including ambulance vehicle(s); • Adequate warning or cautionary signage will be posted as required; • All electrical equipment shall be properly installed, earthed and regularly inspected, and where practicable will comply with IEE 17th edition regulations; • Only properly trained and authorised employees shall operate equipment or machinery; • Tullow driving policy and all other project-specific driving policies and journey management plans to be strictly adhered to and enforced; • Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place; and • Personnel on seismic survey operations and those on transit around the project area to be provided armed escort.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
▪ Prevent workers and/or visitors from	▪ 100% use of personal protective equipment	▪ Continuous monitoring and recording of	▪ The Seismic contractor EHS Representative should ensure all the	Low

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
possible injuries/harm and health-related risks	<p>(PPE) when and where required</p> <ul style="list-style-type: none"> ▪ Warning and Cautionary signage placed visibly in required places ▪ Training and drills on health and safety in the workplace, including fire-fighting 	incidences under each work component section	protocols relating to environmental health and safety, and occupational health and safety policies are adhered to. Frequent training programs on first aid, fire-drills and other related health issues should be a prerequisite. The field team will be self-contained and will carry its own water to the work sites.	

10.9.15 SECURITY AND PUBLIC SAFETY

The impact sources from the project operations will be related to the workforce security needs during seismic data acquisition, at the camp and when on transit

Potential Impacts	Mitigation
<ul style="list-style-type: none"> ▪ Improvement in security around the camp site due to security enhancement for project activities ▪ Community feeling exposed due to hiring of KPR to guard seismic survey crew and base camp leaving the villages vulnerable 	<ul style="list-style-type: none"> • Ensure that all workers can be identified by staff uniform and badges at the seismic survey operation areas as well as at the base camp; • Adequate security measures should be provided, e.g. perimeter fencing, safe havens and security manning at the campsites and whilst on line utilising Administration Police (APs) and Kenya Police Reservists (KPRs); • The company should liaise with the Provincial Administration, the Kenya Police, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation; • Barriers and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity; • Site lighting will be configured not to spill into community areas or into oncoming vehicles; • Camp population will be forbidden from interacting with the local populace; • Camp will be located at a significant distance from any local communities; • Journey management policy and monitoring to be enforced; and • No cooking on site and no fires other than at base camp; smoking will only be permitted in designated areas; no litter will be left on site; there will be no collecting of vegetation or firewood, and no hunting and trapping of wildlife; and vehicle speed will not exceed 40 km/h, with all vehicles fitted with vehicle tracking and monitoring systems.

<i>Desired Outcomes, Objective Indicators and Monitoring and risk after mitigation</i>				
Desired Outcome	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No security-related incidents ▪ Adequate security for the workforce and communities 	<ul style="list-style-type: none"> ▪ Number of security-related incidents recorded 	<ul style="list-style-type: none"> ▪ Continuous monitoring and recording of incidences 	<ul style="list-style-type: none"> ▪ The involvement of government agencies during the project operations may enhance long-term security initiatives from the concerned parties, hence improving the security situation in the area. Security issues should be the overall responsibility of the Country Manager. ▪ Provincial administration and Kenya Police Service to continuously monitor security needs for the project and communities and where need be recruit more Kenya Police Reservists 	Low

10.9.16 CONSTRUCTION OF THE CAMPSITE

The impact sources from the project operations will be the camp design and security, water supply, waste management, air quality socio-economic factors and occupational health and safety.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> • Disturbance to soils and vegetation during construction • Reduced landscape aesthetics due to stockpiling of excavated soils • Health and safety hazard 	<ul style="list-style-type: none"> • Construction of the campsite shall be undertaken during daylight hours only; • Mitigations in sections 10.9.1 (Physiography and Geology), 10.9.2 (Soils), 10.9.4 (Surface and Groundwater) and 10.9.6 (Terrestrial Environment), 10.9.11 (Noise and Vibrations) 10.9.15 (Occupational Health and Safety) and 10.9.16 (Security and Public Safety) apply;

Potential Impacts	Mitigation
<p>due to poor campsite construction</p> <ul style="list-style-type: none"> Spillage of chemicals, oils and fuels from construction equipment and vehicles Nuisance to communities Health and safety hazard during campsite occupation 	<ul style="list-style-type: none"> Excavated soil should be used in landscape design of the campsite rather than stockpiling; Use of T-card system for access control within the campsite shall be enforced Campsite will be erected by a qualified and licensed civil and building contractor with workers who are qualified to carry out assigned tasks; Use of appropriate Personal Protective Equipment to be enforced Adequate temporary housing and sanitation facilities shall be provided for the construction workers; Construction equipment and vehicles shall be well-maintained, checked and promptly repaired to ensure no spillage of oils and fuels and to minimise gaseous emissions; Company employees shall comply both with the relevant national legislation, and its own in-house environmental health and safety (EHS) policies; and, Adequate warning signs and fire extinguishing equipment will be visibly and appropriately posted.

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with Mitigation (High, Medium or Low)
<ul style="list-style-type: none"> Minimal disturbance to environment during construction Reduced potential for environmental pollution due to oil and fuel leaks and noise and gaseous emissions 	<ul style="list-style-type: none"> Clearing of vegetation kept to the minimum possible levels and soil are not unnecessarily cleared Maintenance schedule for equipment and vehicles adhered to and no 	<ul style="list-style-type: none"> Continuous monitoring and recording of incidences 	<ul style="list-style-type: none"> The construction of the campsite shall be supervised by the chosen contractor and overseen by Tullow. Camp operations shall be supervised 	Low

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with Mitigation (High, Medium or Low)
<ul style="list-style-type: none"> Communities are not disturbed No security-related incidents No safety and health-related incidents Minimal noise and vibration pollution to the neighbouring communities 	<ul style="list-style-type: none"> pollution incidents reported Incidence Occurrences records of community disturbance, number of security-related issues and safety and health-related incidents recorded and maintained 		and coordinated by the Camp Manager	

10.9.17 FUELLING STATION

The impact sources will include oil or chemical leaks from garage and storage areas, vehicles and machinery leaks along the operation areas.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Fuel spills Fire hazard Fuel contamination 	<ul style="list-style-type: none"> The fuelling station will be concrete based ; The fuel storage area will be set at one end of the parking bay area, and will be bunded. The bunds should have the capacity to contain all the fuel stored inside the fuel bladder in case of leakage; The fuel storage area will have a tarpaulin covering to protect it from extremes of weather, and should be well aerated; The fuel storage floor shall be concrete-based, and canvas-lined to capture minor spillages; The bladder will be charged with fuel ferried by tankers, and will be conveyed to the pump via an outlet hose; Clearly marked spill kits will be placed adjacent to the refuelling area, and all staff involved in vehicle maintenance and refuelling will be trained in their use. Clear 'no smoking' signage shall be posted in this area;

Potential Impacts	Mitigation
	<ul style="list-style-type: none"> Fire-fighting equipment will be placed at strategic places within the fuelling station and in other areas of the campsite; and All workers will be trained in the use of the installed fire-fighting equipment.

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with mitigation (High, Medium or Low)
<ul style="list-style-type: none"> No fuel spills No fires No fuel contamination 	<ul style="list-style-type: none"> Number of incidents recorded 	<ul style="list-style-type: none"> Continuous monitoring and recording of incidences 	<ul style="list-style-type: none"> Proper operations in the fuel filling station shall be supervised and coordinated by the Camp Manager. 	Low

10.9.18 CAMP CLINIC

The impact sources for the project activities will be waste management and handling practices.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Pollution due to poor handling of biomedical and pharmaceutical wastes 	<ul style="list-style-type: none"> Biomedical wastes generated at the facility will be handled as per NEMA Waste Management Regulations, 2006; The wastes will be segregated, and disposed of in the waste disposal facility as provided for by the relevant Local Authority; and Biomedical waste will not be stored above 0°C for more than seven days without the written approval of the relevant lead agency, provided that untreated pathological waste shall be disposed of within 48 hours.

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with Mitigation (High, Medium or Low)
<ul style="list-style-type: none"> No pollution from medical and pharmaceutical wastes 	<ul style="list-style-type: none"> Number of incidents of improper disposal recorded 	<ul style="list-style-type: none"> Continuous monitoring and recording of incidences 	<ul style="list-style-type: none"> The operation of the medical clinic will be under the direct management of the Camp Doctor, and shall be overseen by the Camp Manager. 	Low

10.9.19 WATER BOREHOLE DRILLING

The impact sources for the project operations will be disturbance to soils and vegetation and contamination of water in the project area.

Potential Impacts	Mitigation
<ul style="list-style-type: none"> Disturbance to soils and vegetation during data acquisition and borehole drilling Contamination during well development Drill cuttings from borehole Pollution/contamination of borehole/aquifer water 	<ul style="list-style-type: none"> Minimise soil disturbance and vegetation clearance as is practicable; Well development must be done with the Airlift method for at least 30 minutes or until the water is clear of drilling cuttings; Great care should be taken that the water quality of the different aquifers is accurately determined. Upon the first strike, drilling fluids should be effectively flushed, and after sufficient time, a water sample should be taken of the air blown (rotary) or bailed (percussion) yield; On-site analysis using an EC meter, and preferably a portable laboratory, is recommended; Screen-off non-targeted aquifer(s); The services of an experienced hydrogeologist should be engaged during the drilling, design, installation, and testing of the borehole; Drill cuttings from the borehole should be buried in clay or other suitably lined pit in the event that the borehole is successful, but if

Potential Impacts	Mitigation
	<p>not successful, the drill hole should be refilled with the drill cuttings;</p> <ul style="list-style-type: none"> • Drilling should be carried out at a diameter of not less than 6" using either a rotary type or percussion machine, to allow for casing, gravel packing and pump installation; • The borehole should be cased to the bottom using suitable non-polluting material, with screens at the aquifer position and plain casings at non-aquifer position; • The borehole should be bottom-plugged in loose formations; • The annular space must be gravel packed at the screen and aquifer position with durable and suitably sized material with respect to the size of the aquifer materials; • Grouting should be done by placing a concrete mixture up to 6m depth from ground surface; and, • Any drilling additives to be used (e.g. foam or polymer) must be non-toxic and bio-degradable. Bentonitic additives should not be acceptable, as they may plug the aquifer zones and are extremely difficult to remove during development.

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with Mitigation (High, Medium or Low)
<ul style="list-style-type: none"> ▪ No disturbance to soil and vegetation ▪ No contamination of the aquifer during well development and post-development ▪ Non-target aquifer strata are protected ▪ Drilling cuttings are 	<ul style="list-style-type: none"> ▪ No unnecessary clearing of vegetation and soil disturbance ▪ No contamination of aquifers ▪ Aquifers, borehole and well-head are protected based on good construction 	<ul style="list-style-type: none"> ▪ Monitoring during the drilling and well-head construction phases 	<ul style="list-style-type: none"> ▪ The Tullow Kenya B.V. EHS Representative should ensure all the protocols relating to environmental health and safety, and occupational health and safety policies are adhered to by the Drilling Contractor. Overall 	Low

<i>Desired Outcomes, Objective Indicators, Monitoring, Responsibility, and Risk</i>				
Desired Outcomes	Objective Indicators	Monitoring	Responsibility and Management	Risk with Mitigation (High, Medium or Low)
safely disposed of	practice <ul style="list-style-type: none"> ▪ Drill cuttings are safely disposed 		supervision will be the responsibility of the Camp Manager, who should also ensure that a qualified and registered hydrogeologist is available on site to supervise the drilling and well protection works.	

10.10 OTHER GENERAL REQUIREMENTS AND TRAINING ISSUES

10.10.1 OCCUPATIONAL HEALTH AND SAFETY PLAN

Tullow in conjunction with the Seismic Contractor will develop an Occupational Health and Safety Plan (OHSP), based on Tullow's EHS and CSR policies, prior to commencement of the project operations. The OHSP will uphold Tullow's commitment to a safe environment for employees, contractors and visitors. The plan will also address all applicable legal requirements relating to health and safety. The OHSP will set out the framework under which health and safety on the project site, and to and from the site, will be managed. The roles and responsibilities of the company, manager, supervisors and workers will be set out under this plan.

A health and safety training program will also be implemented at the site. The objectives of this training program will be to:

- provide appropriate orientation and support to all employees, contractors and visitors on site so that they can act in an appropriately safe manner;
- provide ongoing training to workers; and
- Inform at-risk workers to help attain a positive and safe work environment.

10.10.2 VEHICLE TRAFFIC MANAGEMENT

All vehicular movement and driving will be undertaken as per Tullow Oil's Driving Policy for Land Transportation (See section 2.6). Priority will be given to careful Journey Management Planning.

10.10.3 WASTE MANAGEMENT PLAN

A Waste Management Plan (WMP) will be developed for the project. It will identify all waste streams, including potentially hazardous materials to be used and provide a system for monitoring them. Transportation, storage, use and ultimate disposal will be considered. Safety of the workers and the surrounding communities will be taken into account for all stages of materials handling during all project phases.

Hazardous materials and wastes require special handling and training procedures. All employees will be provided with basic training so that, at a minimum, they can: identify hazardous materials; know how to obtain appropriate information on special handling procedures required; know what precautions and protective equipment are required; know how to label and package hazardous materials and wastes; know where and how hazardous wastes are to be stored; and know how wastes are to be disposed of. Employees who are tasked with receiving, off-loading and storing potentially hazardous materials or involved in the storage and shipment off-site of hazardous wastes should receive hazardous materials handling training.

10.10.4 SPILLS PREVENTION AND RESPONSE PLAN

Before the project commences, a Spill Prevention and Response Plan (SPRP) will be developed for use by Tullow and contracted personnel in the event of a deleterious material spill. The objective of the spill response measures will be to ensure that where accidental spills occur, all available resources are used appropriately to minimize the extent and severity of effect on the environment. All spills occurring on the project site will be responded to in a way that will uphold the following priorities: protection of human life and health; protection of the environment; protection of property; and minimized disruption to operational activities. At all times, applicable regulations will be used to guide response and cleanup activities.

At locations where the potential for spillage of hazardous material is highest, such as at fuelling points, spill control and containment means will be incorporated into the infrastructure during construction. The storage of materials will be tied in with the HMMP.

Spill response kits appropriate to the types and volumes of materials that will be used during the project operations will be specified, including the types of equipment that will handle or transport contaminant materials (including fuel). Spill response kits will be located at appropriate material handling and storage locations. The contents of the kits will be based on the potential risk associated with the material, volume of material, and environmental sensitivity of the area. General kit contents could include: oil absorbent pads; absorbent socks; granular absorbents; and protective equipment such as gloves, goggles and protective suits. All kits will be stored in a visible location, and in appropriate weather-resistant containers. Regular inspections of the kits will be performed to ensure that kits are complete and all materials remain functional.

All Tullow employees and contractors will undergo, as part of their orientation to the site, a training program on spill-prevention and hazard-identification, as well as spill-response, containment and reporting procedures. Other aspects of the training will include education on the:

- SPRP
- Applicable legislation
- Potentially affected environmental receptors (e.g. soil, surface and groundwater)
- Field application of appropriate spill-response techniques.

10.10.5 EMERGENCY RESPONSE PLAN (ERP)

A more general plan that will deal with emergencies such as those related to accidents and personal injury, medical evacuations, fires, and escalating insecurity shall be put in place before the commencement of project operations. Issues to be addressed would include the capacity for response and management, and the support agencies that can be called in to assist (e.g. Kenya Police, Hospital staff, KWS, etc). A detailed and project specific Emergency Response Plan will be developed in conjunction with the Seismic Contractor.

10.10.6 ENVIRONMENTAL AWARENESS PLAN

On appointment, all contracting companies and employees will receive a copy of the EMP and will be trained in the relevant categories of the EMP that are outlined in sections 8.9 and 8.10 above. In addition, a detailed environmental awareness plan will be developed prior to commencement of the seismic survey activities. The plan will address the following items:

- Basic workforce environmental awareness;
- Sensitivity of the site
- Personnel environmental training needs; and
- Resources available for use in personnel environmental awareness training
- Daily toolbox talks will be held to sensitise the workforce on environmental issues of concern.

Ongoing monitoring and auditing will also assist in continually improving the environmental awareness of the project team. Tullow will also target the community leaders and government administrators for awareness-building on the project components. These leaders and administrators would, thereafter, be able to explain the project components, the environmental issues, and mitigation measures that are being undertaken, to the community at large.

10.11 CAMPSITE DECOMMISSIONING PLAN

The campsite decommissioning plan will follow the same sequence of project decommissioning as activities as described in chapter 2:

- Workers lay-off and compensation;
 - Equipment demobilization (such as containers, vehicles, accommodation facilities)
 - Dismantling of camp facilities;
 - Cleaning the camps and disposal of solid, liquid and hazardous waste;
 - Restoration of waste pits, cesspools and the whole camp site;
 - Restoration of cut lines, shot hole repairs, removal of any debris and recovery and destruction of dead charges within the project area; and
 - Audit and sign off.
-
- The decommissioning will cover the base camp and any fly camps or any other facility that shall be erected. The decommissioning will lay emphasis on:
 - Examining the conformity to the EMP's developed during the EIA for the seismic survey project;
 - Preparation of a decommissioning strategy and EMP before decommissioning begins;

- Awareness creation;
- Ecological, socio-cultural and economic survey of camp sites and impacts;
- Conforming to national legislation and regulatory requirements and international best practices.

The decommission will be carried out as soon as is practicable after the end of the seismic survey, hence the specifics of it, which will depend largely on what was actually constructed on the ground, will need to be formulated well in advance.

10.12 COST OF THE PROJECT

The cost of the 3D seismic program is initially estimated at USD. \$20 Million and would be undertaken in a period of 8 to 12 months. The final cost and duration of the project will be dependent on the outcome of a competitive tendering process and subject to change.

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 SUMMARY OF THE PROJECT COMPONENTS

Tullow Oil PLC is one of the world's largest independent oil and gas exploration companies, and is an FTSE100 company. The Group has over 100 licences in more than 22 countries, with operations in Africa, Europe, South Asia and South America. Tullow has been successfully operating in Africa since 1986 where it is already a dominant player following exploration success in Ghana and Uganda.

The initial Production Sharing Contract (PSC) with the Government of Kenya was awarded to Africa Oil B.V. with the aim of exploring in detail, the assigned project area of 14,747.57 km², in accordance with its contractual obligations under the PSC, in order to: (a) delineate potential hydrocarbon prospects, (b) carry out exploratory drilling within the identified potential prospect areas, and (c) carry out well appraisal and production of oil and/or gas if the prospects turn out to be economically viable. However, under the new NOCK block 10BB demarcation, the project area measures approximately an area of 12,491 km².

The Company commissioned Earthview Geoconsultants Limited to undertake an extensive Environmental Impact Assessment (EIA) study that examined the current environmental, social, cultural, and physiographical as well as geological setting on the ground. This EIA report covered the area and requirements as spelt out in the EMCA 1999 and the EIA/ EA Regulations of 2003. Key areas covered in the report include a comprehensive project description, project area baseline information, guiding legal and regulatory framework and alternatives to the proposed project. There are possible impacts from the 3D seismic operation that have been identified and appropriate mitigation measures suggested. The mitigation measures suggested in this report and the environment management plan (EMP) developed will ensure that the project is technically, environmentally and socially sound and acceptable.

11.2 RECOMMENDATIONS

The proposed project will have both positive and negative impacts. The EIA team has endeavoured to give comprehensive mitigation measures and environmental management and monitoring mechanisms which if put in place will minimise or completely eradicate the possible negative impacts. The EMP developed in this report should be strictly adhered to, to ensure that the project remains environmentally and technically sound throughout its life. Some of the measures in Chapter 10 that need close implementation and monitoring include the following:

- Pre-survey possible access routes, and use the selected routes rather than accessing work sites through free-ranging driving across the open country;
- Use low sulphur fuels if available and where suitable;
- Employees working in dusty conditions must use appropriate PPE;
- A water supply borehole should be drilled to provide the water required for the project; this could be donated to the community on completion of the seismic survey;
- Ensure that all vehicles and machinery operating in the field (and in the campsite) are properly maintained so as not to have any oil leaks that could contaminate the soils

- Any planned lines that are considered to be a threat to the ecosystem integrity especially ecologically sensitive site such as luggas and trees serving as nesting spot for birds should be relocated;
- Consultations should be undertaken with local elders to help in identifying and avoiding any sensitive cultural sites during the seismic survey in order to avert possible conflict with the community;
- Use of modern line cutting technology, preferably *mulchers* (in areas with dense bushland) for clearing of the geophysical survey transects will ensure that minimal vegetation is removed, hence ensuring that re-vegetation will occur in a much shorter period since the seeds and branches will be left along the traverses and this will promote faster re-growth;
- Built up area should be avoided as is practical;
- It is recommended that segregation of solid wastes at source is appropriately carried out and consideration given to re-use, recycling, or disposal as appropriate;
- A waste management plan documenting the waste strategy, storage (including facilities and locations), handling procedures and means of disposal, should be developed and should include a clear waste-tracking mechanism to track waste consignments from the originating location to the final waste treatment and disposal location in compliance with the Environmental Management and Coordination (Waste Management) Regulations;
- The communities should be informed well in advance of the start of the seismic survey operation and prior to execution along a specific seismic transect/location using appropriate wide-penetration communication media;
- Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan;
- Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place; and
- The company should liaise with the Provincial Administration, the Kenya Police, Kenya Police Reservists and other agencies to provide adequate security during the seismic survey operation.

APPENDICES

APPENDIX 1: REFERENCES

- Africa. *Regional Characterization of Water Quality* (Proceedings of the Baltimore Symposium, May 1989). IAHS Publ. no.182, 1989.
- CEA Agency, 1997. Guide to the Preparation of a Comprehensive Study for Proponents and Responsible Authorities. Canadian Environment Assessment (CEA) Agency, Halifax, NS.
- Dindi, E.W., 1994. Crustal structure of the Anza-graben from gravity and magnetic investigations. *Tectonophysics*, 236, 359-371.
- Dodson R.G. 1991. Geology of the Barchuma-Kom Area. Report No. 93. Mines and Geological Department, Nairobi, Kenya. 39 pp.
- Exploration and Production (E&P): *Environmental Management in Oil and Gas Exploration and Production*. E&P Forum/ UNEP 1997. Report No. 2, 72/254.
- FAO-UNEP, 1977. Assessing Soil Degradation. FAO Soils Bulletin 34, FAO, Rome.
- FAO-UNESCO, 1997. Soil Map of the World; revised legend with corrections and updates, ISRIC, Wageningen, 1997.
- Government of Kenya, 1999. National Policy on Water Resources Management and Development, Sessional Paper No 1 of 1999, Government Printer, Nairobi.
- GVEP Kenya, 2006. Energy Road Map to Achieving MDG Targets Kenya Sectoral Energy Requirements. Final Report. Consultant: S. Arungu Olende PhD, and Benard Osawa. Published by GVEP Kenya.
- Hilton-Taylor, C. 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, United Kingdom.
- Hughes, F.M.R., 1987. Conflicting uses for forest resources in the Lower Tana River basin of Kenya. In: Anderson D, Grove R (eds) *Conservation in Africa: people, policies and practice*. Cambridge University Press, Cambridge, pp 211–228.
- IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Downloaded on 30 November 2012.
- IUCN (1993). Oil and Gas Exploration and Production in Mangrove Areas. IUCN Gland, Switzerland and Cambridge, UK, with E&P Forum, London, UK. Viii+47pp.
- Kenya National Bureau of Statistics, 2009. Kenya Population and Housing Census. Volume 1A.
- Kenya Soil Survey, 1987. Manual for soil survey and land evaluation, M24.
- Nicholson, S., 1980. Climatic fluctuations in the arid belt of the 'old world' since the last glacial maximum; possible causes and future implications. *Palaeoecol. Afr.*, 12: 3–12.
- Onshore Seismology Using a Vibrator Truck as a Seismic Energy Source downloaded from <http://www.cougarlandservices.net/landowner>
- Republic of Kenya, 2002. Turkana District Development Plan, 2002-2008. Ministry of Finance and Planning. Government Printers.

Sombroek, W.G., Braun H.M.H. and Van der Pouw B.J.A., 1982. Exploratory Soil Map and Agroclimatic Zone Map of Kenya. Kenya Soil Survey, Ministry of Agriculture, Nairobi. Report No. E1.

Survey of Kenya, 1977. *National Atlas of Kenya*. 3rd edition., Nairobi.

Walsh, J., 1966. Geology of the Karasuk Area. Report No. 72, Ministry of Natural Resources Geological Survey of Kenya.

APPENDIX 2: ASSESSMENT OF IMPACTS – PLANNED ACTIVITIES – SCREENING MATRIX

1.0 Environmental Impact significance Assessment

Table 1: Determination of Event Magnitude

Environmental Parameter	Impacts	Extent	Frequency	Duration	Intensity	Probability	Event Magnitude
Physiography and Geology	<ul style="list-style-type: none"> Landscape scarring along cut lines in the ranges, and displaced soils and boulders that may arise from landslips and rock topples related to use of the <i>vibroseis</i>. 	3	1	3	2	2	High
Climate	<ul style="list-style-type: none"> None 						
Air quality	<ul style="list-style-type: none"> None 						
Surface and Groundwater	<ul style="list-style-type: none"> None 						
Soils	<ul style="list-style-type: none"> The potential residual impacts would be enhanced gully and erosion due to altered runoff and drainage patterns 	2	2	3	2	1	Medium
Terrestrial Environment	<ul style="list-style-type: none"> The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years. 	1	1	1	1	3	Medium
Water Quality	<ul style="list-style-type: none"> None 						
Land resources and National Reserves	<ul style="list-style-type: none"> Cut lines affect pastoral resources 	1	2	2	1	1	Medium
Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> None 						

Environmental Parameter	Impacts	Extent	Frequency	Duration	Intensity	Probability	Event Magnitude
Visual aesthetics	<ul style="list-style-type: none"> Cutline footprints and vegetation cover removal lower aesthetic value of landscape 	1	1	2	1	1	Medium
Noise and vibrations	<ul style="list-style-type: none"> None 						
Liquid and Solid Wastes	<ul style="list-style-type: none"> Land degradation 	2	2	3	1	2	Medium

Table 2: Determination of Receptor Sensitivity

Environmental Parameter	Impacts	Presence	Resilience	Receptor Sensitivity
Physiography and Geology	<ul style="list-style-type: none"> Landscape scarring along cut lines in the ranges, and displaced soils and boulders that may arise from landslips and rock topples related to use of the <i>vibroiseis</i>. 	2	2	Medium
Climate	<ul style="list-style-type: none"> None 			
Air quality	<ul style="list-style-type: none"> None 			
Surface and Groundwater	<ul style="list-style-type: none"> None 			
Soils	<ul style="list-style-type: none"> The potential residual impacts would be enhanced gullying and erosion due to altered runoff and drainage patterns 	1	2	Medium
Terrestrial Environment	<ul style="list-style-type: none"> The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years. 	2	1	Medium
Water Quality	<ul style="list-style-type: none"> None 			

Environmental Parameter	Impacts	Presence	Resilience	Receptor Sensitivity
Land resources and National Reserves	<ul style="list-style-type: none"> Cut lines affect pastoral resources 	3	1	Medium
Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> None 			
Visual aesthetics	<ul style="list-style-type: none"> Cutline footprints and vegetation cover removal lower aesthetic value of landscape 	2	2	Medium
Noise and vibrations	<ul style="list-style-type: none"> None 			
Liquid and Solid Wastes	<ul style="list-style-type: none"> Land degradation 	2	3	High

Table 3: Determination of Impact Significance

Environmental Parameter	Impacts	Event Magnitude	Receptor Sensitivity	Impact Significance
Physiography and Geology	<ul style="list-style-type: none"> Landscape scarring along cut lines in the ranges, and displaced soils and boulders that may arise from landslips and rock topples related to use of the <i>vibroiseis</i>. 	High	Medium	Major
Climate	<ul style="list-style-type: none"> None 			
Air quality	<ul style="list-style-type: none"> None 			
Surface and Groundwater	<ul style="list-style-type: none"> None 			
Soils	<ul style="list-style-type: none"> Enhanced gullying and erosion due to altered runoff and drainage patterns 	Medium	Medium	Moderate
Terrestrial Environment	<ul style="list-style-type: none"> The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years. 	Medium	Medium	Moderate

Environmental Parameter	Impacts	Event Magnitude	Receptor Sensitivity	Impact Significance
Water Quality	<ul style="list-style-type: none"> None 			
Land resources and National Reserves	<ul style="list-style-type: none"> Cut lines affect pastoral resources 	Medium	Medium	Moderate
Archaeological, Historical and Cultural Sites	<ul style="list-style-type: none"> None 			
Visual aesthetics	<ul style="list-style-type: none"> Cutline footprints and vegetation cover removal lower aesthetic value of landscape 	Medium	Medium	Moderate
Noise and vibrations	<ul style="list-style-type: none"> None 			
Liquid and Solid Wastes	<ul style="list-style-type: none"> Land degradation 	Medium	High	Major

Impact Significance Assessment

An impact, as defined by ISO14001:2004 is: *“Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation’s environmental aspects (activities, products or services)”*.

Where project activity – receptor interactions occur, an impact was defined. The ESIA process ranked impacts according to their “significance” determined by considering project activity “event magnitude” and “receptor sensitivity”. Determining event magnitude required the identification and quantification (as far as practical) of the sources of potential environmental and social effects from routine and non-routine project activities. Determining receptor environmental sensitivity required an understanding of the biophysical environment.

The sections below set out the methodology for both environmental and socio-economic impact assessment that was used to determine the impacts and their significance.

Method for Determining Event Magnitude

Event magnitude was determined based on the following parameters, which were equally weighted and were each assigned a rating of “1”, “2”, or “3”:

Extent / Scale: Events range from those affecting an area:

- 1 – Up to 500m from the source or an area less than 50 hectares; to
- 2 – Greater than 500m and up to 1km from the source or an area between 50-100 hectares; to
- 3 – Greater than 1km from the source or an area greater than 100 hectares.

Frequency: Events ranged from those occurring:

- 1 - Once; to
- 2 - Up to 50 times; to
- 3 - More than 50 times or continuously.

Duration: Events ranged from those occurring for:

- 1 – Up to one week; to
- 2 - More than one week and up to one month; to
- 3 - Periods longer than one month to permanent.

Intensity: The expected size or magnitude of an impact, e.g. the concentration of an emission or discharge or noise level with respect to standards of acceptability that include applicable legislation and international guidance. Degree/permanence of disturbance or physical impact (e.g. disturbance to species loss of habitat or damage to cultural heritage). Ranged from:

Negligible;

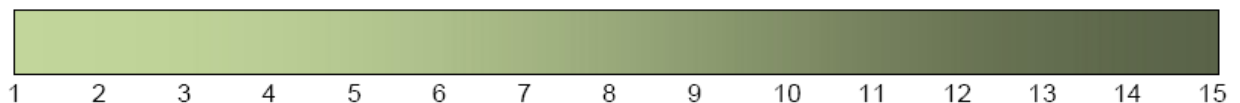
- 1** - A low intensity event (where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected); to
- 2** - A moderate intensity event (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive or vulnerable systems or communities are negatively affected); to
- 3** - A high intensity event (where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected).

Probability: The expected size or magnitude of an impact, e.g. the concentration of an emission or discharge or noise level with respect to standards of acceptability that include applicable legislation and international guidance. Degree/permanence of disturbance or physical impact (e.g. disturbance to species loss of habitat or damage to cultural heritage). Ranges from:

Improbable – where the possibility of the impact materialising is very low; to

- 1 - Probable** – where there is a good possibility (<50% chance) that the impact will occur; to
- 2 - Highly probable** – where it is most likely (50-90% chance) that the impact will occur; to
- 3 - Definite** – where the impact will occur regardless of any prevention measures (>90% chance of occurring)

Overall event magnitude was then scored on a spectrum from low (1) to high (12) by adding the individual parameter scores:



Resulting individual ratings were summed to give the overall event magnitude ranking. Table 4 presents the score ranges for magnitude rankings of: "Low", "Medium" and "High".

Table 4: Event Magnitude Rankings

Event Magnitude Score (Summed Parameter Rankings)

Event Magnitude	Score (Summed Parameter rankings)
Low	1-5
Medium	6-10
High	11-15

Method for Determining Receptor Sensitivity

Receptor sensitivity was determined based on the following parameters, which were equally weighted and were each assigned a rating of "1", "2", or "3":

Biological/Ecological Receptors:

- **Presence:** Ranged from:

3 - Routine, regular or reliably predictable presence of any species which is, in reverse order, a unique, threatened or protected species; to

2 - Regionally rare or largely confined to the Tullow project area or sensitive to industry emissions /disturbances; to

1 - A species which is none of the above and is therefore assessed at the community level only.

- **Resilience (to the identified stressor):** Ranged from:

1 - Species or community unaffected or marginally affected; to

2 - Species undergoing moderate but sustainable change which stabilises under constant presence of impact source, with ecological functionality maintained; to

3 - Substantial loss of ecological functionality (e.g. loss of species in key groups, substantially lower abundance and diversity).

Human Receptors:

- **Presence:** Ranged from:

3 - People being permanently present (e.g. residential property) in the geographical area of anticipated impact; to

2 - People being present some of the time (e.g. commercial property); to

1 - People being uncommon in the geographical area of anticipated impact.

- **Resilience (to the identified stressor):** Ranged from:

1 - People being least vulnerable to change or disturbance (i.e. ambient conditions (air quality, noise) are well below applicable legislation and international guidance); to

2 - People being vulnerable to change or disturbance (i.e. ambient conditions (air quality, noise) are below adopted standards); to

3 - Most vulnerable groups (i.e. ambient conditions (air quality, noise) are at or above adopted standards).

Physical Receptor/Feature:

- **Presence (to the identified stressor):** Ranged from:

3 - Presence of feature any species which has, in reverse order, national or international value (e.g. state protected monument); to

2 – Feature with local or regional value and is sensitive to disturbance; to

1 - Feature which is none of the above.

– **Resilience (to the identified stressor):** Ranged from:

1 – Feature/receptor is unaffected or marginally affected i.e. resilient to change;

2 – Undergoes moderate but sustainable change which stabilises under constant presence of impact source, with physical integrity maintained; and

3 – Highly vulnerable i.e. potential for substantial damage or loss of physical integrity.

Soil, Ground Water and Surface Water:

– **Presence:** Ranged from:

3 – Receptor is highly valued e.g. used extensively for agriculture, used as a public water supply; to

2 – Receptor has moderate value e.g. moderate/occasional use for agriculture purposes; to

1 – Receptor has limited or no value.

– **Resilience (to the identified stressor):** Ranged from:

1 – No or low levels of existing contamination (well below accepted standards) and receptor is unaffected or marginally affected i.e. resilient to change; to

2 – Moderate levels of mobile contamination present which are vulnerable to physical disturbance; to

3 – High levels of mobile contamination present which are highly sensitive to physical disturbance.

Overall receptor sensitivity was then scored on a spectrum from low (1) to high (6) by adding the individual parameter scores:



Table 5 presents the score ranges for sensitivity rankings of "Low", "Medium" and "High".

Table 5: Receptor Sensitivity Rankings

Receptor Sensitivity	Score (Summed parameter Rankings)
Low	2
Medium	3-4
High	5-6

Method for Determining Environmental Impact Significance

Impact significance, as a function of event magnitude and receptor sensitivity was subsequently ranked as “Negligible”, “Minor”, “Moderate” or “Major” as presented in Table 6 below. Impacts were “positive” or “negative”.

Table 6: Impact Significance

		Receptor Sensitivity		
		Low	Medium	High
Event magnitude	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

Any impact classified as “Major” was considered to be significant and where the impact was negative, requires additional mitigation. Impacts of negligible, minor or moderate significance were considered as being mitigated as far as practicable and necessary, and therefore, do not require further mitigation.

2 Socio-economic Impacts Significance

Parameter	Impacts	Magnitude		Probability	Receptor sensitivity	Impact Significance
		Spatial scope	Timing and Duration			
Social Characteristics	<ul style="list-style-type: none"> Erosion of culture and social values as a result of intercultural association 	Local	Long-term	Possible	Youth	Negative
Economic factors	<ul style="list-style-type: none"> Employment opportunities Infrastructure improvements. Kenya police reservists in the communities will also benefit by getting some allowance for their security services. 	Local	Long-term	Highly likely	Elderly, Youth, children	Major Positive
Occupational Health and Safety	<ul style="list-style-type: none"> None 					
Security and public safety	<ul style="list-style-type: none"> The presence of contingent of security officer along areas of operation and at the base camp will enhance security not only for the workers but for local communities. 	Local	Long-term	Highly likely	Elderly, Youth, children	Major Positive

Socio-Economic Impacts

The socio-economic impact assessment identified and evaluated the significance of impacts associated with the Tullow Project, including:

The identification of all socio-economic impacts (direct and indirect, positive and negative) that are linked to the Tullow Project.

The measurement (and where possible, monetisation) of socio-economic impacts, including the following:

- The numbers and characteristics of people affected (number of property owners, affected people and/or those subjected directly to changes in their socioeconomic conditions and living environment);

- Changes in people's access to, or changes in the status of: employment, commercial, recreational, cultural and social services and facilities;
- Direct loss of land, or change in people's access to land;
- Social patterns and linkages: changes in how areas function as a community with respect to levels of social interaction; personal relationships; feeling of belonging to the area or aspects relating to self-identification; and
- General amenity (perceived and actual) and change in the physical conditions that affect the quality of the environment and residential amenity; change in aesthetic values; change in recreation development and opportunities.

The socio-economic impact assessment assessed the significance of potential direct impacts based on probability, magnitude and receptor sensitivity.

Probability: The likelihood that the impact will occur, and degrees of uncertainty, based on the following criteria:

- **Highly likely** - almost certain to occur or may have already occurred.
- **Likely** - some substantiated evidence that the impact is likely to occur, or has previously occurred in a similar context.
- **Possible** - could occur without intervention.
- **Unlikely** - some evidence that impact could occur, no such incident in the region but may have occurred elsewhere.
- **Highly unlikely** - no evidence to suggest impact will occur.

Magnitude: Determined was based on:

- **Spatial Scope:** The geographical scope of the impact relative to local community receptors:
 - o **Local** – effects extending to the communities in the immediate areas
 - o **Regional** – effects extending to the entire county; and
 - o **National** - effects extending to Kenya.
- **Timing and Duration:** The likely timing and duration of the impact (including whether the impact would be temporary or permanent in nature) and how this links to activities undertaken by Tullow;

Receptor Sensitivity: The groups of people or populations most likely to be affected and, in particular, whether impacts are likely to be disproportionately experienced by **vulnerable groups**.

Significance of impacts was assessed as presented in Table 7.

Table 7: Socio-economic Impact Significance

Event	Magnitude		Probability	Receptor Sensitivity	Significance
	Spatial scope	Timing and Duration			

Significance was based on judgement taking into account the likelihood and magnitude of the impact and the sensitivity of the population or group of people that may be affected. The significance of impact (taking into account existing controls) is categorised as follows:

- **Major Positive** – a substantial positive change.
- **Positive** - some positive change.
- **Negligible** - very little change or no change.
- **Negative** - measurable negative change.
- **Major Negative** - considerable negative change.

Any impact classified as “Major Negative” was considered to be significant and required additional mitigation. Impacts of “Negligible”, “Major Positive” or “Positive” significance were not considered to require mitigation.

Indirect impacts i.e. induced effects, could not be readily assessed using the same approach. A qualitative assessment was therefore made based on judgement and taking into account existing controls.

Transboundary and Cumulative Impacts

Transboundary impacts are impacts that occur outside the jurisdictional borders of a project's host country. Potential Tullow project transboundary impacts were considered to include:

- Social and economic issues surrounding the sourcing of labour, goods and services from the international market; and
- GHG emissions to air.

Cumulative impacts arise from:

- Interactions between separate project-related residual impacts; and
- Interactions between project-related residual impacts in combination with impacts from other projects and their associated activities.

These were either additive or synergistic effects, which resulted in larger (in terms of extent or duration) or different (dependent on impact interaction) impacts when compared to project related residual impacts alone.

The cumulative assessment initially considered the potential for impact interaction and accumulation in terms of the following:

- **Temporal Overlap** – the impacts are so close in time that the effect of one is not dissipated before the next one occurs;

- **Spatial Overlap** – the impacts are so close in space that their effects overlap.

MITIGATION AND MONITORING

The iterative and integrated nature of the ESIA and project planning processes means that the majority of proposed additional mitigation measures and strategies were incorporated into the Baseline Environmental and Social parameters (as provided within Chapter 7) and project description (Chapter 3). These measures / strategies have included mitigation measures and ongoing commitments as previously adopted by other Tullow projects and which are of relevance to the 3D seismic surveys. These include monitoring and reporting commitments, for example, emissions, discharges line cuttings, as well as policies and procedures that form part of the Environmental Management Plan that will be approved by the relevant authority.

APPENDIX 3: LIST OF STAKEHOLDERS AND MINUTES OF MEETINGS

Name	Organization	Designation	Cell phone	E-mail
Abedi Malusha	World Vision Kenya	Commodity Officer	0723829276	Abedi-malusha@wvi.org
Mark E. Lokaito	Nat. Drought Mgt. Authority	Ag. Drought Management Officer	0710796186	lokaitomark@yahoo.com
Dr. Ephem Esekoni	MOPHS	Dist. Medical Officer of Health	0729477000	Epem.esekon@gmail.com
D.K. Cheruiyot	Kenya Wildlife Service	Warden	0733521963	dcheruiyot@kws.go.ke
James Aruoto	Min. of Youth Affairs	Youth Officer	0725452753	jamesaruoto@rocketmail.com
Kwaba Omwenga	MOPHS	Deputy Dist. Public Health Officer	0737774442	kwabbaj@gmail.com
Daniel Ingollan	Mt. Kenya Univ.	QA Officer	0724768604	ingollandaniel@yahoo.com
Vincent Morara Gesora	Min. of Agric	Dist. Agric Officer	0720029590	daoturkanasouth@gmail.com
Patricia Ekadeli	Min. of Education	Education officer	0713725234	paekadeli@yahoo.co.uk
John Ekuton	MOPHS	Dist. Health Records Mgt. Officer	0721107474	ekutonjohn@yahoo.com
John Kamau Musasia	National Registration Bureau	Registrar	0724064611	musasiaj@yahoo.com
Kenneth Omondi	Min. of Water	Dist. Water Officer	0723979109	Kennethomondi2005@yahoo.com
Victor Lekaram	Min. of Planning & Vision 2030	Development Officer	0721862864	seremlex@hotmail.com

MINUTES OF MEETING HELD IN NAKUKULAS, KOCHODIN SUB-LOCATION, KOCHODIN LOCATION, LOKORI DIVISION, TURKANA EAST DISTRICT- 27/10/2012.

Attendance: Evaluation team

Sub-Chief

Females: 12, Males 17

The meeting started at 0940 hrs with a prayer from Solomon a community member. The chief welcomed everyone to the meeting and explained the agenda of the meeting.

One of the consultant's representatives Daniel Ejore explained to the community members the purpose of the meeting. He told them that the meeting was about the socio-economic and environmental impact assessment in the area and the positive and negative impacts brought about by the proposed Tullow oil exploration.

Social organization -people live together as one although all of them do not belong to the same clan. The villages are made of clans. In the old days when the girls were of marriageable aged cattle were taken to the girl's father but these days the girls are not being married because there is no cattle to pay bride price. There is also a change in the number of women a man can marry these days. People marry few wives because, due to drought and cattle raids they have become poor hence cannot sustain big families.

Since they are pastoralists they move from place to place but when they settle down they live close together so as to provide security for their cattle. The elders oversee the rites of passage among the young people and they also have the responsibility of teaching the young men about their community's culture and traditions.

Family structure –A man lives with his wives and children in the same homestead but when the son gets married he moves out to start his family. For a girl who gives birth out of wedlock she stays at her father's home.

Conflict resolution – if a conflict occurs within the family the head of the household who is the man is the one to solve the conflict. Conflict between the clans is solved by the clan elders. If the elders are not able to solve the conflicts then the elders take the matter to the chief.

Decision Making – all the decisions in the community are made by the men sometimes they consult the women on some issues concerning the family but the final decision comes from the man.

Asset Distribution - Asset distribution occurs in several ways including marriage, formation of a new family unit, friendship, inheritance and debt repayment. Assets move from one family/clan to another, in the process of gift exchange during **marriage**. After a young man is married, he and his wife are given some animals by family and clan members in order for the two to begin operating independently as a **new family unit**. However until the man moves to his own homestead, he will still be under the guidance of his parent(s), and must therefore consult his father when making a major decision.

Friends exchange gifts and a friend who does not have much may get some property, typically livestock, from friends in the expectation of future reciprocity. An individual with many wives and children, those children will **inherit** property according to how the same has been distributed to their mothers. A clan that feels aggrieved by another clan can ask for compensation, and in that way assets get redistributed as a form of debt repayment.

Other issues of concern

1. There was a problem of famine and constant cattle raids by the Pokot community in the area. Other than that people also came from other places to take their sand which they said belonged to the local residents as its God given.
2. They were concerned about the presence of Tullow people in the area and said that they just cared about what they could get from the community and then they would just abandon them. Their concern was that since they are illiterate they needed to be explained clearly the intentions of Tullow Company.

3. Poor feedback was also an issue. They said that they do not get feedback whenever people come to talk to them about anything.
4. The government should control the activities of Tullow so that they do not intrude in their lives so much.
5. The seismic survey lines should not affect the trees in the region or the houses. This is because they consume the fruits produced by these trees for food and they are also used to feed their livestock.
6. Tullow has however helped them build water points- boreholes, built a school in the area and built a classroom in one of the already existing school- *Nakukulas* Primary School.
7. The water points are far away from the grazing areas so forcing the community members to walk long distances in search of water for their animals. In one of the areas called *Lopii* there is not even one water point so both the people and their animals dig up river beds to get water (*juggas*). There is a new borehole built by Tullow around the area but the residents complained it was locked so they could not access the water.
8. There is no market in the area so people go to *Lokichar* market.
9. There are three churches in the area. These are Redeemed Gospel Church, Reformed Church of Africa, and Catholic Church.
10. There are no burial sites in the area. If a person dies he/she is kept in the houses meant for their livestock. Those who get killed elsewhere are not buried but the bodies are left to be fed on by the wild animals.
11. Men are responsible in all decision making either in the household or in any other thing. They believe that women do not know how to divide property in the community.
12. They have no means to support their children in school because their livestock has died due to drought in the area and the remaining raided by the Pokot community.
13. They have a clinic in the area but it is not well equipped hence they refer many people to Lokichar to be treated. Many people lose their lives in the process because there is no vehicle provided by the clinic to transport them to Lokichar.

The chief thanked the people for coming and participating in the meeting. There being no other business the meeting ended at 1107hrs with a prayer from one of the community members.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED TULLOW TEST WELL DRILLING – BLOCK 10 BB

Date 27/10/2012

SNo.	NAME	ID. No.	SIGNATURE	CONTACTS (cellphone)
1.	NANANAE UBUKIA			
2.	NANUNIA SIKI			
3.	AFENG ETUNTUN			
4.	AFUPE NANGIRO			
5.	LOKURE LOPILE			
6.	NANARETANYANG LORUBU			
7.	LOMARIMKOL IKIMAT			
8.	ESONYO LOKORIMOT			
9.	LOKODO LOKWAKORI			
10.	AKAL ENOI			
11.	LORENG ECHUTO			
12.	AIATAR LOSIKE			
13.	REBECCA NATER			
14.	ATASO LOKUREN			
15.	AGIPURIN ECHOTO			
16.	AKIRO ESEKUN			
17.	ETIDONG IKIMAT			
18.	LOTIANE IKIMAT			
19.	NANALE ESONYON			
20.	ERUPE LOKALE			
21.	KALUKOU AKOO			
22.	LOBUN NABIDAN			
23.	KINDONG LOKODI			
24.	NANUNIT ACHUKA			
25.	LOPUNGURE ATANAN			
26.	AKUKODI LOKIRIM			
27.	EMERIKWA LOKIRIM			
28.	NATER ESEKUN			
29.	ERIS LOKIRIM			
30.	NATIR LOKWAKI			

District TURKANA EAST Division LOKORI Location KACHODINSub Location KACHODIN Village NAKUKULASMeeting Started 0935 Meeting Ended _____Secretary [Signature] Community Representative D.E Consultant _____Representative E.O Date 27/10/2012

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED TULLOW TEST WELL DRILLING – BLOCK 10 BB

Date 27/10/2012

SNo.	NAME	ID. No.	SIGNATURE	CONTACTS (cellphone)
1.	JOSEPH LUPUS			
2.	JAMES LOCHUCH			
3.	LOKIBUM ITITAN	4766807		
4.	NAKUSA LONDO			
5.	LOKADIMO LOKEYA			
6.	ETONTUN LOKE-M			
7.	OKAUBOT ANGERAT			
8.	NYRUGUT EKOL			
9.	KARETO AKAL			
10.	LOKUNGI ECHUA			
11.	NAKOLC AKUDUPUS			
12.	EKITELA EGACMAN			
13.	EDUKAI LOCHOTUO			
14.	LOKALAI RIKAMOLE			
15.	ERERE LOKITELA			
16.	LOKWAHI EKITELA			
17.	ACHUKUT EVLAN			
18.	ERUKIA ANGERI			
19.	ANGITO LOPAI			
20.	AKIRU LOTITAN			
21.	ECHAKAN NITAN			
22.	NAMUDUK IKAL			
23.	ATIAN LOKLEI			
24.	ADUKI LOKOL			
25.	MOIT EPUR			
26.	NAPLE IPAST			
27.	NAIANAE LOKUWANA			
28.	ERUPE ENEKU			
29.	AGULE LOKADIMO			
30.				

District TURKANA EAST Division LOKORI Location KOCHODINSub Location KOCHODIN Village NAKUKULAS

Meeting Started _____ Meeting Ended _____

Secretary [Signature] Community Representative D.E ConsultantRepresentative E.D Date 27/10/2012

MINUTES OF COMMUNITY MEETING HELD IN LOPEROT VILLAGE, LOPEROT SUB-LOCATION, KALAPATA LOCATION, LOKICHAR DIVISION, TURKANA SOUTH DISTRICT – 27/10/2012

Attendance: Evaluation team, Chief, Males: 37; Females 22

Meeting began with at 1230 hours with two songs of praise by one village member, followed by prayers by another community member.

The community guide then explained the purpose of our visit to the location – being to explore the social and environmental aspects related to the proposed Tullow oil exploration and invited the consultants to introduce themselves

Social organization – there are two clans in the area. Each clan has its own traditions. However they collaborate and coordinate in other activities that ensure their mutual survival and continued existence. “Even development is done and undertaken communally”

Family structure – Each elder has his own household and manages it. However celebrations, food, and other ceremonies are conducted communally regardless of family, clan. They say that while the clans and families living in the same geographical area may be different, the share in food consumption and other things, so that they do survive.

Conflict resolution - Conflict between families and between clans is resolved through elders. The same strategy applies to clan conflict. For example, if members from the two clans disagree, then elders come together to find strategies of solving the same. Intra-clan conflict can be traditionally solved at clan level, unless a resolution is not possible. They cannot go to the chief before resolving issues at the clan level. Another accepted strategy for resolving conflict, especially within families is whereby an individual that can no longer be tolerated within the family/clan, this individual is given some animals and asked to go and live elsewhere away from the clan/family, although the individual will still be supervised by the family or clan elder.

Asset Distribution - Asset distribution occurs in several ways including marriage, formation of a new family unit, friendship, inheritance and debt repayment. Assets move from one family/clan to another, in the process of gift exchange during **marriage**. After a young man is married, he and his wife are given some animals by family and clan members in order for the two to begin operating independently as a **new family unit**. However until the man moves to his own homestead, he will still be under the guidance of his parent(s), and must therefore consult his elder when making a major decision. **Friends** exchange gifts and a friend who does not have much may get some property, typically livestock, from friends in the expectation of future reciprocity. An individual with many wives and children, those children will **inherit** property according to how the same has been distributed to their mothers. A clan that feels aggrieved by another clan can ask for compensation, and in that way assets get redistributed as a form of debt repayment.

Other issues of concern – Avoid destroying trees and vegetation, as these are feed for livestock. The community also felt that the water they have, that has been drilled for them, and from natural water pans is still not enough for their needs. They need a borehole “just like the one in Nakukulas”

There are no markets in the area. Burial is done within homesteads and therefore they do not have sacred burial sites. There are two churches in Loperot – the Catholic and the Reformed church.

Julie Mutura gave a vote of thanks and the meeting ended at 1330 hours

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED TULLOW TEST WELL DRILLING – BLOCK 10 BB

Date 27/10/2012

SNo.	NAME	ID. No.	SIGNATURE	CONTACTS (cellphone)
1.	AGELANG EIRACH			
2.	AGNESS NAKAMURAN			
3.	CONFIDANT NACH			
4.	ARUKUDI KERD			
5.	REBECCA EKIRD			
6.	AROTALE LOSIKE			
7.	MARY ROKOD			
8.	ROSAN NAKOT			
9.	MERINYANG AKAT			
10.	EWOL LOMJONGE			
11.	ITOOT ENGEROK			
12.	MARIANA ATOOT			
13.	MARY ADAPAL			
14.	APUYE PESE			
15.	ANNAH TIKAE			
16.	SUKUJA KAPOLO			
17.	NAWIAKWAH LOKOL			
18.	NICHOLAS EWARAN	20584090	<i>[Signature]</i>	0700031079
19.	ERAC ECHOTO			0700021079
20.	JACKSON P. AMALER	21323137	<i>[Signature]</i>	0718935435
21.	ANATH NACHOK			
22.	ASUAKOMOL IKDEL	4789103	<i>[Signature]</i>	
23.	ABONG LOKINEI			
24.	DAVID EKARAN	1203457	<i>[Signature]</i>	
25.	EKAT LONGIRD			
26.	CHAMARE OYAN			
27.	ESEKON EWOL			
28.	EKAGACE ERENO			
29.	PHILIP E. EIMMUN	4798007	<i>[Signature]</i>	0725088182
30.				

District TURKANA SOUTH Division LOKICHAR Location KARAPATA

Sub Location LOPEROT Village LOPEROT

Meeting Started 12:30 Meeting Ended 1:30

Secretary _____ Community Representative *[Signature]* Consultant _____

Representative _____ Date _____

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED TULLOW TEST WELL DRILLING – BLOCK 10 BB

Date 27 / 10 / 2012

SNo.	NAME	ID. No.	SIGNATURE	CONTACTS (cellphone)
1.	ATELENG EIBACH			
2.	AGNESS NAKAMURAN			
3.	CONFRIDAN AACH			
4.	AROKVAD KERD			
5.	REBECCA EKURD			
6.	ARALE LOSIKE			
7.	MARY RUKOD			
8.	ROSAH NAAOT			
9.	MERINYANG AMAT			
10.	ENOI LOMOJONG			
11.	ITOOT ENGEROK			
12.	MARIANA ATOOT			
13.	MARY ADAPAL			
14.	APUYEI PESE			
15.	ANNAH TIWAE			
16.	SUKUTA KAPOLON			
17.	NAWIAKWAN LOKOL			
18.	NICHOLAS EKACAN	20584070	<i>[Signature]</i>	0700031079 0700031079
19.	ERAC ECHOTO			
20.	JACKSON P. AMALER	21323137	<i>[Signature]</i>	0718935435
21.	ANATH NACHOK		<i>[Signature]</i>	
22.	ASUAKOMER IKDEI	47891103	<i>[Signature]</i>	
23.	ABONG LOKINEI			
24.	DAVID EKARAN	1203457	<i>[Signature]</i>	
25.	EKAT LONGIRD			
26.	CHAMARE OYAN			
27.	ESEKON ENOI			
28.	EKAGARE ERENO			
29.	PHILIPH E ERIMAM	4798007	<i>[Signature]</i>	0725038182
30.				

District TURKANA SOUTH Division LOKICHAR Location KARAPATASub Location LOPEROT Village LOPEROTMeeting Started 12.30 Meeting Ended 1.30Secretary _____ Community Representative *[Signature]* Consultant

Representative _____ Date _____

APPENDIX 4: SUPPORTING STUDIES**AIR QUALITY DATA IN THE AREA - FROM AUDIT REPORT OF AUGUST 2012**

SAMPLING SITE AND DATE	COORDINATES	PARAMETER	CONCENTRATIONS	WHO GUIDELINES
LOKICHAR TOWN (18-06-2012)	02° 22.497'N 035° 38.337'E Elevation 770 m	Total Suspended Particulate Matter (dust)	147 µg/m ³	150-230 µg/m ³ - 24 hours 60-90 µg/m ³ - 1 year
		Sulphur dioxide	Not Detected	500 µg/m ³ - 10 minutes 350 µg/m ³ - 1 hour 125 µg/m ³ - 24 hours 60 µg/m ³ - 1 year
		Nitrogen dioxide	3 µg/m ³	120 µg/m ³ - 8 hours 40 µg/m ³ - 1 year
		Carbon dioxide	32.4 mg/m ³	No published WHO guidelines
AT THE CAMPSITE IN LOKICHAR (SITE 2) (18-06-2012)	02° 22.921'N 035° 38.215'E Elevation 761 m	Total Suspended Particulate matter (dust)	168 µg/m ³	150-230 µg/m ³ - 24 hours 60-90 µg/m ³ - 1 year
		Sulphur dioxide	Not Detected	500 µg/m ³ - 10 minutes 350 µg/m ³ - 1 hour 125 µg/m ³ - 24 hours

SAMPLING SITE AND DATE	COORDINATES	PARAMETER	CONCENTRATIONS	WHO GUIDELINES
				60 µg/m ³ - 1 year
		Nitrogen dioxide	Not Detected	120 µg/m ³ - 8 hours 40 µg/m ³ - 1 year
		Carbon dioxide	64.9 mg/m ³	No published WHO guidelines
NAWOITORONG AREA, LODWAR TOWN (SITE 4) (20-06-2012)	03o 06.593'N 035o 37.773'E Elevation 500 m	Total Suspended Particulate matter (dust)	191 µg/m ³	150-230 µg/m ³ - 24 hours 60-90 µg/m ³ - 1 year
		Sulphur dioxide	28 µg/m ³	500 µg/m ³ - 10 minutes 350 µg/m ³ - 1 hour 125 µg/m ³ - 24 hours 60 µg/m ³ - 1 year
		Nitrogen dioxide	5 µg/m ³	120 µg/m ³ - 8 hours 40 µg/m ³ - 1 year
		Carbon dioxide	7351 mg/m ³	No published WHO guidelines
LODWAR TOWN CENTRE (SITE 5) (20-06-2012)	03o 07.046'N 035o 35.426'E Elevation 513 m	Total Suspended Particulate matter (dust)	7.2 mg/m ³	150-230 µg/m ³ - 24 hours 60-90 µg/m ³ - 1 year
		Sulphur dioxide	30 µg/m ³	500 µg/m ³ - 10 minutes 350 µg/m ³ - 1 hour 125 µg/m ³ - 24 hours

SAMPLING SITE AND DATE	COORDINATES	PARAMETER	CONCENTRATIONS	WHO GUIDELINES
				60 $\mu\text{g}/\text{m}^3$ - 1 year
		Nitrogen dioxide	10 $\mu\text{g}/\text{m}^3$	120 $\mu\text{g}/\text{m}^3$ - 8 hours 40 $\mu\text{g}/\text{m}^3$ - 1 year
		Carbon dioxide	7415 mg/m^3	No published WHO guidelines
NAKWAMEKWI AREA, LODWAR TOWN (SITE 6) (20-06-2012)	03o 06.688'N 035o 34.097'E Elevation 519 m	Total Suspended Particulate matter (dust)	1.04 mg/m^3	150-230 $\mu\text{g}/\text{m}^3$ - 24 hours 60-90 $\mu\text{g}/\text{m}^3$ - 1 year
		Sulphur dioxide	Not Detected	500 $\mu\text{g}/\text{m}^3$ - 10 minutes 350 $\mu\text{g}/\text{m}^3$ - 1 hour 125 $\mu\text{g}/\text{m}^3$ - 24 hours 60 $\mu\text{g}/\text{m}^3$ - 1 year
		Nitrogen dioxide	7 $\mu\text{g}/\text{m}^3$	120 $\mu\text{g}/\text{m}^3$ - 8 hours 40 $\mu\text{g}/\text{m}^3$ - 1 year
		Carbon dioxide	6637 mg/m^3	No published WHO guidelines

REQUIREMENTS AS PER NEMA REGULATIONS
WATER QUALITY

Table 1: Standards for Effluent Discharge into the Environment

Parameter	Max Allowable (Limits)
1,1,1-trichloroethane (mg/l)	3
1,1,2-trichloroethane (mg/l)	0.06
1,1-dichloroethylene	0.2
1,2-dichloroethane	0.04
1,3-dichloropropene (mg/l)	0.02
Alkyl Mercury compounds	Nd
Ammonia, ammonium compounds, NO ₂ compounds and NO ₃ compounds (Sum total of ammonia-N times 4 plus nitrate-N and Nitrite-N) (mg/l)	100
Arsenic (mg/l)	0.02
Benzene (mg/l)	0.1
Biochemical Oxygen Demand (BOD 5days at 20 °C) (mg/l)	30
Boron (mg/l)	1.0
Boron and its compounds – non marine (mg/l)	10
Boron and its compounds –marine (mg/l)	30
Cadmium (mg/l)	0.01
Cadmium and its compounds (mg/l)	0.1
Carbon tetrachloride	0.02
Chemical Oxygen Demand (COD) (mg/l)	50
Chromium VI (mg/l)	0.05
Chloride (mg/l)	250
Chlorine free residue	0.10
Chromium total	2
Cis –1,2- dichloro ethylene	0.4

Parameter	Max Allowable (Limits)
Copper (mg/l)	1.0
Dichloromethane (mg/l)	0.2
Dissolved iron (mg/l)	10
Dissolved Manganese(mg/l)	10
E.coli (Counts / 100 ml)	Nil
Fluoride (mg/l)	1.5
Fluoride and its compounds (marine and non-marine) (mg/l)	8
Lead (mg/l)	0.01
Lead and its compounds (mg/l)	0.1
n-Hexane extracts (animal and vegetable fats) (mg/l)	30
n-Hexane extracts (mineral oil) (mg/l)	5
Oil and grease	Nil
Organo-Phosphorus compounds (parathion, methyl parathion, methyl demeton and Ethylparantropheryl phenylphosphorothroate, EPN only) (mg/l)	1.0
Polychlorinated biphenyls, PCBs (mg/l)	0.003
pH (Hydrogen ion activity----marine)	5.0 – 9.0
pH (Hydrogen ion activity--non marine)	6.5 - 8.5
Phenols (mg/l)	0.001
Selenium (mg/l)	0.01
Selenium and its compounds (mg/l)	0.1
Hexavalent Chromium VI compounds (mg/l)	0.5
Sulphide (mg/l)	0.1
Simazine (mg/l)	0.03
Total Suspended Solids, (mg/l)	30
Tetrachloroethylene (mg/l)	0.1
Thiobencarb (mg/l)	0.1

Parameter	Max Allowable (Limits)
Temperature (°C) based on ambient temperature	± 3
Thiram (mg/l)	0.06
Total coliforms (counts /100 ml)	30
Total Cyanogen (mg/l)	Nd
Total Nickel (mg/l)	0.3
Total Dissolved solids (mg/l)	1200
Colour in Hazen Units (H.U)	15
Detergents (mg/l)	Nil
Total mercury (mg/l)	0.005
Trichloroethylene (mg/l)	0.3
Zinc (mg/l)	0.5
Whole effluent toxicity	
Total Phosphorus (mg/l)	2 Guideline value
Total Nitrogen	2 Guideline value

Remarks:

Standard values are daily/monthly average discharge values. Not detectable (nd) means that the pollution status is below the detectable level by the measurement methods established by the Authority.

Table 2: Monitoring Guide for Discharge into the Environment

DISCHARGING FACILITY	Gas and Oil	Dairy Products	Grain Mills	Canned Fruits & Vegetables	Canned & Preserved Sea Foods	Sugar Processing	Textiles	Cement	Feedlots	Electroplating	Organic Chemicals	Inorganic Chemicals	Plastics & Synthetics	Soap & Detergents	Fertiliser Manufacturing	Petroleum Refining	Iron & Steel Manufacturing	Non Ferrous	Phosphate Manufacturing	Steam Electric Power Generating
Water quality parameters																				
Biochemical Oxygen Demand, BOD	x	x	x	x	x	x	x		x		x	x	x	x	x	x				
Total Suspended Solids	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x
pH	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Faecal Coliforms	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Oil & Grease	x				x		x				x			x		x	x	x	x	x
Temperature	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x
Chemical Oxygen Demand, COD						x	x				x	x	x	x		x		x		
Colour/Dye/Pigment	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Elemental Phosphorus																			x	
Total Phosphorus						x				x					x				x	x
Ammonia (as N)												x			x	x	x	x		
Organic Nitrogen as N						x									x					
Nitrate						x									x		x			
Flow	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Phenols							x				x		x			x	x			
Sulphide							x									x	x			
Total Chromium							x			x		x				x				
Chromium VI										x		x				x				x
Chrome																				
Copper										x		x	x							x
Nickel										x		x								
Zinc										x			x				x			x
Zinc												x								
Cn total										x		x								

DISCHARGING FACILITY	Gas and Oil	Dairy Products	Grain Mills	Canned Fruits & Vegetables	Canned & Preserved Sea Foods	Sugar Processing	Textiles	Cement	Feedlots	Electroplating	Organic Chemicals	Inorganic Chemicals	Plastics & Synthetics	Soap & Detergents	Fertiliser Manufacturing	Petroleum Refining	Iron & Steel Manufacturing	Non Ferrous	Phosphate Manufacturing	Steam Electric Power Generating
Cyanide A										x		x								
Fluorine										x		x	x					x	x	
Free Available Chlorine																				
Residual Chlorine	x																			x
Cadmium										x		x					x			
Lead										x		x					x	x		
Iron										x										
Tin										x		x								x
Silver										x										
Gold										x										
Iridium										x										
Palladium										x										
Rhodium										x										
Ruthenium										x										
Mercury (total)												x								
Total Organic Carbon												x					x			
Aluminium												x					x			
Arsenic												x					x		x	
Selenium												x								
Barium																				
Manganese																	x			
Tannin																				
Oil																				
Settleable Solids																				
Surfactants																				

x = Parameters to be monitored

Table 3: Maximum Permissible Noise Levels

Zone		Sound Level Limits dB(A) (Leq, 14h)		Noise Rating Level (NR) (Leq, 14h)	
		Day	Night	Day	Night
A.	Silent zone	40	35	30	25
B.	Places of worship	40	35	30	25
C.	<u>Residential:</u>				
	Indoor	45	35	35	25
	Outdoor	50	35	40	25
D.	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E.	Commercial	60	35	55	25

Time Frame

Day: 6.01 a.m. – 8.00 p.m. (Leq, 14h)

Night: 8.01 p.m. – 6.00 a.m. (Leq, 10h)

**Table 4: Maximum Permissible Noise Levels for Construction Sites
(Measurement taken within the facility)**

Facility	Maximum Noise Level Permitted (Leq) in dB(A)		
		Day	Night
(i)	Health facilities, educational institutions, homes for the disabled, etc.	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

Time Frame:

Day: 6.01 a.m. – 6.00 p.m. (Leq, 14h)

Night: 6.01 p.m. – 6.00 a.m. (Leq, 14h)

Table 5: Maximum Permissible Noise Levels for Mines and Quarries.
(Measurement taken within the facility)

Facility		Limit Value in dB (C)
1.	For any buildings used as health facilities, educational institutions, convalescent homes, old age homes or residential buildings.	109 dB (C)
2.	For any building in an area used for residential and one or more of the following purposes: commerce, small-scale production, entertainment, or any residential apartment in an area that is used for purposes of industry, commerce or small-scale production, or any building used for the purpose of industry, commerce or small-scale production.	114 dB (C)

Standard for Treatment and Disposal of Wastes

A. Classification of Incinerators

Class 1: Industrial Plants Burning Waste as an Additional/Alternative Fuel

Incinerators in which the waste serves as the fuel or supplementary fuel in an industrial process (e.g. the use of cement kilns or any other industrial boilers or furnaces for the disposal of noxious or hazardous materials).

Class 2: Industrial Incinerators

Class 2A: Commercial

Incinerators for the disposal of waste that contain hazardous, potential hazardous and bio-medical waste, where the operator exceeds 100 Kg/day.

Class 2B: Small Scale Incinerators for Private Use

Incinerators for the disposal of hazardous, potential hazardous and bio-medical waste where, the operator does not exceed 100 kg/ day.

Class 3: General waste Incinerators

Incinerators for general waste that is non-toxic, non-hazardous, non-medical or does not contain organic halogens, i.e., selected customs, police, contraband goods, office waste, commercial waste and industrial wastes) where the operator does not exceed 1 ton/ day.

Table 6: Standards, Guidelines, Criteria, Procedure for Installing/Operating Incinerators

No.	Parameter	Standards, Guideline, Criteria and Procedure
1	Basic Plant Design	<p>An approved plant must have four distinct sections that demonstrate three principles of Turbulence, Residence Time and Temperature are inbuilt in the plant design .The regulated sections may include but not limited to:</p> <ul style="list-style-type: none"> • Overall plant layout • Feed chamber/ charging • Primary Combustion Chamber • Secondary Combustion Chamber • Particulate Scrubbers • Acid Gas Scrubbers • The stack/ chimney.
2	Feeding and Charging	<p>Controlled hygienic, mechanical or automatic feeding methods have to be used which will not influence the air temperature in the primary and secondary chambers of the incinerator negatively.</p> <p>No waste is to be fed into the incinerator:</p> <ol style="list-style-type: none"> 1. Until the minimum temperatures have been reached. 2. If the minimum combustion temperatures are not maintained. 3. Whenever the previous charge has not been completely combusted in the case of batch feeding. 4. Until such time as the addition of more waste will not cause the design parameters of the incinerator to be exceeded.
3	Primary Combustion Chamber	<p>The primary combustion chamber must:</p> <ol style="list-style-type: none"> 1. Be accepted as the primary combustion zone. 2. Be equipped with a burner/s burning gas/fuel or low sulphur. Liquid fuels. Other combustion methods will be judged on merit. 3. Ensure primary air supply is controlled efficiently. 4. Ensure minimum exit temperature is not less than 850 C
4	Secondary Combustion Chamber	<p>The secondary combustion chamber must:</p> <ol style="list-style-type: none"> 1. Be accepted as secondary combustion zone. 2. Be fitted with secondary burner/s burning gas or low sulphur liquid fuel or any suitable fuel. 3. Ensure secondary air supply is controlled efficiently. 4. Ensure flame contact with all gases is achieved. 5. Ensure residence time is not less than two (2) seconds. 6. Ensure the gas temperature as measured against the inside wall in the secondary chamber & not in the flame zone, is not less than 1100 C.

No.	Parameter	Standards, Guideline, Criteria and Procedure
		<ol style="list-style-type: none"> 7. Ensure the oxygen content of the emitted gases is not less than 11%. 8. Ensure both primary and the combustion temperatures are maintained until all waste has been completely combusted.
5	Particulate Removers	<p>A mechanical particulate collector must be incorporated after secondary combustion chamber for removal of particulate pollutants entrained in the flue gas stream. The particulate collectors may include any of the following or a combination thereof:</p> <ul style="list-style-type: none"> • Cyclone separator • Electrostatic precipitators • Fabric filters
6	Chimney/Stack	<ol style="list-style-type: none"> 1. The chimney should have a minimum height of 10 meters above ground level and clear the highest point of the building by not less than 3 meters for all roofs. The topography and height of adjacent buildings within 50 meters radius should be taken into account. 2. If possible the chimney should be visible to the operator from the feeding area. 3. The addition of dilution air after combustion in order to achieve the requirement of these guidelines is unacceptable. 4. The minimum exit velocity should be 10 m/s and at least twice the surrounding wind speed (Efflux velocity = wind speed x 2) whichever is higher to ensure no down washing of exiting gases. Point for the measurement of emissions shall be provided.
7	Instrumentation	<ol style="list-style-type: none"> 1. Instrument for determining the inside wall temperature and not burner flame temperature must be provided for both primary and secondary chambers. 2. An audible and visible alarm must be installed to warn the operator when the secondary temperature drops to below the required temperature. 3. In addition to the above the following instruments may also be required. 4. A carbon monoxide and/or oxygen meter/recorder. <ul style="list-style-type: none"> • A smoke density meter/recorder • A gas flow meter/recorder • A solid particulate meter/recorder • Any other instrument or measurement that may be considered necessary
8	Location/Siting	<ol style="list-style-type: none"> 1. Must be sited in accordance with the relevant local municipal authority planning scheme, the topography of the area and be compatible with premises in the neighborhood. 2. Must be housed in a suitably ventilated room.
9	Emission Limits	<ol style="list-style-type: none"> 1. Combustion efficiency: <p>Combustion efficiency (CE) shall be at least 99.00%</p> <p>The Combustion efficiency is computed as follows:</p>

No.	Parameter	Standards, Guideline, Criteria and Procedure																								
		<div>C.E= $\frac{\% \text{CO}_2}{\% \text{CO} + \text{CO}}$ x 100</div> <div>2. The temperature of the primary chamber shall be 800 ± 50 C</div> <div>3. The secondary chamber gas residence time shall be at least 1 (one) second at 1050 ± 50°C, with 3% Oxygen in the stack gas.</div> <div>4. Opacity of the smoke must not exceed 20% Viewed from 50 Meters with naked eyes.</div> <div>5. All the emission to the air other than steam or water vapour must be odourless and free from mist, fume and droplets.</div> <div>6. The Authority may require that the certificate holder have tests carried out by an accredited institution to determine stack and/or ground level concentrations of the following substances.</div> <div><table><tr><td>Cadmium and compounds as</td><td>Cd</td></tr><tr><td>Mercury</td><td>Hg</td></tr><tr><td>Thallium</td><td>Tl</td></tr><tr><td>Chromium</td><td>Cr</td></tr><tr><td>Beryllium</td><td>Be</td></tr><tr><td>Arsenic</td><td>As</td></tr><tr><td>Antimony</td><td>Sb</td></tr><tr><td>Barium</td><td>Ba</td></tr><tr><td>Lead</td><td>Pb</td></tr><tr><td>Silver</td><td>Ag</td></tr><tr><td>Cobalt</td><td>Co</td></tr><tr><td>Copper</td><td>Cu</td></tr></table></div>	Cadmium and compounds as	Cd	Mercury	Hg	Thallium	Tl	Chromium	Cr	Beryllium	Be	Arsenic	As	Antimony	Sb	Barium	Ba	Lead	Pb	Silver	Ag	Cobalt	Co	Copper	Cu
Cadmium and compounds as	Cd																									
Mercury	Hg																									
Thallium	Tl																									
Chromium	Cr																									
Beryllium	Be																									
Arsenic	As																									
Antimony	Sb																									
Barium	Ba																									
Lead	Pb																									
Silver	Ag																									
Cobalt	Co																									
Copper	Cu																									

No.	Parameter	Standards, Guideline, Criteria and Procedure
		<p>Manganese Mn</p> <p>Tin Sn</p> <p>Vanadium V</p> <p>Nickel Ni</p> <p>Hydrochloric HCL</p> <p>Hydrofluoric acid HF</p> <p>Sulphur dioxide SO₂</p> <p>7. A 99.99% destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) in the waste feed where:</p> $DRE = [(Win - Wout)/Win] * 100$ <p>Where:</p> <p>Win = mass feed rate of the POHC in the waste stream fed to incinerator, and</p> <p>Wout = mass emission rate of POHC in the stack prior to the release to the atmosphere.</p> <p>9. The average dioxin and furan concentration in the emissions should not exceed 80ng/m total dioxins and furans if measured for a period of 6 to 16 hours.</p> <p>Note:</p> <ul style="list-style-type: none"> ▪ All pollutant concentrations must be expressed at 0° C and 1.013 x 10⁵ N/m², dry gas and 11% oxygen correction. • Oxygen correction is computed as: $E_s = \frac{21 - O_s}{21 - O_M} \times E_M$ <p>Where: E_s = Calculated emission concentration at the standard percentage oxygen concentration</p> <p>E_M = Measured emission concentration</p> <p>O_s = Standard oxygen concentration</p> <p>O_M = measured oxygen concentration</p>
10	Operation	<p>1. Materials destined for incineration should be of known origin and composition and must be only incinerated in a furnace that</p>

No.	Parameter	Standards, Guideline, Criteria and Procedure
		<p>is registered for the particular type of waste.</p> <p>2. A record must be kept of the quantity, type and origin of the waste to be incinerated.</p> <p>3. The incinerator must be preheated to working temperature before charging any waste.</p> <p>4. The incinerator must not be overcharged.</p> <p>5. The incinerator must be in good working order at all times and must not be used if any component fails. Any malfunction should be recorded in a log book and reported to the relevant authority.</p> <p>6. The incinerator operator and all relevant staff must be trained to the satisfaction of the relevant control authority.</p>
11	Housekeeping	<p>The site where the incinerator is built must:</p> <p>1. Have running water.</p> <p>2. Have a solid floor.</p> <p>3. Have lighting if 24hrs operation</p> <p>4. Have fly ash containerization and storage before disposal.</p>
12	Health and Safety (Protective Gear)	<p>1. Staff handling waste must be well trained on safe handling of hazardous wastes.</p> <p>2. Staff must be provided with appropriate protective gear such as, gas mask, aprons, gumboots, helmets, gloves, goggles.</p> <p>3. Caution and Warning signs must be provided.</p> <p>4. Firefighting equipment must be provided</p> <p>5. There should be no smoking or eating on the site.</p>