ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

PROJECT REPORT

FOR

THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B

BY

TULLOW KENYA B.V.

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January 2013

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JANUARY 2013

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Submitted By: TOM GRAY

Position: SUPPLY CHAIN MANAGER

Signed: ....

Date: 29TH JANUARY 2013

We the undersigned confirm that the contents of this report are a true representation of the Environmental and Social Impact Assessment Project Report of the proposed 2D seismic survey project in Block 12B; covering parts of Kisumu, Kericho, Homa Bay, Migori,Siaya, Nandi, Vihiga and Busia Counties.

Prof. Norbert Opiyo-Akech
Team Leader and Director

Sign......................

Date 29/1/2013

Prof. Daniel Olago
Lead Expert and Director

Sign......................

Date 29/1/2013

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ABBREVIATIONS

BMU	Beach Management Unit
CLO	Community Liaison Officer
CRA	Commission of Revenue Allocation
CSR	Corporate Social Responsibility
DHMBS	District Health Management Boards
EHS	Environmental Health and Safety
ESIA	Environmental and Social Impact Assessment
EMCA	Environmental Management and Coordination Act
ESMP	Environmental and Social Management Plan
E & P	Exploration and Production
ERP	Emergency Response Plan
EPR	Exclusive Prospecting Rights
ESIA	Environmental and Social Impact Assessment
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
ICRAF	International Centre for Agroforestry
KARI	Kenya Agricultural Research Institute
KEMFRI	Kenya Marine and Fisheries Research Institute
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

SACCOs	Savings and Credit Cooperatives
SPRP	Spill Prevention and Response Plan
TKBV	Tullow Kenya B.V.
TOR	Terms of Reference
UNEP	United Nations Environment Programme
WRMA	Water Resources Management Authority

NON TECHNICAL SUMMARY

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 ESIA was carried out for Tullow Kenya B.V. (Pin P051340553u), a subsidiary company of Tullow Oil PLC, with respect to the proposed 2D seismic survey in Block 12B.

Block 12B is located in Western Kenya and covers the eastern part of Lake Victoria. The Block is delimited by Kisumu, Homa Bay and Kericho Counties. Block 12B straddles 16 Districts in Nyanza, Western and Rift Valley including Kisumu East, Kisumu West, Homa Bay, Kericho West, Rachuonyo, Nyakach, Suba, Busia and Bondo districts. Block 12B covers a total area of approximately 7,102.76 km^2. The block has a diverse ecosystem comprising of crops, dense forests, flooded vegetation, shrub savanna and tree savanna. Several rivers also traverse the block including River Sondu-Miriu, River Nyando, River Awach and River Nyamasaria. The study area comprises both rural and urban settlements and is densely populated.

The project is an exploratory activity for determination of potential oil and gas resources in the assigned area (Block 12B) in Western Kenya. Seismic survey techniques vary according to the environment and are guided by various international standards. Seismic surveys are a primary tool utilized during the exploration of hydrocarbons in both onshore (land) and offshore (marine or lake) areas.

Onshore 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 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', and; large 'Vibroseis' trucks equipped with heavy plates that vibrate on the ground. 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.

Offshore seismic exploration is similar to onshore exploration, but rather than trucks and geophones, a boat is used to convey the equipment needed to generate the seismic waves and gather the seismic data, and hydrophones are used to pick up seismic waves underwater.

The hydrophones are towed behind a boat or cables are laid on the bottom of the sea or lakebed in various configurations, and are respectively referred to as "streamer arrays "or Ocean Bottom Cables (OBC). The seismic boat uses compressed point-source air pulses ("airgun") that releases bursts of compressed air under water to create sound waves that travel down through the water column and into the earth's crust and generate the necessary seismic reflection signal.

Block 12B encompasses both land (onshore) and lake (offshore – Lake Victoria) settings. 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 ESIA at the various stages of the project activity, and adherence to the ESMP would ensure environmental sustainability.

Earthview Geoconsultants (K) Ltd. was contracted by Tullow to undertake an ESIA for the proposed 2D seismic programme within Block 12B. The ESIA approach with respect to the proposed 2D 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 and Social Management and Monitoring Programme; and
- Preparation of the ESIA 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 ESMP. 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;

- If required, 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 rivers, wetlands 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;
- For any marine craft, carry out vessel surface cleaning to remove biofouling prior to departure from areas with known or potential aquatic pests as required under the Fisheries (General) Regulations;
- Ensure that vehicles and Vibroseis trucks are thoroughly cleaned before being used in the project area to prevent translocation of non-endemic invasive land species.
- Due to the fact that the breeding, spawning and migration seasons of the lake and lake-related fauna (fish, invertebrates, reptiles, water birds, hippos) are all different and are spread throughout the calendar year, avoidance of operations during such seasons is impractical, but particular care should be taken at all times to avoid disturbing the fauna;
- All seismic survey vessels will carry out visual monitoring and clearance of an exclusion zone around the array and in the immediate vicinity of the survey vessel;
- 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, and other agencies to provide adequate security during the seismic survey operation.

The Environmental and Social Management Plan (ESMP) recommended in this report should be followed and the Company should strive to set high environmental standards at all times.

1. INTRODUCTION

1.1 BACKGROUND

This environmental and social impact assessment (ESIA) project report presents baseline biophysical and socio-economic information, project description and mitigation measures, and an environmental management and monitoring plan for the proposed 2D seismic data acquisition programme by Tullow Oil in Block 12B in western Kenya. Block 12B is located on the eastern edge of Lake Victoria and covers an area of 7,102.76 km^2 and is delimited by Kisumu, Homa Bay and Kericho Counties in western Kenya (see Figure 1.1 below).

Tullow Oil, a FTSE100 company, is one of the largest independent oil and gas exploration and production companies. 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.

Tullow Kenya B.V. (TKBV), herein referred to as “Tullow”, a subsidiary of Tullow Oil PLC, holds a 50% interest along with Swala Energy Limited in Kenya’s oil exploration Block 12B, and is the appointed operator for the proposed oil and natural gas exploration programme.

This project report has been prepared for the project proponent, Tullow, by Earthview Geoconsultants Ltd. in accordance with the requirements of Kenya’s Environmental Management and Coordination Act, No. 9 of 1999 and subsidiary legislation, and in fulfillment of the more general requirement that projects maintain a clean, sustained and healthy environment. This ESIA project report is aimed at establishing and mitigating any potential impacts resulting from the proposed 2D seismic survey operations during development and operational phases at the identified site in the project area.

1.2 DEVELOPER IDENTIFICATION

This ESIA is carried out for Tullow (Pin P051340553U), a subsidiary company of Tullow Oil PLC, with respect to the proposed 2D seismic survey in Block 12B.

Table 1.1: Developer Identification

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

Tullow will engage an internationally experienced seismic acquisition geophysical company that will use suitable state-of-the-art technology to execute the seismic program in Block 12B.

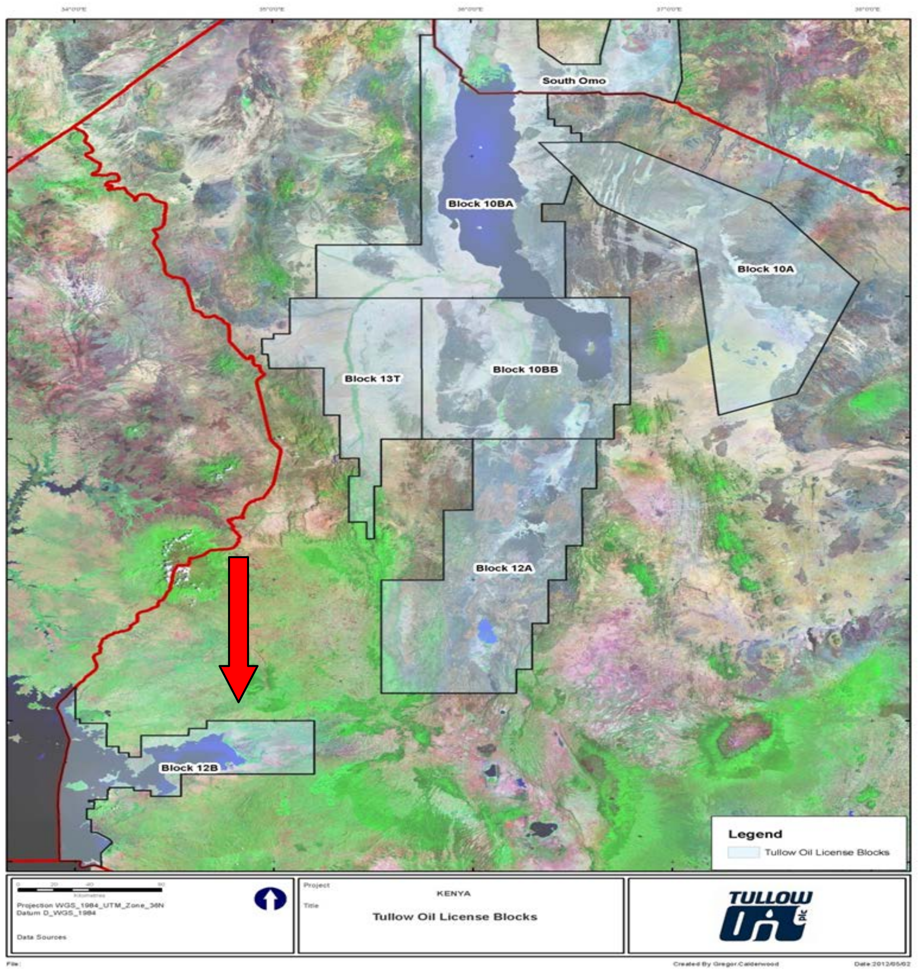


Figure 1.1: The location of the proposed project area (see red arrow).

1.3 BRIEF REGIONAL DESCRIPTION

Block 12B is located in Western Kenya and covers, partially or fully, 8 Counties including Kisumu, Homa Bay, Migori, Siaya, Busia, Vihiga, Kericho and Nandi. Block 12B straddles the equator, perched high on the African craton in tectonic sag between the two Rift Valleys of East Africa.

The proposed project area falls within the Lake Victoria Basin which experiences the equatorial hot and humid climate with a bi-annual rainfall pattern. The long rains are experienced from March to May and short rains from October to December. July is the coolest month of the year and the warmest month is variable and fluctuates in the period from October to February. Rainfall varies considerably from one part of the project area to another with the average annual rainfall being between 1,350 mm - 2,447 mm. The temperatures reach their maximum in February, just before the March equinox and reach its lowest records in July after the June equinox maximum and range from 28.6° C – 28.7° C. The minimum temperature varies from 14.7° C to 18.2° C. Comparison of temperature records for the periods of 1950-2000 and 2001-2005 show that maximum temperatures have increased by an average of 1° C.

The annual population growth rate of Kenya is estimated to be 3%. The project area is densely populated with higher population in the urban centres, which attract higher settlement due to better communication services and availability of schools, health centres, agricultural potential and water. The rural areas are equally densely populated and the land is highly fragmented. The major economic activities practiced in the project area include rice and sugarcane farming especially in the lowlands of Kano Plains. Tobacco farming is also carried out on the western parts of the Block. Most of the land in the proposed project area is under private ownership and people practice subsistence farming of maize, sorghum, sweet potatoes and cassava. Livestock farming is also practiced in the project area, with most farmers keeping indigenous cattle known as Zebu. Crop irrigation is mainly practiced in the Yala swamp area and at Ahero Irrigation scheme. Another irrigation scheme is underway in Rachuonyo at the Kimira Oluch smallholder farms project. Fishing is the major economic activity on the beaches surrounding Lake Victoria.

Block 12B is accessible from Nairobi through the Kisumu - Nairobi highway, though there are several parts of the highway which are currently undergoing construction near Kericho and in Awasi area. The rest of the road is in relatively good condition. The Block can also be accessed through air transport which is very reliable as there are local flights to Kisumu from Nairobi on a daily basis, and a good airport following the upgrading of Kisumu Airport to international standards. Within Block 12B, there are several roads connecting the areas. The Kisumu- Homa Bay, Kisumu - Busia and Kisumu - Muhoroni roads are in good condition with the exception of the Kisumu-Siaya road through Luanda and the Kisumu-Chemelil road through Miwani which have potholes and require careful driving.

Lake Victoria is relatively young, formed through tectonic forces over 400,000 years ago (Johnson et al. 2000). The project area comprises of the Nyanza system of rocks and sediments of Precambrian to recent times (Saggerson, 1952; Binge, 1962). The area is marked by the Nandi escarpment and associated footslopes in Kibos area that is characterised by granite. Piedmont plains in the area consist of accumulations of mixtures of hill creep (coarse talus and fine materials of recent origin from the Kipsigis ridges and Nandi escarpment. Sedimentary plains in the area are covered by alluvium of recent age (Saggerson, 1952). Most of the lake is surrounded by Precambrian bedrock, with the exception of the Kavirondo Gulf in the north-eastern corner. Tertiary and recent alkali volcanic and sedimentary units dominate the terrain. Three major desiccation events are recorded in the seismic records that may reflect the 100,000-year Milankovitch cycle. The lake has suffered periods of complete desiccation and sometimes pluvial flooding escapades. The most recent arid period resulted in complete desiccation of the pre-existing lake.

1.4 PROJECT BACKGROUND, OVERVIEW, JUSTIFICATION AND OBJECTIVES

Tullow, the proposed project proponent, plans to carry out 2D seismic survey in Block 12B to determine the possibility of potential oil and natural gas deposits in the area. A Production Sharing Contract (PSC) for the Exclusive Prospecting Right (EPR) for Block 12B was signed with the Government of Kenya on 17th September 2008. The proponent holds 50% ownership of the Block and is the main operator.

Tullow's main aim and objective over the years will be to explore in detail the assigned area of 7102.76 km^2 (Block 12B), 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, (c) carry out well appraisal and production of oil and/or gas if the prospects prove to be economically viable. Tullow is committed to ensuring that the activities that will be carried out to achieve the stated objectives performed in a manner that will not be detrimental to the natural environment or the local communities in the area.

1.4.1 OVERVIEW OF THE PROJECT

The project is an exploratory activity for determination of potential oil and gas resources in Block 12B in Western Kenya, and is commonly referred to, in the Oil and Gas Industry parlance, as a "seismic survey". A seismic survey is conducted by creating an acoustic energy wave (commonly referred to as a 'seismic wave') using an energy source placed on or close to the surface of the ground along a predetermined line (seismic survey line, or transect). 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. 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. The seismic waves can be induced using two types of energy sources,: (i) vibratory sources which utilise Vibroseis trucks that are equipped with heavy plates that vibrate on the ground, and (ii) impulsive sources which involve dynamite charges between 50 to 60mm diameter that are set off in shallow (5 to 20m deep) holes (known as 'shot holes') to transfer seismic energy into the ground in the form of a short duration pulse.

Offshore seismic exploration is similar to onshore exploration, but rather than trucks and geophones, a boat is used to convey the equipment needed to generate the seismic waves and gather the seismic data, and hydrophones are used to pick up seismic waves underwater. The hydrophones are towed behind a boat or cables are laid on the bottom of the sea or lakebed in various configurations, and are respectively referred to as Ocean Bottom Cables (OBC). The seismic boat uses compressed point-source air pulses ("airgun") that releases bursts of compressed air under water to create sound waves that travel down through the water column and into the earth's crust and generate the necessary seismic reflection signal.

As per the PSC requirements, a minimum of 500 km of 2D seismic data will be acquired over a projected time period of eight to twelve weeks, beginning in quarter one of 2013. The workforce that will be required to carry out the survey will be between 250 and 400 in number. Line clearance along the pre-determined and pre-surveyed transects will be done by use of mulchers and light hand-cutting tools, 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 will reside in a base camp that will be constructed by the seismic contractor who will have many years of experience in setting up such camps. The contractor is expected to comply with OGP standards (Oil and Gas Producers). Issues such as camp security, provision of basic services (e.g. accommodation, water, sanitation, lighting, and health care), waste management, materials storage areas, etc., shall be incorporated in the camp design. The base and fly camps will be sited as far away as is reasonably practicable from densely settled localities within the block and their locations shall be determined in consultation with the relevant authorities taking cognizance of neighbouring communities. 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, and its own in-house environmental health and safety (EHS) policies which embrace the international best practices for such activities. An emergency response plan will be put in place in case of any accidents. 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.

1.4.2 PROJECT JUSTIFICATION

Following the recent discovery of hydrocarbon deposits in Ngamia1 within Block 10BB and Twiga 1 in Block 13T) by Tullow, exploration efforts have been intensified in the related Mesozoic and Early Tertiary rift basins of Kenya with a view to meeting the global, regional and local demand for energy.

Energy is an important factor in socio-economic development (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). To improve on the sustainability of energy supply in Kenya, 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 contributed to high industrial production costs. Thus, the availability of fossil fuels locally would significantly reduce the energy cost as well as production cost of industries.

This project, if successful, would play a major role in enabling the country to reduce the cost of energy and over-reliance on hydroelectric power and crude oil imports, as well as benefit from oil and gas exportation to other countries, thus increasing the per capita income and the GDP from foreign exchange. Other possible spin-offs would include job creation and increased economic activity in the area. The project is in line with the objectives of the National Energy Policy (improving access to affordable energy services, enhancing security of supply, promoting development of indigenous energy resources; promoting energy efficiency and conservation;

and promoting prudent environmental, health and safety practices), the Economic Recovery for Wealth and Employment Creation Strategy (expanding and improving infrastructures, developing arid and semi-arid lands, and safeguarding environment and natural resources), and Kenya Vision 2030 (enhanced equity and wealth creation for the poor in semi-arid and arid districts, and; must generate more energy at a lower cost and increase efficiency in energy consumption).

1.5 PURPOSE OF THE ESIA

In Kenya, the primary authority that regulates the environment with respect to oil and gas exploration activities is the National Environment Management Authority (NEMA). Other key national players and regulators in the oil and gas industry are: the Ministry of Environment and Mineral Resources, the Ministry of Energy, and the National Oil Corporation of Kenya. The country is also a signatory to a number of international treaties and conventions related to environmental protection and conservation.

1.5.1 THE MANDATE OF NEMA

The National Environment Management Authority (NEMA) is the institution that has been established under the Environment Management and Coordination Act (EMCA), No. 8 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 the principal instrument of government in the implementation of all policies relating to the environment. Some of its mandates that are relevant to ESIAs 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 preventing or abatement of environmental degradation; and
- 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.

1.5.2 REQUIREMENTS AND SCOPE OF WORK FOR THE ESIA

A project report is defined, in the preliminary section of the EMCA, No. 8 of 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 Environmental Management and Co-ordination Act, 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 Environmental Management Authority (‘the Authority’) in the prescribed form accompanied by the prescribed fee. The seismic survey project falls under Schedule 2, at 6 (j) “exploration for the production of petroleum in any form” of EMCA 1999.

Regulation 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 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.

1.5.3 THE ESIA 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 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.

1.6 THE ESIA TEAM

Earthview Geoconsultants Ltd. was appointed by Tullow in December 2012 to undertake the ESIA for the 2D seismic survey in Block 12B. Earthview Geoconsultants Ltd. is a well-established consultancy firm based in Nairobi with good capacity in, e.g., environmental and social impact assessments and audits, geological and hydrogeological studies, geographic information systems, natural resource surveys, and project planning, implementation and management.

Earthview is officially registered with NEMA as an Environmental Consultancy Firm. The firm comprises of individuals with many years of experience and knowledge in these and other areas. A list of the team is presented in Table 1.2 below.

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 1.2: The ESIA team

Name	Role	Qualifications	Experience (years)
Prof. Norbert Opiyo-Aketch	Overall coordination/Geological issues	PhD	30
Prof. Daniel Olago	Coordination/Biophysical and Socio-economic issues	D.Phil.	20
Dr. Stephen Mathai	Ecology	PhD	25
Mr. Sospeter Kiambi	Terrestrial Ecology	BSc	8
Mr. Peter Owenga	Soils and Geology	MSc	20
Mr. Daniel Lango	Socio-economics, Health and Socio-cultural issues	MA (Anthropology)	10
Mr. Shadrack Orinda Okumu	Socio-economic , Health and Socio-cultural issues	BA (Anthropology)	3
Ms. Grace Njeri Murage	Biophysical and Socio-economic issues	BSc	2
Ms. Christine Omuombo	GIS Expert	MSc	6
Mr. Nicholas Aketch	Logistics/Administration	BSc	8
Ms. Emily Atieno	Policy/Legislation/Regulations	LLB	25

1.7 OBJECTIVES OF THE ESIA PROJECT REPORT

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

- 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;
- Assess and analyse the environmental costs and benefits associated with the proposed project;
- Outline environmental management plans and monitoring mechanisms during the project execution phase;
- Ensure that concerns and aspirations of the local community are addressed in all stages of the project cycle;
- 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:
    - o Ecosystem in general;
    - o Land resources and national heritage sites in and around the project area;
    - o Local communities and land tenure systems, and;
    - o Sensitive historical, archaeological and cultural sites.
- 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; and
- Boost the economy by providing jobs and trading opportunities to the local community in the region.

1.8 TERMS OF REFERENCE (TOR)

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

- 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

- Environmental protection is an integral part of sustainable development.
- The environment and its natural resources can meet the needs of present as well as those of future generations if used sustainably.
- 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.
- Poverty reduction is an indispensable requirement for sustainable development.
- 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.
- Endogenous capacity building is essential for development, adaptation, diffusion, and transfer of technologies for sustainable development.
- Indigenous/traditional knowledge and skills are vital in environmental management and sustainable development.
- Effective public participation is enhanced by access to information concerning the environment and the opportunity to participate in decision-making processes.
- Public participation including women and youth is essential in proper environmental management.
- For sustainable management, the polluter pays principle should apply.
- Access to judicial and administrative proceedings, including redress and remedy, is essential to environmental conservation and management.
- Private sector participation in environmental management is essential for sustainable development.
- Effective measures should be taken to prevent any threats of damage to the environment, notwithstanding lack of full scientific certainty.
- Peace, security, development, and environmental protection are interdependent and indivisible.
- 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

- To incorporate environmental management and economic development as integral aspects of the process of sustainable development;
- To promote maintenance of a quality environment that permits a life of dignity and well-being for all;
- 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;
- To promote maintenance of ecosystems and ecological processes essential for the functioning of the biosphere;
- To promote the preservation of genetic resources, biological diversity, their cultural values and their natural heritage; and
- To incorporate indigenous knowledge, skills, and interests for effective participation of local communities in environmental management and sustainable development.

Objectives

- To conserve and manage the natural resources of Kenya including air, water, land, flora, and fauna;
- To promote environmental conservation with regard to soil fertility, soil conservation, biodiversity, and to foster afforestation activities;
- To protect water catchment areas;
- To enhance public awareness and appreciation of the essential linkages between development and environment;
- To initiate and encourage well-coordinated programmes of environmental education and training at all levels of society;
- To involve NGOs, private sector, and local communities in the management of natural resources and their living environment;
- To support a coordinated approach to policy formulation on environmental matters;
- To ensure development policies, programmes, and projects take environmental considerations into account;
- To ensure that an acceptable environmental impact assessment report is undertaken for all public and private projects and programmes;
- To develop and enforce environmental standards;
- To enhance, review regularly, harmonize, implement, and enforce laws for the management, sustainable utilization, and conservation of the natural resources;
- To provide economic and financial incentives for sustainable utilisation, conservation, and management of natural resources;

- 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;
- To ensure adherence to the polluter pays principle; and
- To develop adequate national laws regarding liability and compensation for the victims of pollution and other environmental damage.

2.3 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:

- Preserve, conserve and protect available water resources and allocate it in a sustainable, rational and economic way;
- 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;
- Establish an efficient and effective institutional framework to achieve a systematic development and management of the water sector; and
- Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

2.3.1 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:

- Provide sustainable quality energy services for development;
- Utilise energy as a tool to accelerate economic empowerment for urban and rural development;
- Improve access to affordable energy services;
- Provide an enabling environment for the provision of energy services;
- Enhance security of supply;
- Promote development of indigenous energy resources; and
- Promote energy efficiency and conservation as well as prudent environmental, health and safety practices.

2.3.2 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:

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

2.3.3 MINING POLICY

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 and Social Impact Assessment ('ESIA') Licence.

2.3.4 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.

2.3.5 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:

- Expanding and improving infrastructures;
- Reforms in Trade and Industry;
- Reforms in forestry;
- Affordable shelter and housing;
- Developing arid and semi-arid lands; and
- 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).

2.3.6 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.

2.4 THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

2.4.1 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.

2.4.2 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, EIA practitioners, lead agencies and members of the public to understand the process and the basis on which decisions are made.

2.5 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.

Table 2.1: Kenyan Legislation, Regulations, Standards and International Conventions Relevant to the Project

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
Physiography and Geology	The Petroleum (Exploration and Production) Act, Cap. 308	The Energy Ministry	Tullow activities must be restricted to the area specified in the terms and conditions of the petroleum agreement.	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	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 the seismic acquisition program. Tullow 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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	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 Environmental Impact Assessment project study 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.	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.
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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Environmental Management and Co-ordination (Wetland, Riverbank, Lakeshore and Seashore Management) Regulations, 2009	The National Environment Management Authority	Activities that may cause pollution and siltation, or in other ways degrade the environment, must be prevented or controlled.	Environmental Restoration orders may be given to allow a wetland, riverbank or lakeshore that has been degraded to regenerate.
Water Resources	The Public Health Act, Cap. 242	The Public Health and Sanitation Ministry	Tullow 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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Tullow 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 compensation.
			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.	Cancellation of licence for contravening any provision of the Act or failing to comply with any specified conditions in the licence.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Water Act, Cap. 372	The Water and Irrigation Ministry	Tullow 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.	Any person who contravenes the Water Quality Regulations commits an offence and is liable to a fine not exceeding five hundred thousand shillings.
	The Environmental Management and Co-ordination (Water Quality) Regulations, 2006	The National Environment Management Authority	Tullow 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.	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.

Environmental or Social Parameter	Legislation/Regulations/ International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Water Resources Management Rules, 2007	The National Environment Management Authority	Tullow 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.	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.
	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 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.	
	The International Plant Protection Convention, Rome, 1951		Tullow must take effective measures to ensure that its boats, ships and activities in or near Lake Victoria do not introduce and/or spread pests and diseases in plants within the country and across Kenya's territorial borders into Tanzania or Uganda.	

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, 1991		Tullow must endeavour to reduce waste generation to a minimum in terms of quantity and/or hazard potential. Whenever it does generate such wastes, Tullow should transport and dispose of them in a manner consistent with the protection of human health and the environment. Hazardous wastes should as far as is compatible with environmentally sound and efficient management, be disposed of where they were generated, in this case, in Kenya.	
	The Ramsar Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, 1971		Tullow must make every effort to conserve the wetlands and their flora and fauna, especially waterfowl in their habitat.	
	Convention for the Establishment of Lake Victoria Fisheries Organization, 1994		Tullow should avoid any acts that would detract from the Kenya government's initiatives in the management of the Lake Victoria resources, including fisheries, water and other resources.	
Ecosystems	The Wildlife (Conservation and Management) Act, Cap. 376	The Forestry and Wildlife 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 the test-well drilling process, 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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Petroleum (Exploration and Production) Regulations	The Energy Ministry		
	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 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	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	Offences and Penalties
			sought. Failure to prepare an environmental impact assessment in accordance with the Act and regulations is an offence.	
		The Fisheries Development Ministry	Tullow should consider the recommendations of the Kenya Marine Fisheries Research Institute (KMFRI)'s Marine Environment and Ecology Programme (MEEP) on the prudent use of the aquatic ecosystems, and adopt any appropriate pollution mitigation measures that the Institute may prescribe.[1]	
	The Fisheries (General) Regulations[2]	The Directorate of Fisheries	Anyone who does so is guilty of an offence and liable to a fine of up to twenty thousand shillings and imprisonment for up to two years or to both.	No person is permitted to disturb any spawn or spawning fishing a breeding area.

[1] The Kenya Marine and Fisheries Research Institute (KMFRI) is a State Corporation in the Ministry of Fisheries Development of the Government of Kenya and was established by the Science and Technology Act, Cap. 250, in 1979. It has a research mandate focusing on Marine and Freshwater Fisheries, Aquatic Biology, Aquaculture, Environmental Chemistry, Ecological, Geological and Hydrological Studies, as well as Chemical and Physical Oceanography. The Institute aims to ensure the rational exploitation and sustainability of the fisheries resources. Its aquatic research reach covers all the Kenyan inland waters and the corresponding riparian areas including the Kenyan's Exclusive Economic Zone in the Indian Ocean waters.

[2] The Fisheries Act, Cap. 378 is intended to develop, manage, exploit, use and conserve fisheries. Licensing provisions under this statute are meant for fishing activities, namely local and foreign fishing licences and licences for local and foreign fishing vessels. In addition, the Minister may make regulations for the licensing of other fishery activities including sport fishing, or the use of any gear or method of fishing with or without the use of a vessel, or fish processing or dealing in fish. Engaging in any of these activities without a licence is an offence, attracting a fine of up to twenty thousand shillings or imprisonment for a year or both. The Fisheries (General) Regulations which are made under section 14(1) of the Fisheries Act deal with the licensing issues mentioned above. Other provisions relate to the registration of local fisheries vessels, the licensing of fishermen, trout and crustae fishing, the importation of live fish, restriction on the purchase of fish, prevention of pollution and protection and conservation of fishery waters, and private marks for fishing gear.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
Livelihoods	The Fisheries (General) Regulations	The Directorate of Fisheries The Fisheries Development Ministry	Lake Victoria is a designated pollution-prevention zone. Unless it is to protect the safety of craft or crew in an emergency, Tullow must not place or discharge into the lake any pollutant that may cause harm to any fisheries resource or marine animal, interfere with fishing or obstruct fishing gear or vessels, or become a hazard to navigation. Should Tullow require to move a boat from a body of water to another within Kenya's inland waters, or anything already placed in that body of water, it must notify a fisheries officer who will inspect the vessel or equipment for forbidden weeds, fish or other organisms that may spread to other fishery water bodies.	
	The Merchant Shipping Act, 2009	The Transport Ministry	The Minister may make regulations to enhance the safety and security of crew and vessels plying the inland waters as well as preserve the aquatic environment. Tullow must endeavour to avoid the unnecessary disturbance of aquatic life and habitats such as would be caused by vessel strikes and the use of airguns. It must also not interfere with fishing and other marine activities.	
	The International Plant Protection Convention, Rome, 1951		Tullow must take effective measures to ensure that its boats, ships and activities in or near Lake Victoria do not introduce and/or spread pests and diseases in plants within the country and across Kenya's territorial borders into Tanzania or Uganda.	

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	Convention for the Establishment of Lake Victoria Fisheries Organization, 1994		Tullow should avoid any acts that would detract from the Kenya government's initiatives in the management of the Lake Victoria resources, including fisheries, water and other resources.	
Public Safety and Security	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 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.
Occupational Health and Safety	The Explosives Act, Cap. 115	The Environment and Natural Resources Ministry	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 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 is working with explosives or in the vicinity of where explosives are being used, whether under his direct supervision or not.	A fine not exceeding three thousand shillings, and in default of payment, 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	None specified. A general penalty applies - a fine not exceeding one million

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
			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.	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 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	

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
			tested regularly.	
	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.
Land Resources	The Land Act, 2012 The Convention on Biological Diversity, Rio de Janeiro, 1992	The National Land Commission	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.	None indicated
	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	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. Contravention or failure to comply with any of the matters provided in the Regulations will constitute an	Suspension, cancellation or revocation of the licence. Imprisonment for a term not exceeding eighteen months, or

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
			offence	to a fine 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 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 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 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.	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	Offences and Penalties
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 Vibratio Pollution) (Control) Regulations, 2009		Tullow 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, 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.	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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Explosives Act, Cap. 115	The Department of Mines and Geology	Addressed under Occupational Health and Safety above, but also applicable to Noise and Vibrations	
	The Environmental (Impact Assessment and Audit) Regulations, 2003	The National Environment Management Authority		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.
Offensive Odours	The Environmental Management and Coordination Act, 1999	The National Environment Management Authority	Tullow 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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	The Public Health Act, Cap. 242 The Local Government Act, Cap. 265	The Public Health and Sanitation Ministry	Tullow must apply to the Authority for a licence 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.	Cancellation of licence.
		The Local Government Ministry	Tullow 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. Tullow 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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	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. Tullow 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. These regulations do not apply to flaring during well testing. Currently Kenya has no legislation or regulations on flare pit construction specifications. Tullow will need to consider the application of international standards in this regard, as well as consideration of all relevant legislative and regulatory provisions on environmental protection and prevention of pollution set out in this chapter.	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.

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	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 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.
	The Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, 1997		Tullow must show that it is consistently taking steps to control/reduce greenhouse gas emissions.	
Archaeological and Natural Heritage Sites	The National Museums and Heritage Act, Cap. 216	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 Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972			

Environmental or Social Parameter	Legislation / Regulations / International Conventions	Regulatory Agency	Relevance to Project	Offences and Penalties
	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.

2.6 INTERNATIONAL PRACTICES AND CONVENTIONS

2.6.1 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.

2.6.2 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)

	Convention	Entry into force	Date of ratification
8.	Amendments to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Geneva, 1995. 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).	5 May, 1992	9 September, 2009 (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)

2.7 TULLOW POLICIES

Think Environment
Think Health
Think Safety
Think Forward

TULLOW plc

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

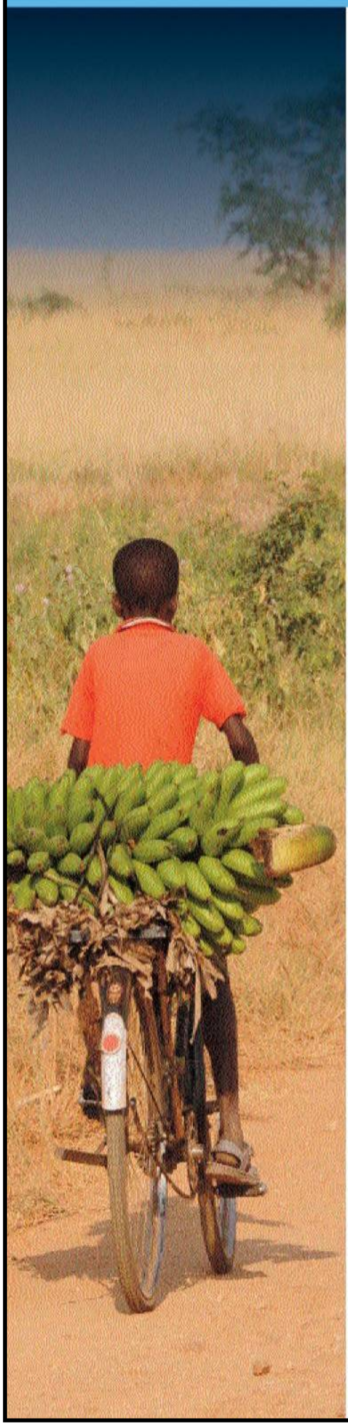
In adhering to this Policy, everyone in Tullow or working on our behalf is empowered to stop any activity they regard as irresponsible or unsafe.

Aidan J Heavey

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

TULLOW Oil plc

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.

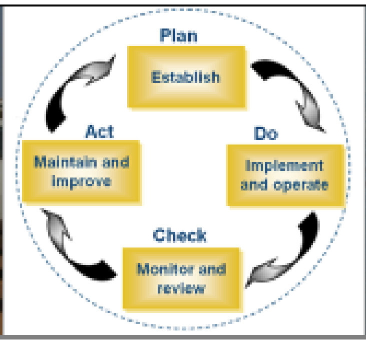
Further requirements for developing countries:

- 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.

TULLOW Oil plc

TOP-EHS-POL-002-Rev2



EHS commitment statement

Geophysical Technology Group

The Geophysical Technology Group 2011 Environmental Health and Safety (EHS) Statement confirms our commitment to best practice standards of EHS management in accordance with Tullow Management Systems. We commit by our actions, to identify, mitigate and manage EHS risks meeting management system standards, expectations and requirements.

Key EHS challenges and focus areas:

- Contributing to the achievement of company EHS Key Performance Indicators and implementing Company EHS programmes in the group's area of the business;
- To manage and monitor the top 10 risks to Tullow in the following areas:
    - Health and Safety
    - Environment
    - Security
- Ensuring the Group, Company representatives and geophysical contractors recognise and accept the importance Tullow attaches to EHS and that we all work to meet those expectations; and
- Ensuring consistent compliance with Tullow management systems and other industry-related standards during the execution of operated geophysical work scopes.

Specific Group action plan to meet these challenges and achieve EHS objectives:

- Identify main corporate EHS risks and set an agenda to mitigate these risks;
- Deliver Tullow EHS induction to all appointed client representatives on operated projects;
- Participate in programmed EHS Leadership training to ensure sufficient EHS competence within Group;
- Provide strong and visible EHS leadership during all aspects of Group activities;
- Incorporate principles of Tullow Safety Rules into Group operational activities;
- Use industry standard tools to assure good EHS standards and compliance in order to benchmark against the global geophysics industry;
- Ensure all reportable incidents are recorded within the emex incident reporting and investigation database; and
- Strive for continuous EHS improvement in all Group activities by shared learning and lessons learned through periodic formal review.

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3. PROJECT DESCRIPTION

3.1 INTRODUCTION

Tullow is proposing to undertake a seismic survey in order to delineate potential hydrocarbon prospects in Block 12B (which covers an area of 7,102.76 km^2) in western Kenya. The project area is served by the Kisumu-Kisii-Isebania road, the Kisumu-Busia road, the Kisumu-Kakamega road and the Kisumu-Kericho road which connect various sections of the Block. These roads are in good condition except in a few places such as parts of the Kisumu-Kericho road which are still undergoing construction. The roads in the hinterland which connect to these major roads such as the Maseno-Siaya and Kisumu- Miwani roads are however in bad condition due to presence of potholes. The project area is also served by the Kisumu International Airport in Kisumu City.

Other infrastructure in the area includes telecommunication and mobile telephony, with major stakeholders being Safaricom, Airtel, Orange Telkom (Kenya) and the Postal Corporation of Kenya. It was also noted that each district within the Block has at least one market managed by the Local Authority.

3.2 PROJECT LOCATION

The project area lies in western Kenya and incorporates the entire Nyanza Rift and parts of its flanking highlands, as well as the Kenya portion of Lake Victoria and its shoreline area (Figure 3.1 and 3.2). The Block covers parts of Budalangi, Bondo, Rarieda, Kisumu West, East and Central, Nyando, Nyakach, Belgut, Ainamoi, Karachuonyo, Homa Bay, Mbita, Suba and Nyatike.

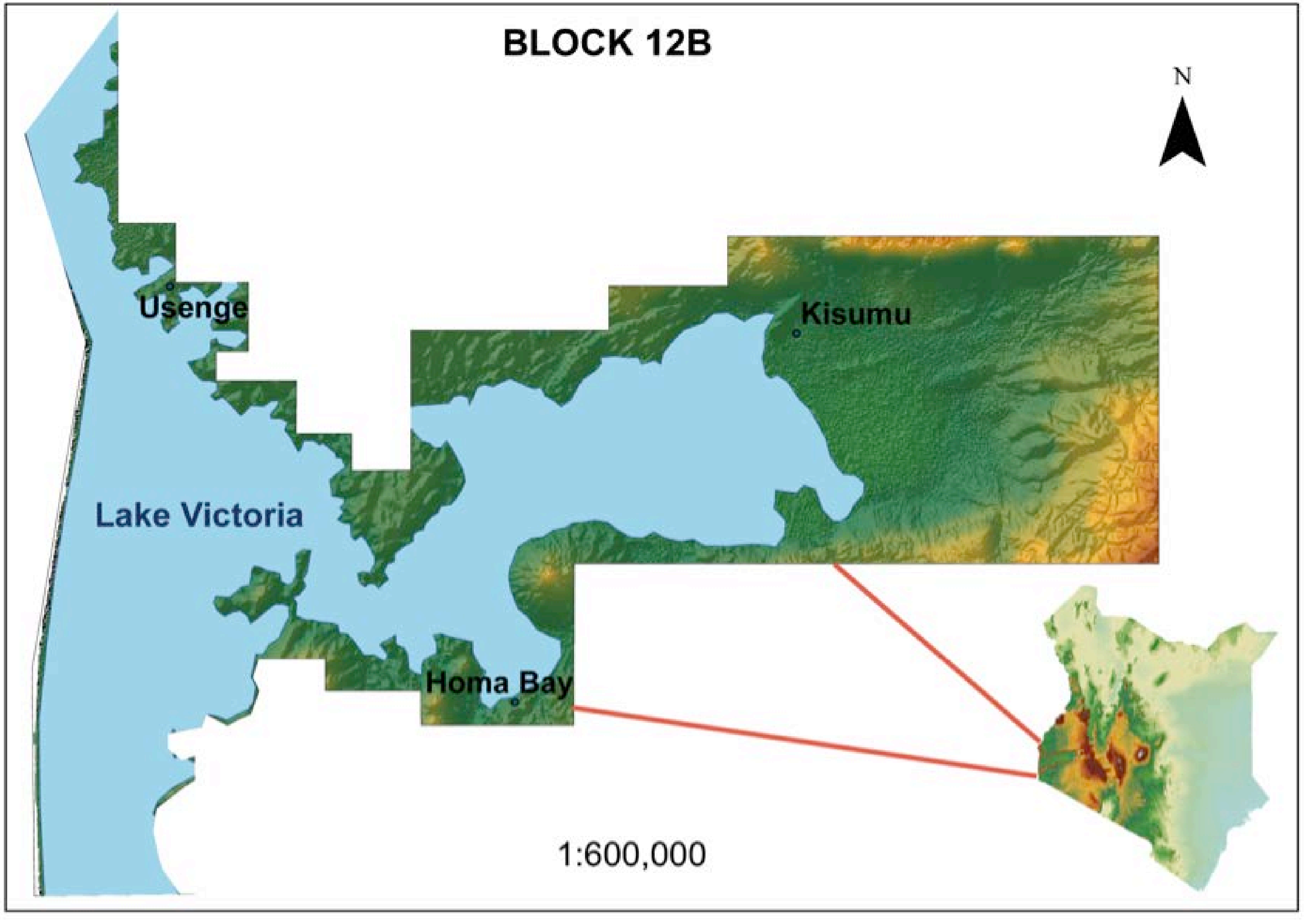


Figure 2.1: The Location of Block 12B in Kenya

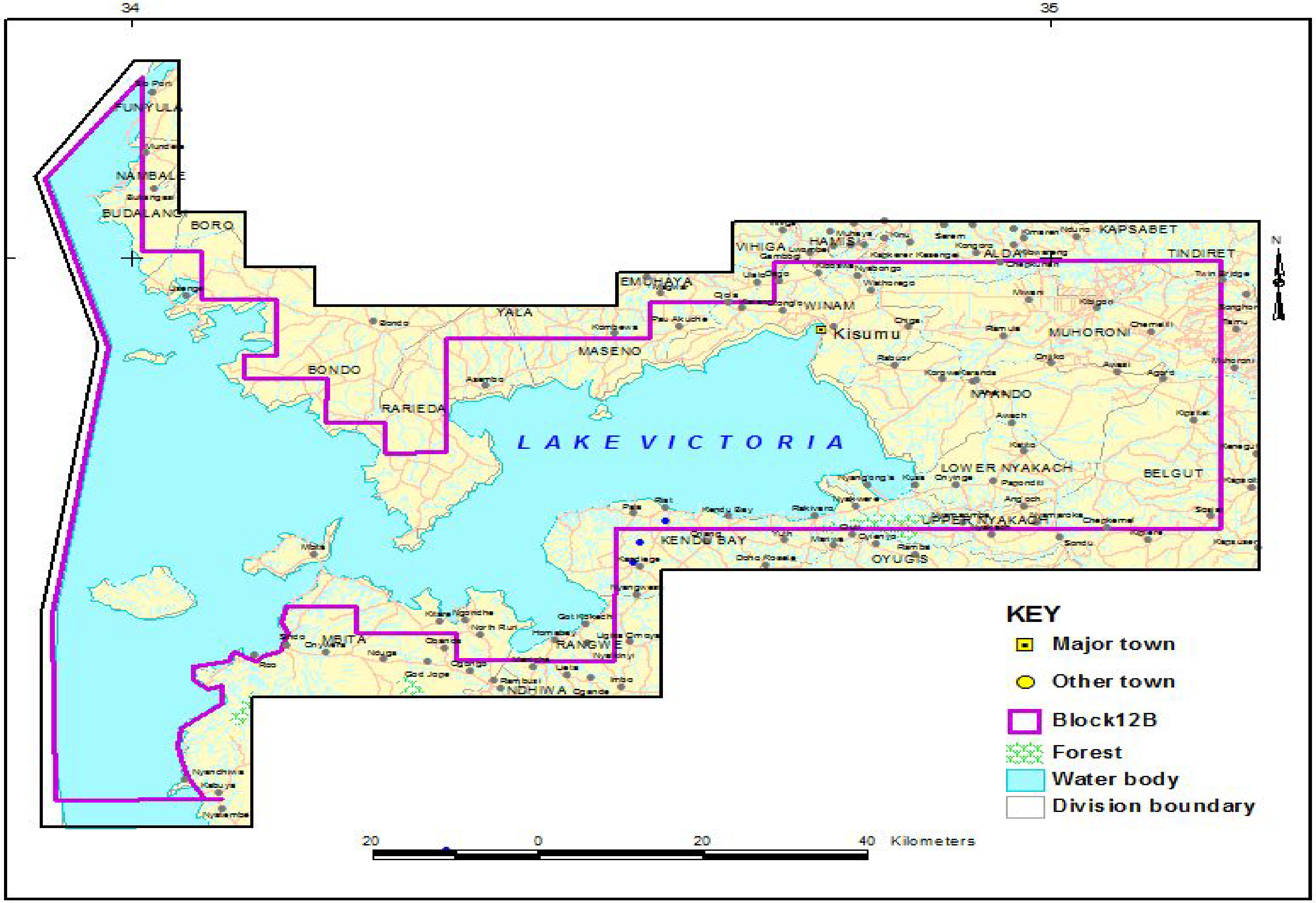


Figure 3.2: Block 12B

3.3 OVERVIEW OF 2D SEISMIC SURVEY PROCESS

3.3.1 PRINCIPLES OF SEISMIC SURVEY

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 3.3), formations can be mapped and potential oil or gas deposits identified.

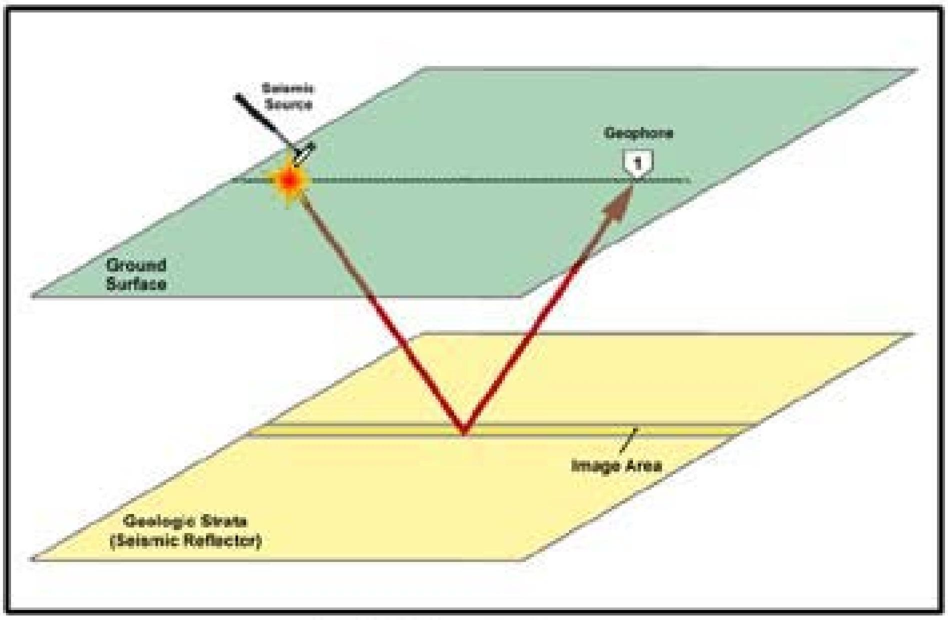


Figure 3.3: Schematic of 2D seismic survey process (Source: rri-seismic.com)

3.4 THE PROPOSED SEISMIC SURVEY

The proposed seismic survey process in Block 12B covers both onshore and offshore seismic acquisition. The acquisition or recording of seismic data requires the generation and transmission of an acoustic pulse into the earth or water and recording of the reflected acoustic wave using geophones or hydrophones. The acoustic energy generated by the seismic source is reflected by sub-surface geological strata at different rates according to the characteristics of specific geological strata. The choice of energy source for a particular project or project area is subject to topography, ground conditions and the quality of seismic data that can be returned by these sources subject to the known, sub-surface geology.

The recorded sound waves are processed and used to generate images of the subsurface geology. The interpretation of subsurface images is used to identify or delineate potential hydrocarbon bearing structures.

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 ONSHORE SEISMIC ACQUISITION

This is a sequential process that involves a number of steps including survey design, permitting, line survey, line clearance, drilling, recording and restoration. Onshore 2D seismic surveys are conducted along ground transects where sequential “receiver cables” of 6 to 12 kilometres in length are laid out on the ground. A group of evenly spaced geophones that are sensitive to small sound waves and vibration are placed on the ground and connected to the cable. A truck-mounted recording system connected at one end of the receiver cable records the sound waves picked up by the geophones.

At carefully calculated points along the receiver line, an impulse is sent into the earth. This “shot” may be caused by a specially-built vibrator truck shaking the surface (Vibroseis) or by a small detonation at the bottom of a five to twenty metre deep, narrow-diameter hole drilled into the ground. On completion of recording, a section at one end of the cable is unplugged and moved, together with its geophones/hydrophones, to the front of the cable where the process is repeated. In this way, the recording moves along the pre-determined seismic line.

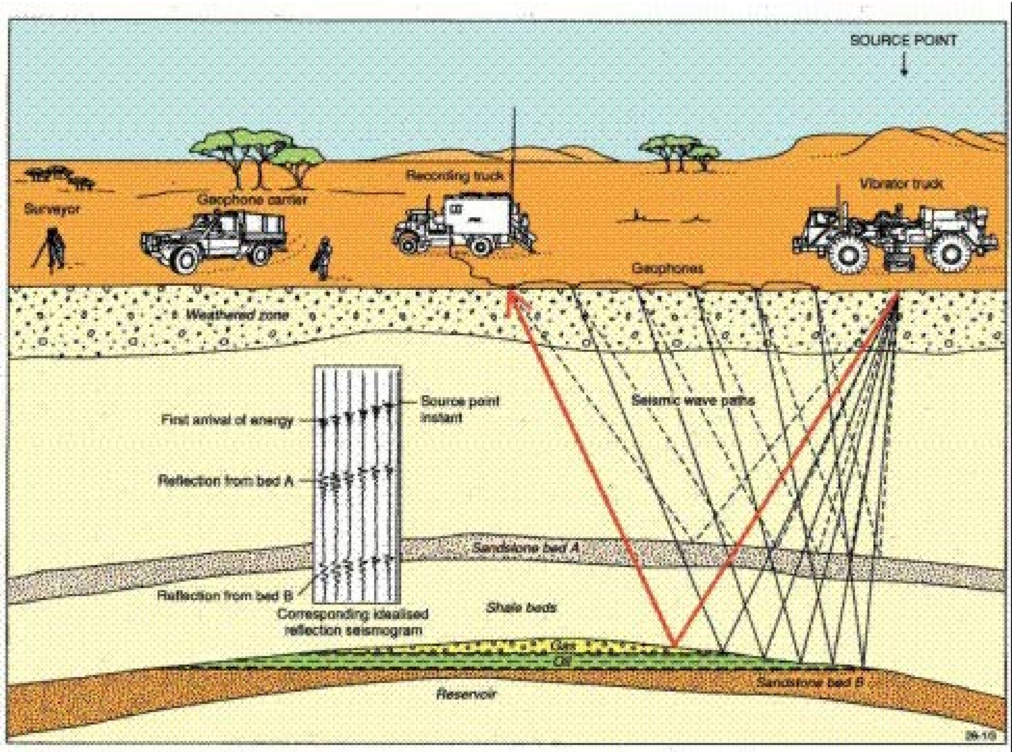


Figure 3.4: Onshore 2D seismic acquisition process
(Source: mines.industry.gld.gov.au)

3.4.2.1 SURVEY DESIGN

This involves the Positioning of seismic lines to achieve subsurface imaging objectives. Seismic survey design is driven by exploration objectives to image the sub surface. The survey design requires the placement of a pattern of seismic lines on the surface and set of acquisition parameters that define seismic source and recording configuration e.g. the number of seismic source and receiver points to be surveyed and placed on the ground.

2D seismic lines vary in length and spacing. The length and spacing of seismic lines are dependent of the subsurface imaging objectives. For a regional wildcat survey 2D lines can be up to 2 km apart and vary in length from short lines less than 20 km to in excess of 100 km in length.

3.4.2.2 PERMITTING

Involves following the required processes and procedures in order to obtain access permission from landowners, communities and local authorities.

3.4.2.3 LINE SURVEY

This step involves positioning and marking of seismic lines. Line preparation is started by laying out the seismic lines according to the pre-planned seismic lines by survey teams using Leika 1200 RTK GPS rover units. Where-ever possible, seismic lines are routed around significant biophysical features such as significant trees, surface water features, cultural property such as known archaeological areas, places of worship, sacred locations, graves, etc.

3.4.2.4 LINE CLEARANCE

This step involves the creation of physical access for personnel and equipment on seismic lines. Lines are cleared of natural vegetation (where present) to ground level using a combination of bulldozers as rollers to flatten low level vegetation followed by mulchers; vegetation roots are not removed from the soil which facilitates natural re-growth. Mulched vegetation is left *in situ* to allow for no net loss of soil nutrients over time with natural composting of mulched vegetation. On rocky terrain of gibber like terrain a bulldozer is used to clear stones from the line; upon completion of the recording stones are reinstated to the seismic line.

3.4.2.5 DRILLING

This step involves drilling of shot holes if required for loading dynamite as a seismic source. Dynamite is an impulsive energy source which transfers seismic energy into the ground in the form of a short duration pulse. Explosive charges of diameter between 50 and 60mm in diameter are loaded into drilled holes and detonated during the recording phase. The depth of the drilled holes depends on the composition of the near surface weathered layer and it is desirable to drill the hole to a depth below the weather layer to achieve the best signal and bandwidth.

3.4.2.6 RECORDING

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. The recording of seismic data requires geophone arrays and interconnecting cables to be laid along the seismic lines. This is referred to as the seismic spread. Two popular industry methods include cabled and cable-less systems. Cabled systems include geophone strings and interconnecting cables laid along the surface at typical intervals of 12.5 to 60 m on the seismic line. Cable-less systems consist of autonomous data collection nodes connected to a single or string of geophones that are not inter-connected. Cable-less nodes are similarly placed at typical intervals of 12.5 to 60 m along the seismic line. The choice of system depends on many factors including suitability of terrain and surface conditions.

3.4.3 **OFFSHORE SEISMIC ACQUISITION**

Offshore seismic exploration is similar to onshore exploration, but rather than trucks and geophones, a boat is used to convey the equipment needed to generate the seismic waves and gather the seismic data, and hydrophones are used to pick up seismic waves underwater.

The hydrophones are towed behind a boat or cables are laid on the bottom of the sea or lakebed in various configurations, and are respectively referred to as “streamer arrays "or Ocean Bottom Cables (OBC). The seismic boat uses compressed point-source air pulses (“airgun”) that releases bursts of compressed air under water to create sound waves that travel down through the water column and into the earth’s crust and generate the necessary seismic reflection signal.

3.4.3.1 SURVEY DESIGN

Seismic survey design is driven by exploration objectives to image the sub surface. The survey design requires the placement of a pattern of seismic lines on the surface and set of acquisition parameters that define seismic source and recording configuration.

2D seismic lines vary in length and spacing. Length and spacing of seismic lines are dependent of the subsurface imaging objectives. For a regional wildcat survey 2D lines can be up to 2 km apart and vary in length from short lines less than 20 km to in excess of 100 km in length.

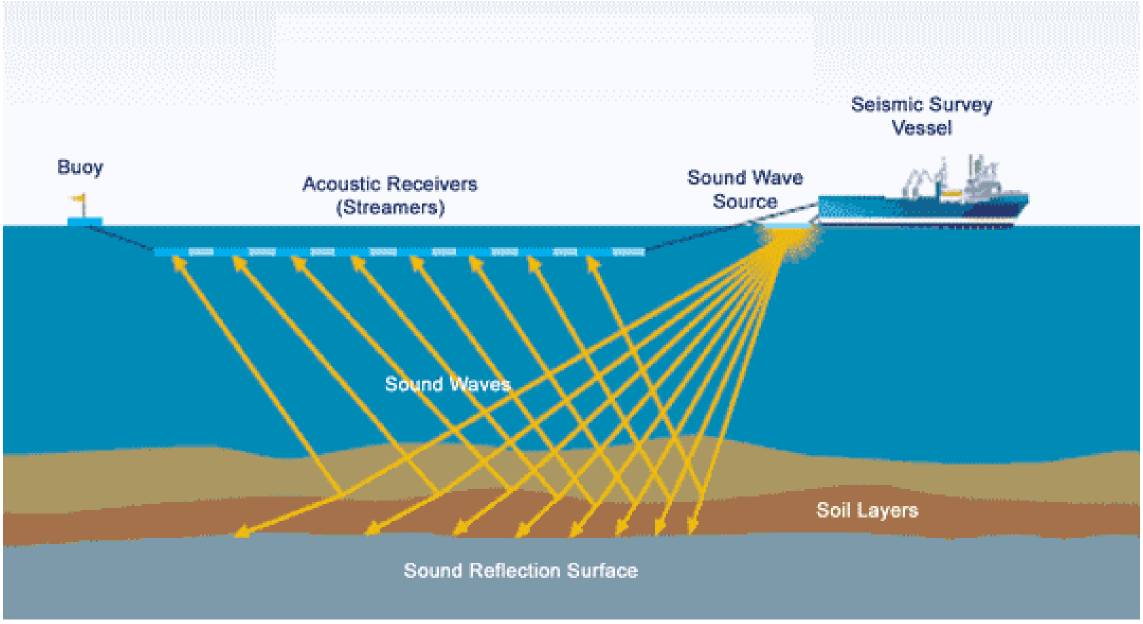


Figure 3.5: Offshore seismic survey
(Source: fishsafe.eu)

3.4.3.2 LINE CLEARANCE

Post sensitisation and prior to layout the lines are cleared of any remaining nets in line with a Marine Line Clearance Procedure.

3.4.3.3 DATA ACQUISITION AND RECORDING

Hydrophone arrays and interconnecting cables are laid along the marine seismic lines behind the Layout Vessels. These cables are laid on the bottom of the sea or lake bed in various configurations, and are respectively referred to as “streamer arrays” or Ocean Bottom Cables (OBC).

The Source Vessel houses the energy source, known as an Air Gun, used to generate and transmit this acoustic pulse. This is a compressed point-source that releases bursts of compressed air under water to create sound waves that travel down through the water column and into the earth’s crust and generate the necessary seismic reflection signal.

Recording in the transition zone (between land and marine) requires the deploying marsh phones from the land side (geophones cable of operating in water depths up to 1.5 m). These are connected to the land seismic recorder in a similar fashion to the geophone arrays.

3.4.4 **SEISMIC SURVEY LOGISTICS**

The seismic surveys are expected to take about three to four months to complete. 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. Base camps range in size and are constructed to accommodate around 250 to 350 persons depending on the size of the project. A mobile fly camp is a tented mobile camp 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 to accommodate 50 to 100 persons. 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. A Medevac plan will be developed for transporting injured parties out of the field. As far as possible, unskilled and semi-skilled workers will be hired from the local communities in an equitable and transparent manner.

3.4.4.1 SURVEY EQUIPMENT

In onshore seismic acquisition, 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. 4x4 vehicles will be required for movement of personnel and equipment and to support camp operations. Small shot hole drill-rig (Tractor-mounted, 4-wheel drive mounted or tracked unit), large drill-rig (self-propelled or truck-mounted), specialist trucks, , fuel delivery trucks (fuel-bowsers), water delivery trucks (water-bowsers), seismic recording trucks, mechanic support, 40 kVA generators, cables and geophone strings and portable seismographs are also used in onshore seismic survey.

In offshore seismic acquisition, equipment required include: Source Vessel (houses energy source), Recording Vessel, Layout Vessel (lays hydrophones), Zodiac (boat used for support), cables and hydrophone strings, fuel delivery trucks, water delivery trucks , mechanic support trucks, 40 kVA generators and portable generators.

Recording in the transition zone (between land and water) requires the deploying marsh phones from the land side (geophones capable of operating in water depths of up to 1.5 m). These are connected to the land seismic recorder in a similar fashion to the geophone arrays. Marine receiver arrays can also be laid out to optimise recording in these areas.

3.4.5 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.

3.4.6 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.

3.4.7 TRANSPORT EQUIPMENT

This could include the following: normal saloon/station wagon 4WD cars, pickups, water bowsers, 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.

3.4.7.1 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 (road and marine);
- 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-IFB).

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.

3.4.7.2 WATER SUPPLY

Bock 12B has a number of surface water sources including Lake Victoria and many other rivers. However, water levels in surface water sources reduce especially during the dry seasons. Groundwater resources are also available in the project area and are exploited through excavation of boreholes. It is expected that the proponent will drill a borehole to meet the water requirements of the proposed project.

3.4.7.3 EMISSION AND WASTE MANAGEMENT

a) Emissions

- **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 nature. Other sources of air emission 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.

- **Noise Emissions**

Noise emissions that could be released during the seismic operations will include those generated by Vibroseis machines, field machinery (mulchers, bulldozers 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.

b) 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.

The domestic waste disposal facilities will be located outside the perimeter fence of the camp compound. Typically, they would consist of solid waste pits and unlined grey water pits that would receive effluent from the bathrooms and kitchens. There would also be black water pits serving as settling and overflow discharge pits, set in a cascading sequence that should be treated and allowed to evaporate. The conveyance of waste water and black water effluents from the bathrooms, kitchens and toilets will be via PVC-drain pipes.

All waste material from field operations should be brought back to the base camp for proper disposal. Disposal options include: compaction and removal from site and burying (especially for biodegradable material), or a combination of these activities. Where practical, non-hazardous and non-recyclable wastes should be managed on-site. During construction of the campsite, qualified personnel should survey the land to determine the best site for construction of waste pits and/or landfills. 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 (Kisumu County Council) (Table 3.1). Biomedical waste will not be stored above 0ºC 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 costs 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-pressures gauges, etc.	Red	
8.	Pressurized containers	Gas cylinders, gas cartridges, aerosol cans.	No details provided	No details provided

	Type of Wastes	Details	Colour of Container and Markings	Type of Container
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 radio nuclides, sealed sources.	Red	Lead box, labelled with radioactive symbol
10.	General solid waste	Waste generated from offices, kitchens, packaging material from stores.	White	
11.	Micro organisms	Any biological entity, cellular or non-cellular capable of replication or of transferring genetic material.	No details provided	No details provided
	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 surface water features.
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
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.

Waste	Source	Management Control
Blood and offal	Slaughterhouse	Very low volume blood/offal waste is expected hence it will constitute a very small part of the waste stream. Under such conditions, wastewater treatment plants are sufficient to handle such waste. Blood is captured in containers and deposited in the food waste pit. Water wash with bloody residue is piped to the wastewater 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.
Building waste (rubble, rebar, metal)	Camp	Buried onsite; burial not to be within 30m of a 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.

Waste	Source	Management Control
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

3.4.8 DECOMMISSIONING/ABANDONMENT

3.4.8.1 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.

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 ESMP's developed during the ESIA for the seismic survey project;
- Preparation of a decommissioning strategy and ESMP before decommissioning begins;
- Awareness creation;
- Ecological, socio-cultural and economic survey of camp sites and impacts; and

- 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.

4. PERMITS

The following permits will be required:

a) Environmental impact assessment licence.
b) A licence from the National Environment Management Authority if it is intended to discharge waste into the environment close to or into a water resource.
c) Water well drilling and abstraction permits to be obtained by the borehole drilling contractor.

Other permissions/notifications which will be required include:

a) Permission from private landholders or the local authority depending on the type of ownership of the particular sites that will be identified as suitable for locating the camps;
b) Permission from affected stakeholders e.g. landowners to allow seismic lines to pass through their premises; and
c) Notification of the local authorities and community on seismic survey plans.

5. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PROCESS AND METHODOLOGY

5.1 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 life cycle. 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

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.

5.2 THE ESIA PROCESS

The approach taken for the ESIA with respect to the proposed 2D seismic survey in Block 12B was based on the following:

- 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;

- A thorough review of the potentially affected environment and the constituent receptors;
- A review of the nature of proposed project activities;
- A review of the results of published studies for similar projects;
- Determination/evaluation of the significance of the potential project impacts and recommendation of mitigation measures;
- The professional judgment of the specialist impact assessment team.
- Development of an Environmental Management Plan and Monitoring Programme; and decommissioning of the project; and
- Preparation of the ESIA Project Report.

The Assessment Report constitutes the final results of the study and will be presented to NEMA as required by the EMCA Act of 1999.

The ESIA process (refer to Figure 5.1) constitutes a systematic approach to the evaluation of the project and its associated activities throughout its lifecycle. The ESIA also included stakeholder consultations that had the goal of creating awareness about the project amongst stakeholder communities and organisations, as well as receiving feedback from them on their views and opinions about the project. They also provided useful information on the socio-cultural set-up of the area. The stakeholder feedback was used to focus the impact assessment and, where appropriate, influenced project design and execution.

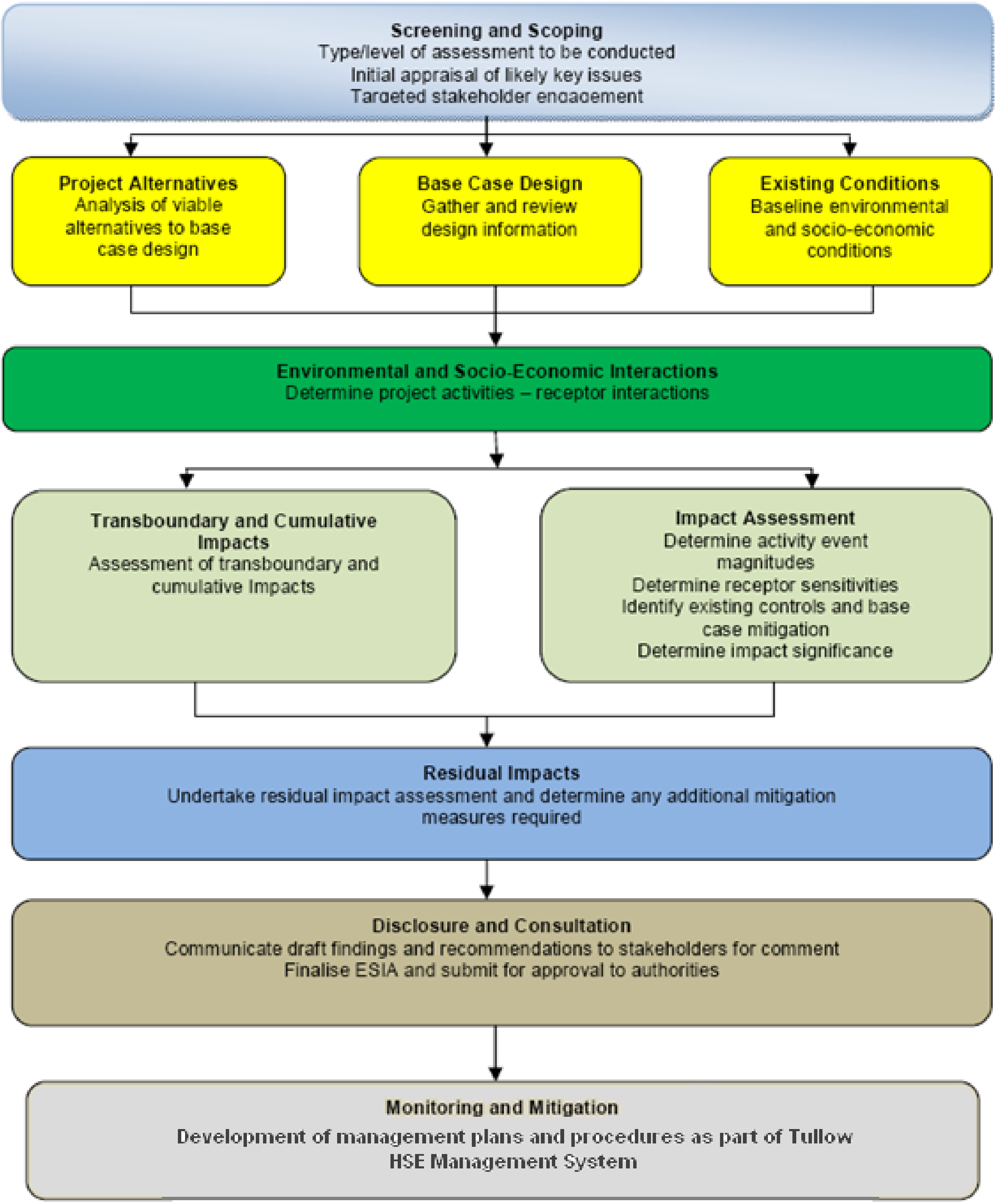


Figure 5.1: The ESIA process

5.3 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.

Table 5.1: Environmental and Social Parameters Assessed

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

PARAMETER TO BE ASSESSED	OUTPUTS
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

5.4 COLLECTION OF BASELINE DATA

5.4.1 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 (9th December to 21st December, 2012);
- Community/stakeholders public consultations and sensitization (9th December to 21st December, 2012);
- Impact identification and development of mitigation measures; and
- Development of an Environmental and Social Management Plan (ESMP) 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.

5.4.2 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.

5.4.3 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.

The soil characteristics determined were applied to predict the likely impacts the proposed 2D seismic survey would have on soil quality or land stability. They included slope, soil texture, colour, consistent soil depth, available water holding capacity, organic matter content, electrical conductivity and sodicity. These parameters were synthesized, rated and clustered with respect to: (1) the erosion potentials of soils that are already disturbed (by gullies, landslides, rill, sheet wash) under the current land use, cover or management and their vulnerability to change (positively or negatively) under the proposed project; (2) potential reduction in soil aggregate stability as a result of movement along the designed seismic survey lines; and (3) potential reduction in soil health due to reduced environmental filter/buffer capacity as result of depressions/compaction created by seismic survey machines.

Table 5.2 shows the land qualities examined and the corresponding land characteristics that were applied to evaluate the soil quality with respect to the proposed seismic survey in terms of soil's resistance to erosive forces expected to emanate from the project activities. The sub-ratings of the individual land characteristics were synthesized into the final rating of the degree of land degradation of all the observation points recorded.

Table 5.2: Selected land quality indicators for land degradation assessment

Land quality	Land characteristics that measure the given land quality
Available Water Holding Capacity (AWC)	Effective soil depth (D), slope (S) and texture (T)
Soil Erodibility (SE)	Organic carbon (SOC), Bulk density (Bd) and Silt/Clay ratio (SCR)
Salinity (SAL)	Electrical conductivity
Sodium (SOD)	Exchangeable sodium percentage (ESP)

Available water holding capacity was applied as a measure of resistance of soil to erosion. Resistance of soil to erosion is determined by the fraction of rainwater that can be absorbed and retained by the soil, leaving relatively less amount to flow on the soil surface as run-off. This fraction is determined not only by the depth of the soil, but also texture and slope. For instance, shallow soil depth will hold less water than deep soil, while steep slope will generate more run-offs, hence less opportunity time for water to infiltrate into the soil than gentler slope. Similarly, course textured soils will drain more water and retain less than fine-textured soils. In addition to holding water, deep soils allow for deeper root penetration to extract nutrients as long as there are no hindering or impermeable horizons.

Soil erodibility was used as an indication of the magnitude of erosion likely to take place if the current land use and production systems remain unchanged towards a more sustainable development. It is determined by organic matter content (SOC), bulk density (Bd), silt/clay ratio (SCR) and flocculation index (FI).

Salinity and sodicity levels were determined as indicators of soil structural stability against the dispersive effects of soil particles on aggregate stability and externally impressed forces on the soils.

Systematic and nomenclature

Broad soil mapping units were identified in different project sites, based on exploratory soil map at a national scale (1:1,000,000) under which systematic soil auguring and descriptions were carried out. In developing the soil mapping units, the first entry into the legend was physiographic described as follows:

M - Mountains

H - Hills

F - Footslopes

U - Uplands

Y - Piedmont plains

Ps - Structural plains

B - Bottomlands

The second entry was geology, described as follows:

U - Undifferentiated basement systems

A - Alluvial and colluvial deposits

The third entry was soil characteristics described as follows:

P - Shallow to deep

p - Shallow to moderately deep

b - Brown

r - Red

Soil and land use characterization

At each project site, observations were made across land use, landscape or ecosystem gradients within the radius of one kilometre from the point where community was met for discussions or interviews. At each point of observation, soil auguring was made to the depth ranging from 20 to 120 cm, depending on the soil depth to the weathering materials or bedrock. At each auger observation point, management practices, slope steepness, soil depth, soil colour, texture and consistence were recorded. On the basis of these characteristics, qualitative description of land degradation was done at the site and representative soil samples were taken for the laboratory determinations of mainly dynamic soil quality indicators (Table 5.3).

Table 5.3: Selected soil quality indicators

Indicator	Functions
Soil organic carbon	Stabilizing soil aggregates, sustaining soil fertility, soil moisture, and water transport.
pH	Defines biological and chemical activity thresholds, determines nutrient availability to plants.
N, P, and K	Plants available nutrients, used as productivity and environmental quality indicators.

Source: Muya *et al*. 2009

Management systems were characterized through visual assessment of land use systems on transects across the slopes.

5.4.4 CLIMATE

Temperature, wind and precipitation data were obtained from desktop studies of existing literature covering the area.

5.4.5 AIR QUALITY

Determination of the ambient air quality in the project area was assessed qualitatively.

5.4.6 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.

5.4.7 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.

5.4.8 AQUATIC ENVIRONMENT

Assessment of the lake environment included field-based identification of floral and faunal components in the project area and sampling, supported by a literature review. The lake habitats were assessed, covering issues such as: inventories of lake habitat types and species; presence of rare, endemic and endangered floral and faunal species; presence of ecological reserves interest were noted.

5.4.9 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.

5.4.10 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.

5.4.11 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.

5.4.12 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.

5.4.13 PUBLIC CONSULTATIONS AND SOCIO-ECONOMICS

Public consultations were carried out in diverse parts of the project area (See Table 7.24 in Chapter 7) 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.

The methodologies employed include review of available literature, posting of notifications of meeting dates times and venues, public meetings and consultation with local residents and their leaders, audiovisuals including PowerPoint presentations, and administration of formal questionnaires and interviews with interested parties and at household level.

Literature Review

This was done by examining different studies that have been done in the project area and other available literature on the socioeconomic baseline conditions in the project area.

Distribution of fliers and posters

Discussions on the appropriate dates and venues for the public consultations were made between the provincial administration, the CLO and consultants. In addition, the CLO and provincial administration facilitated the appropriate distribution of fliers and posters announcing the dates and venues for these consultations.

Public meetings and consultations

Owing to the vast size of 12B, venues for meetings were set on the basis of administrative district/division and representative from various areas under these converged at an appointed venue. The main issues discussed included:

- The extent of the project area;
- What seismic survey entails;
- The potential impacts of seismic survey on land and water resources;
- Tullow's Corporate Social Responsibility; and
- Tullow's compensation plan for those affected by the proposed project.

Presentations

Powerpoint Presentations of the proposed project were made to the stakeholders to give them a clear picture of what the seismic survey entails. The presentations detailed the proposed strategies to be used for 2D seismic survey in the Block under review. The stakeholders were then given a chance to express any issues and concerns they had regarding the proposed project.

Questionnaires and Interviews

Questionnaires were administered to the stakeholders to try and gather their views on the potential impacts that the proposed project was likely to have on their environment and social setup. This was done after giving the stakeholders a detailed account of the project description.

Focused Group Discussions

Other social and economic aspects relating to the project area were assessed after the public consultations. Over and above the consultations, issues related to livelihoods, social organisation, conflict resolution, asset ownership and distribution, organised groupings and cooperatives, important cultural and emotional sites as well as markets/market days were discussed in an open session.

5.4.14 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.

5.4.15 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 2D seismic survey on the operations of organizations/communities
- Main concerns regarding the proposed 2D seismic survey
- Suggestion to address these concerns
- Anticipated positive impacts
- Anticipated negative impacts
- Ways through which positive impacts can be enhanced
- Ways through which negative impacts can be avoided, reduced or mitigated

Plate 5.2: (a) A public meeting at Mbita Boys High School and (b) a public meeting in Nyakach district headquarters in Pap Onditi.

6. OVERVIEW OF THE ENVIRONMENTAL AND SOCIAL BASELINE

6.1 PHYSIOGRAPHY AND GEOLOGY

The geology of the area consists of rocks and sediments that range in age from Nyanzian (Precambrian) to recent times (Saggerson, 1952; Binge, 1962). The undifferentiated basement system rocks, found mainly on the Nyando escarpment, consist predominantly of gneisses and biotite gneisses. The geology of the southern part of the Block consists mainly of acid and intermediate igneous rocks (PreCambrian to Tertiary in age) to Recent alluvium, and various Pleistocene sheet flood and colluvial sediments.

The major Physiography of the eastern part of Block 12B comprises of highlands and lowlands. The highlands consist of hills and minor scarps, footridges, footslopes, uplands, and plateaus. The lowlands consist of piedmont plains, lacustrine plains, river valleys, alluvial plains, lakeside beach ridges and swamps.

6.2 SOILS

The soils of highlands of Kajulu Hills area in Block 12B are excessively drained to well drained, shallow to moderately deep, dark reddish brown to dark greyish brown, clay loam to clay, in places rocky, stony and gravelly loamy sand. They occur on slopes ranging from 7 to 20%. In the south western part of the Block (Sindo, Lambwe Valley and Kanyamwa area), the soils are derived from a range of parent materials and developed on uplands with steep slopes ranging from 4 to 16%. They are shallow to deep, well drained to excessively drained, very dark greyish brown to black, sandy clay to clay, in places, gravelly, stony and rocky. The southern part of Block 12B have soils occurring on various physiographic positions on undulating landscape consisting of hills, uplands, footslopes and plains.

6.3 CLIMATE

Lake Victoria Basin, which harbours Block 12B, has an equatorial hot (average temperatures range from 24°C to 38°C) and humid climate with a bi-annual rainfall pattern, where the long rains are experienced from March to May and short rains from October to December (Republic of Kenya, 2002). July is the coolest month of the year and the warmest month is variable and fluctuates in the period from October to February.

6.4 AIR QUALITY

There are a number of large scale industrial activities in the project area. They include three sugar processing companies, an agrochemical production company and a molasses plant. There are also a number of automobiles especially in the towns which emit exhaust fumes into the atmosphere. Consequently, the concentrations of carbon dioxide, sulphur dioxide, and nitrogen dioxide in air in the project area are considerably high in the towns and low in the rural areas. It is not expected that these emissions exceed the WHO guidelines.

6.5 SURFACE AND GROUND WATER RESOURCES

Lake Victoria forms the largest water resource in the proposed project area, and there are other relatively much smaller satellite lakes, such as Lake Simbi. Major rivers include River Nyando, River Sondu Miriu, River Awach, River Tende, River Nyamasaria, River Kibos and River Kisat. Other sources of surface and groundwater are water pans; hand dug well and deep boreholes and springs.

6.6 TERRESTRIAL ENVIRONMENT

The area is mostly dominated by the lake waters, farm lands and isolated pockets of pristine habitat which are mainly found in protected areas such as Lambwe Valley forest in Ruma National Park. Most of the areas in the block are highly disturbed due to human settlement. Economic activities such as charcoal burning have also resulted in destruction of most indigenous trees in the area. Sugarcane, maize and rice are the maize crops in the region though there are mixed farms with beans, sorghum, cotton, cassava, sweet potatoes and ground nuts. The dominant species of vegetation in the project area includes *Acacia brevispica, Balanites aegyptiaca, Harissonia abysinica* and *Makhamia lutea.* There are a diverse species of birds.

6.7 AQUATIC ENVIRONMENT

The water resources of the area comprises of surface water resources (Lake Victoria (the world's second largest fresh water lake), satellite lakes, rivers, dams and ponds), ground water resources, and rainwater. Lake Victoria is the main surface water body and hence defines the operational framework for the Basin activities. There are a number of other smaller lakes of varying depths, major inflowing rivers, dams and ponds, extensive riverine and lacustrine swamps. Direct rainfall over the Lake contributes by far the greatest (82%) source of water to Lake Victoria and the rest comes via major inflowing rivers, Aquatic diversity in the Lake Victoria has been declining over the last four decades mainly due to introduction of alien species. It is estimated that the number of fish species has been reduced to about over 200, the rest having been decimated through predation by the Nile perch and competition from the introduced tilapiines (*Tilapia zillii, T. rendallii, Oreochromis niloticus, O. melanopleura and O. leucostictus).* Overfishing has also contributed to depletion of the fish species.

6.8 LAND RESOURCES

Fishing, crop farming and pastures are the major land resources in the area. Sand harvesting is practiced in a very small scale near Nyakach and Nyamasaria areas. Abundant prehistoric remains found around the lake indicate the early development of agriculture.

6.9 VISUAL AESTHETICS

The project area lies in a location which has pristine and rugged scenic beauty with hills, riverine forests, plains cultural sites and archaeological sites. Additionally, there are Protected Areas (PA) that harbour wildlife and are therefore tourist attractions.

6.10 NOISE AND VIBRATIONS

Noise levels are acceptable and within the limits of natural background noise for the environment. Noise and vibration occur primarily as a result of vehicular traffic, road construction activities, and industrial and human activities within the small and sparsely populated town centers.

6.11 SOLID AND LIQUID WASTES

The major sources of solid waste are in urban setups especially Kisumu city and other major towns in the proposed project area, and sugar processing factories. Kisumu town for example does not have an adequate waste disposal system. The open dump used by the town is an eyesore and a source of foul odour in the town. Sugarcane and agrochemical industries and fish processing industries, including waste water treatment plants have been known to discharge untreated effluent into water bodies. Kisat River which passes through the industrial area in Kisumu is visibly turbid and has a bad odour as a result of this. Car washing activities on the Lake Victoria beaches in Kisumu has also resulted in pollution of the Lake with oil wastes and phosphorous laden detergents. Waste from urban areas within the catchment of Lake Victoria basin have contributed to increased environmental degradation through uncontrolled municipal and industrial effluents from the fish processing industries, pulp, artisan industries, farming, tanning, and agro-processing industries including sugar industries, which pollute the rivers that drain in the lake and directly to the lake. These factors have resulted in eutrophication of the lake and subsequent blooming of water hyacinth (Kenya LVEMP II ESMF).

The quality of the Lake Victoria water has deteriorated in several respects (Hecky and Bugenyi 1992). The lake depth, bottom oxygen content and transparency (the Secchi index decreased from 5m in 1930 to less than 1m in 1990s) have decreased, while sediment and water phosphorus and nitrogen concentrations have increased (Hecky, 1993). Erosion and subsequent sedimentation of rivers and water bodies cause serious pollution concerns for the lake. Sources of pollution are nutrient runoff from agricultural land, urban and industrial waste and biomass burning (ICRAF, 2000). There are minimal activities in the rural setups hence less waste production. Human activity including urbanization, deforestation, intense cultivation, animal husbandry, introduction of exotic fish species and over fishing, have accelerated the rate of nutrient inputs and recycling, resulting in changes in the physical, chemical and biological properties (Ogutu-Ohwayo, 1990; Hecky,6 1993; Hecky *et al.,* 1994, 1996; Lipiatou *et al*., 1996, Mugidde, 1993, Mwanuzi, 2005). Pollution has increased especially on the lake shores and on the islands in the lake. The effects of increased pollution from urban and industrial discharges and soil erosion are visible in some of the rivers and streams (e.g., Nzoia, Yala, and Nyando).

6.12 SOCIO-ECONOMICS BASELINE

The demographic and ethnic composition the project area include: Luos, Luhyas, Abasuba and Kalenjins. There is a composition of settlers and indigenous people involved in commercial activities of industrial production and trading and other social services. Mostly they are brought together by civil service, commerce and employment motives. These settlers include Arabs, Asians, Nubians and other ethnic groupings from other parts of the region.

The project area is densely populated with Nyanza alone having a population of 4,392,196 (URT, 2002).The age distribution, which has important implications to labour force supply shows a favourable structure in the sense that the dependency ratio is low with the lower end of the pyramid significantly favourable for future labour force. Kenya for example, has a dependency ration of 130% (CBS 2004).

The average number of those without formal education in Kenya is 18% while the health status in terms of delivery of health services measured as mean distance to a health centre or hospital is 24.5 for Kenya and 12.4 for Nyanza which is not way below the national average. The basic needs poverty line for Nyanza which makes a larger portion of the project is 70.9 [42.8] while the national average for Kenya is 52.6 [34.1] (Republic of Kenya, 2000).

Demographic aspects in Block 12B include gender especially the way men and women work together and the division of labour and how they share benefits from their contribution to production. Marital status is looked at in terms of the composition of households, whether polygamous or monogamous. The types of households do have implications on cultural values and beliefs. For instance polygamy is taken to be a sign of wealth and high social status in some communities.

Economic activities in the project area include: fishing, farming, bee keeping, trading activities, quarrying and sand mining and mining of gold and other minerals. Most of the inhabitants of the Lake Victoria Basin are farmers. Despite the abundant land and fisheries resources, the inhabitants of the lake region are among the poorest in the region. An average of 39% of inhabitants of the Kenyan side of the Lake Victoria basin lives below the Basic Needs Poverty Line (Republic of Kenya, 2002). Agriculture is also a major economic activity in the area. Farming of food crops including maize, bananas, cassava, sorghum, millet, rice, sweet potatoes and an assortment of vegetables and fruits and cash crops is practiced in the area while the main cash crops cultivated in the area include sugar cane and rice.

6.13 PUBLIC CONSULTATIONS

The ESIA public consultation for purposes of acquiring project social permits was conducted over 10 days and had the following broad objectives:

- To present to key stakeholders the process of 2D land and marine seismic surveys, the potential effects and measures in place to ensure public engagement, environmental and social safety, justice and fairness
- To discuss and address environmental, cultural, and socio-economic issues and concerns raised during the consultations
- To acquire social permit and commitment to proceed with 2D seismic surveys.

An average of 25 stakeholders, drawn from the provincial administration, education, beach management, elders, religious leaders, women leaders, youth leaders, environmentalists town, municipal and county councils participated in each of the 8 public consultation meetings.

Key issues

- Social permits were acquired from all 8 public consultations
- Main concerns related to compensation, cultural corruption/pollution, displacement, introduction of new diseases and social ills, (in) security, immediate and long term benefits to the community and project commencement/duration.
- There were a number of culturally important sites, markets, community lands, wetlands and forests as well as cooperatives identified.
- There exist both social and legal dispute and conflict resolution mechanisms
- Decision-making, property distribution and other cultural decisions are largely the province of men although the above issues are of late tempered with consideration of the new constitutional dispensation.

- Any attempt at seismic survey in block 12B needs to be conducted only after an all inclusive sensitization of the community using all available and acceptable media, establishment of clear mechanisms for addressing grievances and loss, a well spelt out assurance that nobody will be displaced and that culturally, economically and historically important sites will not be interfered with to the extent possible.

Table 6.2: A summary of Key Issues Identified during Public Consultations

Area	Key Issues	Recommendations
1. Mbita District	The stakeholders wanted to know: • The specific boundaries of Block 12B • The duration of the seismic survey in the Block • How affected parties will be compensated • If the proposed project will cause conflict as a result of regional boundaries within the Lake	• Tullow should intensify their efforts in creating awareness of the proposed project in the Block. • Tullow should employ more CLOs to provide timely information to the community.
2. Rachuonyo North District	The stakeholders wanted to know: • The mode of compensation that will be used to take care of persons affected by the proposed project • If vibrations from the Vibroseis trucks would destroy built areas • If Tullow had a Social Investment Plan for the area • If vegetation in the area would be destroyed	• Tullow should form a committee with selected community members to discuss compensation plans for affected community members • CLOs should have meetings with community members to inform them about both positive and negative impacts anticipated from the proposed project • Tullow should detail to the community the Social Investment Plans they have in place.
3. Nyakach District	The stakeholders wanted to know: The duration of the proposed seismic survey If another ESIA will be carried out in the event that Tullow wants to proceed to the next phase of the project The specific areas in which the cut lines will pass through The criteria that will be used when sourcing for labour from the community	• Early communication of the areas in which the provisional seismic lines will pass through should be done • Administrative leaders should be involved in the proposed project • The community should be made aware that the ESIA is for the 2D seismic survey project • The possible duration of the seismic survey should be communicated to the community
4. Kericho West District	They wanted to know: • If Tullow will employ members of the community	• Tullow should as much as possible source for skilled and semi skilled labour from the

	• How private landholders whose land will be used during the survey will be compensated	project area • A compensation plan should be discussed with community members before the commencement of the survey to eliminate potential conflicts
5. Kisumu East and Kisumu West Districts	• There was concern about how community members whose land is affected by the seismic survey will be compensated They wanted to know: • How social impacts such as erosion of culture and immorality would be mitigated • If the offshore seismic survey would scare fish away • The measures that will be put in place to ensure that fish breeding areas are not interfered with	• Tullow should have behaviour change communication sessions with its employees • The offshore seismic acquisition process should be explained to the community • Wetlands and fish breeding sites should be avoided during seismic data acquisition
6. Budalangi District	They wanted to know: • If residents would benefit from employment opportunities • The impacts of offshore acquisition on fish on the lake	• In as much as possible, skilled and semi skilled labour should be sourced from the communities • The community should be made aware of the potential impacts of offshore acquisition on aquatic life
7. Bondo District	They wanted to know: • If some people would be displaced from their land by the seismic survey process • If there are chemicals used during the survey processes that can interfere with aquatic and terrestrial life	• CLOs should ensure that they continually liaise with the community on land acquisition and compensation issues
8. Nyando District	They wanted to know: • If built areas will be avoided in the event that the provisional cut lines pass through them • When the seismic survey activities would commence • They wanted to know if the Vibrations caused by Vibroseis trucks would interfere with built areas.	• CLOs should create awareness on the seismic survey process in the community

7. AREA OF INTEREST BASELINE

7.1 ONSHORE BASELINE

7.1.1 CLIMATE

7.1.1.1 WIND

The hydraulic process of the basin is influenced by seasonal winds in the months of January-February and June-September; the wind pattern is predominantly east-west, parallel to the equator, with origins from the western parts of Kenya and Tanzania. These fairly dry winds pick moisture while crossing the lake subsequently depositing it to the western catchments especially Bukora catchment, Uganda. During March-May and October-December, the wind pattern changes towards the northern parts of the lake (LVEMP TRDA, 2005). Wind rose data for Winam Gulf area, showing wind speed and direction recorded on December 2004 is as shown below:

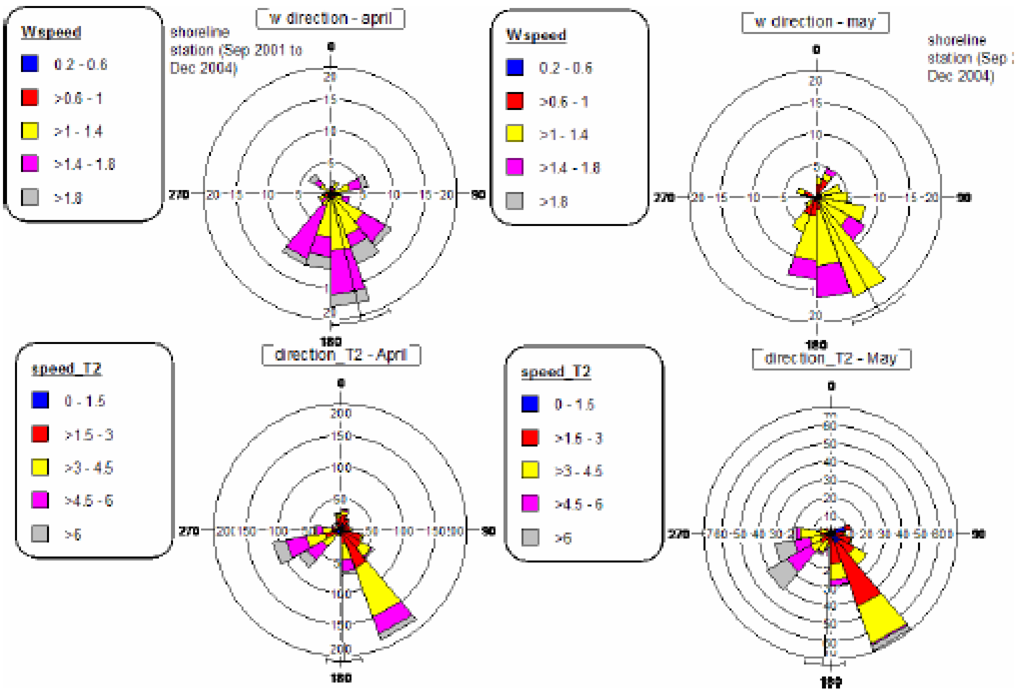


Figure 7.1: The effect of turbid inflows into Winam Gulf, Lake Victoria (source: Khisa *et al.*, 2005).

7.1.1.2 RAINFALL AND TEMPERATURE

Lake Victoria Basin falls under the equatorial hot and humid climate with a bi-annual rainfall pattern, where the long rains are experienced from March to May and short rains from October to December. July is the coolest month of the year and the warmest month is variable and fluctuates in the period from October to February. Rainfall varies considerably from one part of the Basin to another with the average annual rainfall in the project area being between 1,350 mm - 2,447 mm.

The temperatures reach their maximum in February, just before the March equinox and reach its lowest records in July after the June equinox maximum and range from 28.6°C

– 28.7°C. The minimum temperature varies from 14.7°C to 18.2°C. Comparison of temperatures records for the period 1950-2000 to 2001-2005 show that maximum temperatures have increased by an average of 1°C (LVEMP-TRDA, 2005).

Table 7.3: Monthly average rainfall and temperature data for Kisumu in Block 12B

Monthly Average	January	February	March	April	May	June	July	August	September	October	November	December
Rain-fall (mm)	65	97	150	224	162	78	68	84	88	89	146	101
Max. Temp (°C)	35	36	37	35	35	34	34	34	35	35	36	36
Min. Temp (°C)	12	12	12	12	12	11	11	11	12	12	12	12

Source: Kisumu Meteorological Department

7.1.2 SURFACE WATER

7.1.2.1 RIVERS

The major rivers that flow within Block 12B are the Nzoia, Yala, Awach, Gucha, Migori and Sondu. River Sio passes through Funyula while River Nzoia passes through Budalangi which lie within Block 12B. River Sondu Miriu is heavily relied on by KENGEN for the generation of hydroelectric power in the Sondu Miriu power plant.

Some of the other rivers in the region include rivers Budalangi, Maseno, Kisat, Kibos, Nyando, Nyamgun, Mbugru, Yala, Daraja Mbili, Kisat, Nyamasaria, Luanda, Nyando, Awach, Awach Kibuon and Awach Tende. Rivers Asawo, Mariwa and Nyando are perennial rivers. River Awach Tende originates from Belgut area in Kericho. River Kibos has its catchment in Eldai, Nandi County. Yala River does not enter Lake Victoria directly but rather empties its waters into Lake Sare and Lake Kanyaboli. River Kisat passes through Kisumu city hence it is highly polluted by industries and sewage works (Figure 7.2).

The upland of the Lake Victoria Basin such as Eldai and Tinderet in Nandi County have rock outcrops and have a number of springs and streams which provide the residents with fresh water. Man-made surface water sources in the area include pans and dams. Dams in the project area include Futro, Maranda, Masawa, Mwer, Ochilo, Ochot, Ugege and Uranga.

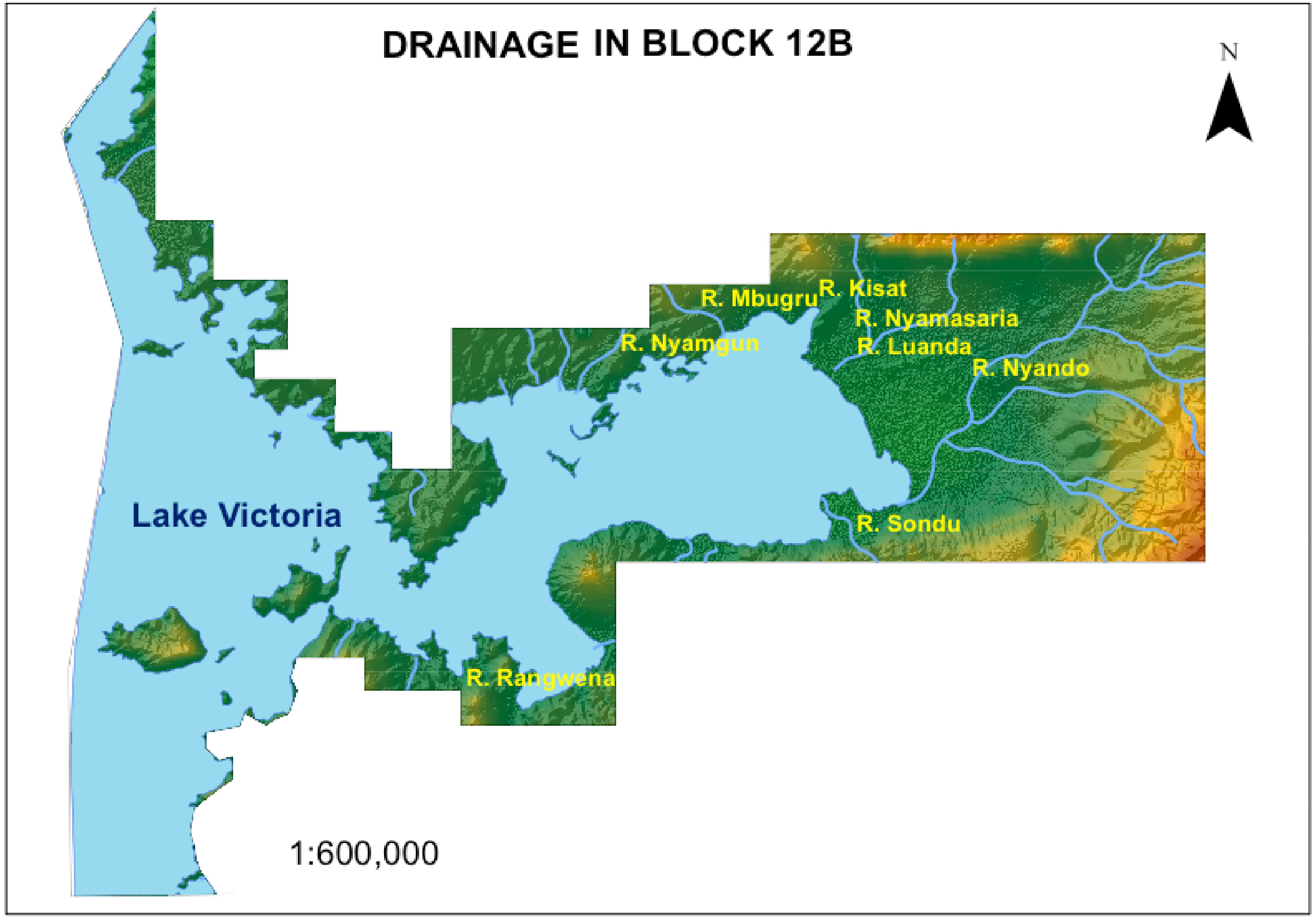


Figure 7.2: The drainage system in Block 12B

Plate 7.1: River Tende in the proposed project area

7.1.2.2 LAKE VICTORIA AND SATELLLITE LAKES

Lake Victoria is the second largest (surface area, 68,800 km^2) freshwater lake in the world. It lies across the equator between 0^0 20'N-3^{0}0'S and 3^{0}0'S and 34^{0}53'E at an altitude of 1135 m above sea level (Crul, 1992). It is shared by Kenya, Uganda and Tanzania. The Kenyan side of the lake occupies an area of 4100 km^2. The lake has a maximum depth of 85m and a mean depth of 40m. The lakes shoreline is highly indented and is estimated to be 3,460 km long (Welcomme, 1972).

There are a number of satellite lakes in the project area. They include: Lake Sare, Lake Namboyo and Lake Kanyaboli. Lake Sare, located at 00^{0}01'45''S 034^{0}03'01''E with an average depth of 3.5m is approximately 50km^2 and connects to Lake Victoria through the Goye causeway. Lake Namboyo located at 00^{0}00'25''N 034^{0}05'32''E, with an average depth of 7m and is approximately 20km^2. Lake Kanyaboli is located on the North Eastern extreme of Yala swamp at 00^{0}04'30''N 034^{0}09'36''E, with an area of 10.5 km^2 has a depth of 5m (Mavuti, 1991). Lake Simbi is also located in the project area.

Plate 7.2: Lake Simbi in Rachuonyo District in the proposed project area

Table 7.2: River flows in the Lake Victoria Basin

River basin	*Flows in cumecs**	*%*	*Flows in Cumecs***	*%*	*Flows in cumecs****	*%*
Sio	11.4	1.4	9.8	1.4	11.3	1.4
Nzoia	116.7	14.5	107.4	15.7	116.1	14.6
Yala	37.7	4.7	47.9	7	38.4	4.8
Nyando	18.5	2.3	41.9	6.1	20.3	2.6
North Awach	3.8	0.5	8.3	0.5	3.7	0.5
South Awach	5.9	0.7	5.8	0.8	5.9	0.7
Sondu	42.2	5.2	43.9	6.4	42.4	5.3
Gucha	58	7.2	39.9	5.8	56.6	7.1
Total	294.2	36.5	304.9	43.7	294.7	37

*Data for 1950-2000; ** Data for 2001-2004; *** Data for 1950-2004

Source: Integrated Water Quality and Limnology Study of Lake Victoria LVEMP, 2005.

Key wetlands in the proposed project area include the Yala Swamp (17,500 ha), Lake Sare (500 ha), Lake Namboyo (1 ha), the Nyando Swamp (15 by 6 km); the Sondu- Miriu wetland (10,000 ha); the Saiwa Swamp (20 km long) and the Kimandi River wetland (4,800 ha). Lake Kanyaboli (1,050 ha), is on the North eastern boundary adjacent to the project area.

Despite the major towns and cities in the Basin being in the neighborhood of one of the largest fresh water lakes in the world, access to clean water remains a major challenge. In Kisumu, Homa Bay and Kendu Bay towns, located on the shores of Lake Victoria, water supply remains far below the demand levels. For the majority of these cities and towns the water and sanitation analyses are such that:

Water supply for domestic and industrial use is far below the demand levels;

On the average, only about 40% the urban Basin population is served with clean water supply as at 2006;

Most of the water supply and sewerage infrastructure is old and outdated equipment;

The conventional waste-water treatment systems have, generally, collapsed. For example, Kisumu City discharges raw sewage into the Lake through Kisat River and into Kisumu Bay due to this situation.

7.1.3 GROUND WATER

Following discussions with Lake Victoria Environmental Management Program II (LVEMP II) water specialist revealed that the higher areas of Block 12B have more fresh and higher quality streams while the lower areas of the block have less saline water but with a high water table. Other water sources were boreholes, as illustrated in Plate 7.3, and a hot spring that was encountered at Abundu area.

Plate 7.3: A community borehole in the project area

The groundwater in the lowlands of Kano Plains has high fluoride levels and high water table which make the water both unpalatable and prone to contamination.

7.1.4 GEOLOGY

Block 12B straddles the equator, perched high on the African craton in tectonic sag between the two Rift Valleys of East Africa (Figure 7.3). The lake is relatively young, formed through tectonic forces over 400,000 years ago (Johnson *et al.* 2000). Most of the lake is surrounded by Precambrian bedrock, with the exception of the Kavirondo Gulf in the north eastern corner. Tertiary and recent alkali volcanic and sedimentary units dominate the terrain. Three major desiccation events are recorded in the seismic records that may reflect the 100,000-year Milankovitch cycle. The lake has suffered periods of complete desiccation and sometimes pluvial flooding escapades. The most recent arid period resulted in complete desiccation of the pre-existing lake. Some of the observation points visited during the field study consisted of rocks and geological formations shown in Figure 7.3.

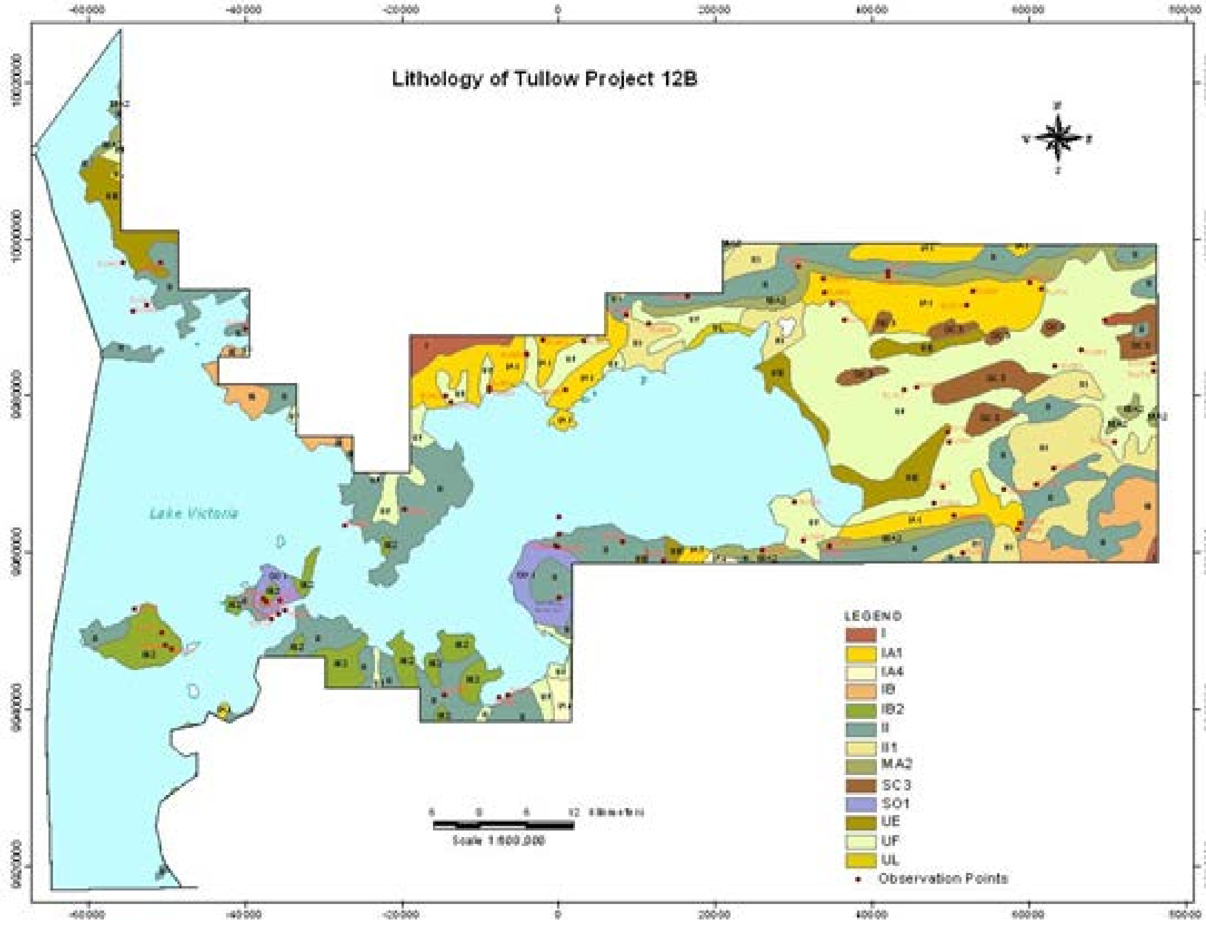


Figure 7.3: The lithology of Block 12B (I – Igneous rock; IA1 – Granite; IA4 – Rhyolite; IB – Basic igneous; IB2 – Basalt; II – Intermediate igneous; II1 – Andesite, trachite, phonolite; MA2 – Gneiss, migmatite; SC3 – Siltstone, mudstone, claystone; SO1 – Limestone, other carbonate rocks; UE – Eolian; UF – Fluvial; UL – Lacustrine).

7.1.5 SOILS

Hill wash accumulations are widespread and occur along the northern and southern escarpments (Saggerson, 1952). The soils may be divided into three principal types: black cotton soil, red lateritised soils and granitic soils (Saggerson, 1952). The black cotton soils (Planisols and Vertisols) occupy much of the lowland watershed of the Nyando River, confined within the northern and southern escarpments, and are separated from the red soils (Nitisols and Cambisols) that characterise the higher elevation areas by the hill wash sediments. These soils are poorly drained, very deep, dark grey to black, slightly sodic, cracking clay (PI12) (Figure 7.4). The soils on the southern strip bordering Winam Gulf, constrained to the south by hill wash sediments and extending eastwards to the footslopes of the Kericho highlands are generally well drained to moderately drained, sandy clay loams to clays. The soils on the northern strip bordering Winam Gulf and extending eastwards along the footslopes of the Nandi escarpment change (from west to east) from well drained, brown to reddish yellow, sandy clay loam to sandy clay (UI3), through to well drained, moderately deep to very deep reddish clay (UI11) then to predominantly imperfectly drained, very deep, dark grey to black, cracking clay (Y11) (Figure 7.4). Lava deposits have produced fertile and sandy loam soils in the plateaus north and south of Winam Bay. The Kericho highlands at the eastern margin of the block comprises mainly of well drained, very deep, reddish sandy clay loam to clay (U-class group of soils - Figure 7.4).

Soil degradation in the basin is both prevalent and severe (Cohen et al., 2006) and the Nyando River basin has been identified as a regional erosion hot-spot (ICRAF, 2000). Erosion is particularly severe in the lowlands where, despite shallow relief, networks of gullies (Plate 7.4 below) and eroded riverbanks threaten transportation, agricultural production, settlements, and downstream water quality (Cohen et al., 2006). Severe soil crusting is prevalent. Soil degradation prevalence (55% of lands degraded, 25% severely) was estimated by linking ground survey data with satellite imagery in the Awach River basin, a major tributary of the Nyando (Cohen et al., 2005). More site specific details on the soils are presented in Appendix 6.

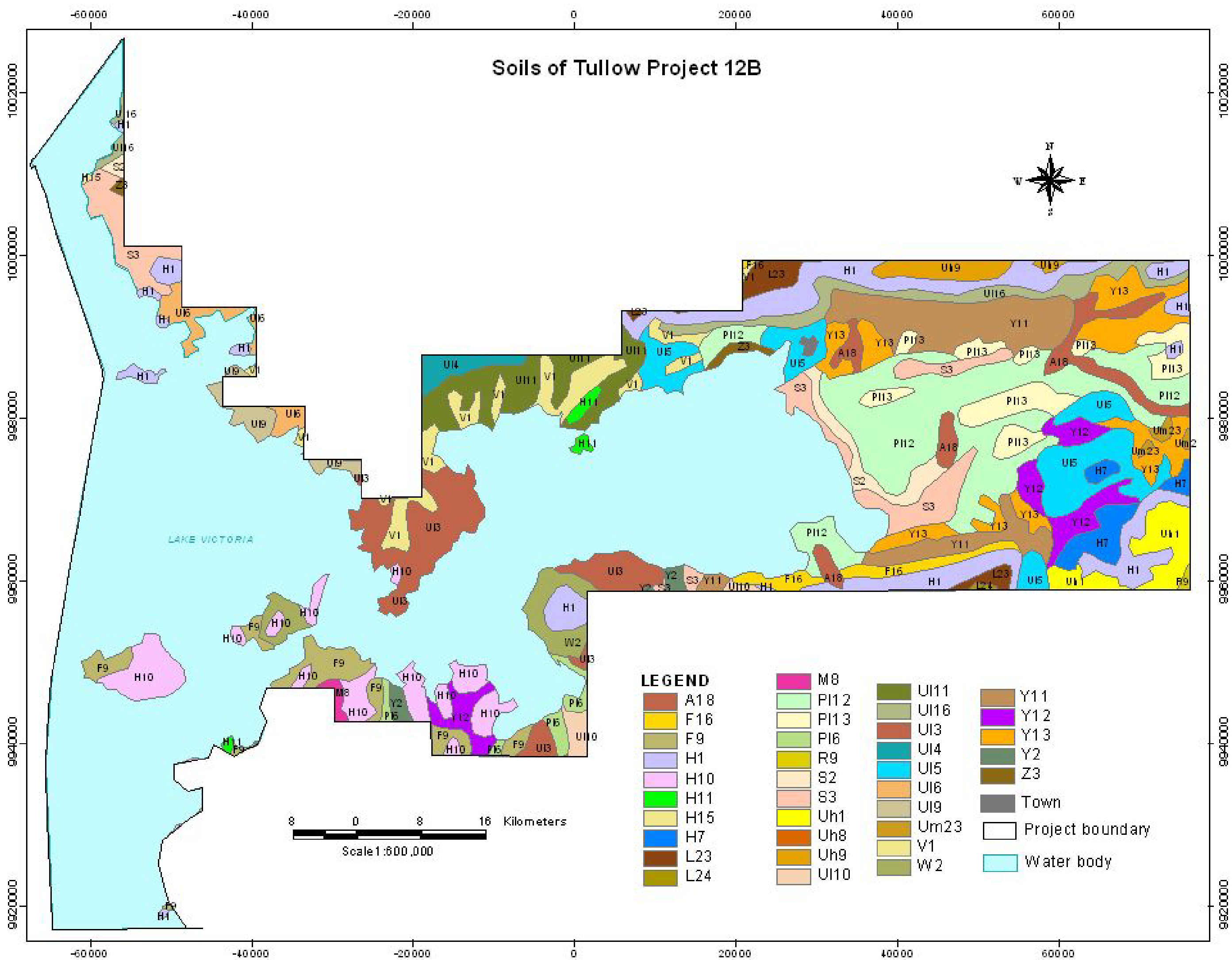


Figure 7.4: Soil mapping units in Block 12B (See table 7.4 below)

Plate 7.4: (a) Black cotton soils in Kano Plains exhibiting severe land degradation and (b) Severe land degradation on the lowlands of Kano plains

Table 7.3: Specific soil mapping units in the project area:

Mapping Unit	**Classification**	**Brief Description**
A18	eutric fluvisols	Complex of well drained to imperfectly drained, very deep, dark grayish brown to dark reddish brown, stratified soils of varying consistence and texture
F16	Complex of well drained, deep to very deep, dark reddish brown to dark yellowish brown soils of varying consistence and texture; in places gravelly and stratified	Ferralic arenosols; with ferralo-chromic/orthic luvisols
F9	Complex of well drained to moderately well drained, deep, reddish brown to very dark grayish brown, firm, sandy clay loam to clay; in moderately calcareous	undifferentiated luvisols
H1	Somewhat excessively drained, shallow to moderately deep, dark reddish brown, friable, gravelly clay, with an acid humic topsoil	Humic Cambisols, partly paralithic phase
H10	Complex of weel drained to moderately well drained, shallow to moderately deep, dark brown, firm, stony, clay loam to clay; in places with a humic topsoil	Eutric Regosols, partly lithic phase; with verto-luvic Phaeozems, partly lithic phase
H11	Complex of somewhat excessively drained, shallow, stony and rocky soils of varying colour, consistence and texture	Dystric Regosols, lithic phase; with ferralic Cambisols, lithic phase and Rock Outcrops

Mapping Unit	Classification	Brief Description
H15	Complex of excessively drained to well drained, shallow, dark red to brown, friable, sandy clay loam to clay; in many places rocky, boulder and stony and in places with an acidic humic topsoil	Dystric Regosols, lithic phase; with Lithosols, humic Cambisols, lithic phase and Rock Outcrops
H17	Well drained, shallow, reddish brown, friable, rocky and stony sandy clay to clay	Chromic ambisols, lithic phase; with eutric Regosols, lithic phase, Lithosols and Rock Outcrops
L23	Well drained, very deep, dark reddish brown to dark red, friable clay	nito-rhodic Ferrasols
L24	Well drained, moderately deep to deep, dark red, friable clay, over petroplinthite; with inclusions of small bottomlands of unit B2	Rhodic Ferrasols, petroferric phase
M8	Well drained, shallow, dark brown, firm, rocky and stony, clay loam	Eutric Regosols, lithic phase; with Rock Outcrops
PI12	Poorly drained, very deep, very dark grey to black, very firm, slightly sodic, cracking clay, with a calcareous deeper subsoil; lower level of Kano plains	Pellic Vertisols, sodic phase
PI13	Poorly drained, shallow to deep, very dark brown to very dark grey, firm to very firm, slightly sodic, cracking clay; upper level of Kano plains	Chromic Vertisols, sodic and partly lithic phase
PI6	Imperfectly drained to poorly drained, very deep, dark grey to dark greyish brown, very firm, slightly calcareous, non to slightly saline, moderately sodic, cracking clay; upper level of Lambwe valley	chromic Vertisols, sodic phase

Mapping Unit	**Classification**	**Brief Description**
R9	Association of: well drained, extremely deep, dark reddish brown, friable clay with an acid humic topsoil; on interfluves -and well drained, shallow to moderately deep, dark reddish brown to dark brown, friable, clay loam to clay, with an acid humic topsoil; on valley sides	Humic Nitosols humicCambisols partly lithic phase
S2	Very poorly drained, very deep, very dark grey to black, firm, cracking clay, with an acid humic topsoil; seasonal swamps	Humic Gleysols
S3	Very poorly drained, very deep, dark grey to black, firm clay, with an acid humic topsoil; in many places peaty; permanent swamps	Humic Gleysols and dystrics Histosols
Uh1	Well drained, extremely deep, dark reddish brown to dark red, friable clay, with an acid humic topsoil	Humic Nitosols
Uh8	Well drained, very deep, dark red to yellowish red, friable to firm, sandy clay to clay, with an acid humic topsoil	humic Acrisols, rocky phase
Uh9	Well drained, deep, yellowish red to brown, friable clay loam, with an acid humic topsoil	humic Cambisols; with humicAcrisols
Ul10	Complex of predominantly well drained, moderately deep to deep, reddish brown to brown, friable, gravelly clay loam to clay, often with a humic topsoil; in many places shallow over petroplinthite	Chromo-luvic Phaeozems and orthic and chromic Luvisols, partly petroferric phase; with Ironstones soils
Ul11	Complex of: well drained, moderately deep to very deep, reddish brown to yellowish brown, friable clay, over petroplinthite and -moderately well , shallow, brown friable sandy clay loam, over petroplinthite	Orthic Ferralsols, partly petroferric phase; with orthic Acrisols Ironstone soils

Mapping Unit	Classification	Brief Description
UI3	Well drained, deep, strong brown to reddish yellow, very friable, sandy clay loam to sandy clay	Orthic Ferralsols; with ferralic Cambisols
UI4	Well drained, moderately deep to deep, dark reddish brown to dark red, friable to firm, sandy clay to clay; in many places with stoneliness	Chromic Luvisols
UI5	Well drained, very deep, dark red to dark reddish brown, very friable, sandy clay loam to clay	Rhodic Ferralsols
UM2	Well drained, very deep, red to dark red, friable to firm, clay; in places moderately deep over petroplinthite	eutric Nitisols; with rhodic Ferralsols, partly petroferric phase
VI	Complex of well drained to poorly drained, deep, dark reddish brown to black, firm, silty clay to clay; in places calcareous and/ or cracking	
W2	Excessively drained, reddish brown, firm, strongly calcareous, slightly to moderately saline, strongly sodic, silt loam to clay loam of varying depth; strongly eroding and in many places with a gravel or stone surface	Undifferentiated Solonetz; with calcic Xerosols, Lithosols, etc.; stone-mantle phase
Y11	Imperfectly drained, very deep, very dark grey to black, very firm, cracking, clay, with a calcareous deeper subsoil; in places gravelly	Verto-eutric Planosols
Y13	Complex of moderately well drained to poorly drained, very deep, dark brown to dark grey, firm to very firm, sandy clay to clay; in places stratified, sodic and/ or cracking	Planosols, Gleysols, Solonetz, Vertisols and Fluvisols
Y2	Well drained, deep to very deep, dark brown, firm clay; in places cracking and/ or calcareous and sodic	Vertic Luvisols; with calcic Luvisols, sodic phase and chromic Vertisols, sodic phase
Z3	Imperfectly drained, very deep, dark brown to grayish brown, friable, sandy loam to sandy clay of varying salinity and sodicity; with inclusions of loose sand to loamy sand	Undifferentiated Solonchaks; with undifferentiated Arenosols

7.1.6 LAND-COVER

The land cover of the proposed project area is mainly composed of plantations of sugarcane, flooded areas where rice is cultivated, shrubby and herbaceous savanna, shrub savanna with *Acacia* and *Themedia* and tree savannah comprising *Commiphora*, *Combretum* and *Hyparrhenia* as well as dense evergreen forests with *Ocotea*, *Aningeria* and *Cassipourea* (Figure 7.6). The natural habitats include open grasslands, wooded/bushed grasslands, bushland, riverine indigenous vegetation, maize and beans farms and thickets.

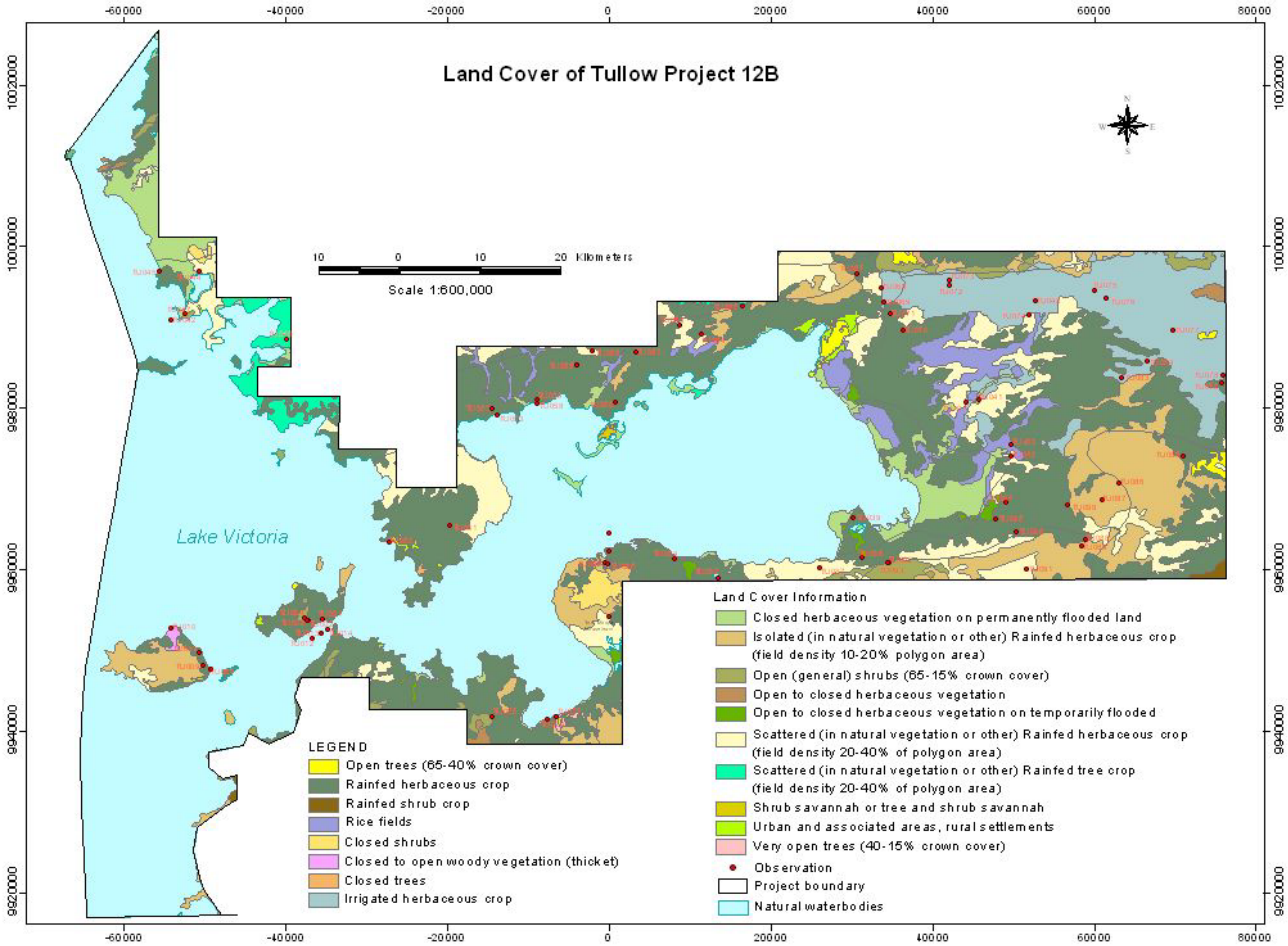


Figure 7.5: Land cover of Block 12B

7.1.7 TOPOGRAPHY

Topographical features in Block 12B include the scattered highlands such as Got Ramogi, Usenge, Sirafungo, Got Abiero and lowlands including Yala Swamp and Uyoma Plains (BONDO DEAP, 2009-2013). Other features include Kano Plains and Nyabondo Plateau.

The topography of these districts is varying, ranging from uplands of various levels to plains and alluvial valleys in the central and western part. Steep topography was found along the shores of Lake Victoria, at the Gwasi and Gembe Hills and various other Hills (*viz* Homa Hills). The majority of the district is underlain by relatively “acid” parent rock, causing soils of low fertility, and only small areas with basaltic rock types with better soils occur. Mountain soils (M) have little profile development, and vary greatly in texture. They often occur together with rock outcrops and stones (units MBC, MPC). These are mainly soils for forests. Hill soils of unit HB1 are similar, but topography is more subdued. On some of the hills, soils of varying depth and stoniness are found. Therefore, the fertility is variable. On the associated foot slopes most soils (F) have moderate fertility. The sloping piedmont plains (Y) carry soils partly similar to those of units F, associated with vertisols where the topography becomes flat. They are fertile for suitable crops which are able to stand on its heavy texture and tendency for water logging.

7.1.8 HABITAT

Block 12B is endowed with a variety of wildlife and sceneries of tourist value. Such sites and sceneries include national parks, wildlife reserves, lakeshore beaches, wetlands, forests and unique physical features, with huge potential for tourism. In the 16 administrative Districts of the area under review are the Ruma National Park (120 Km^2), Ndere Island (4.2 Km^2), Lake Kanyaboli National Reserve (21.42 Km^2) and Impala sanctuary. Impala Sanctuary is divided into two sections, A and B, which are 0.34 and 0.06 Km^2 respectively.

Additionally, there are 40 other gazetted forest reserves in the region. Some of the forests within Block 12B include Karateng A and B forest near Maseno, Kajulu Hills in Nyando, Koguta Forest in Sondu, Homa Hills in Kendu Bay, Asego Hill in Homa Bay and Lambwe Forest in Ruma.

There are a number of wetlands such as Yala swamp (17,500 ha), including Lakes Kanyaboli, Sare and Namboya, Nyando wetland which is situated at the mouth of R. Nyando, extending back to Kano Plains, Sondu Miriu wetland at the mouth of Sondu-Miriu river and Mogusi wetland next to Homa Bay town.

Extensive forest destruction in the proposed project area, which is apparently an important source of Sondu and Mara Rivers should be viewed with great concern. Such continued destruction is likely to have an adverse impact on the potential of hydro-power generation at the Sondu-Miriu plant as well as the health of the Mara and Serengeti ecosystems which are not within the Block 12B area.

As a result of land-use segmentation in the proposed project area, vegetation was divided into different habitat types each of which was described individually. For the ease of vegetation survey, different habitat types which corresponded to different vegetation types were denoted using the name of the local place that lie within the project area. In each vegetation type, a full description of habitat terrain features as well as vegetation physiognomic structure and dominant species composition is given and the habitat/vegetation types identified.

7.1.8.1 KAKRIGU, RUSINGA ISLAND

Open Bushland/Settlements

This is a purely indigenous Open bushland with a dense tree canopy of about 80% with main trees including *Croton megalocarpus*, *Markhamia lutea*, *Acacia seyal*, *Leucaena leucocephala*, *Thevetia peruviana*, *Ficus thonningii*, *Cordia ovata*, *Ehretia cymosa* and *Euphorbia candelabrum*.

There are understory vegetation or bushes of *Ipomoea kituiensis*, *Acalypha frutcosa*, *Senna didymobotrya*, *Lantana cámara*, *Barleria sp*., *Leonotis nepetifolia*, *Abutilon mauritianum*, *Sida cuneifolia*, *Ocimum basilicum*, *Solanum incanum*, *Cissus sp*., *Jasminum sp*., *Maytenus heterophylla*, *Euphorbia triculii*, *Psiadia punctulata*, *Acacia mellifera*, *Capparis tomentosa*, *Grewia mollis*, *Securinega viosa*, *Triumfetta rhomboidea*, *Sesbania sesban*, *Ipomoea cairica*, *Polygonum senegalensis*, *Aloe secudiflora* and *Monadenium sp*. These are mixtures of indigenous and exotic bushes in the settlements that are not ideal for conservation with mitigation measures.

The few animals observed during the study African hares, Vervet monkeys and Squirrels. These are mixtures of indigenous and exotic bushes in the settlements that are not ideal for conservation with mitigation measures.

Plate 7.4: *Acacia polycantha* woodland with an understory of herbs, an indication of regeneration succeeding disturbance

Open Bushland / Thickets

This is a patch of open bushland and thickets with open gaps that together with the bushland and thickets are filled with bushes of *Osyris lanceolata (African Sandalwood), Pappea capensis, Maytenus heterophylla Euphorbia candelabrum Acacia seyal, Ozoroa insignis, Ficus sycomoru.* The bushes are dominated by *Boscia coriacea, Rhus natalensis, Euclea divinorum, Carissa edulis, Psiadia punctulata, Ipomoea kituensis, Jasminum fluminence, Dodonaea angustifolia* and *Harrisonia abyssinica.* This area was an indigenous bush and thicket patch ideal for conservation because of the endangered *Ocyris lanceolata*.

Plate 1.5: *Osyris lanceolata* circled in red in woodland remnants in Rusinga Island

Plate 7.6: Open shrubland remnants in Rusinga Island

The sampling point had an 80% scale on settlement, crop farming and degradation parameters.

7.1.8.2 KANYADA-RUSINGA ISLAND

Open Bushland and Settlements

This open bushland and settlement is made up of mainly bushes and scattered trees that have coppiced from earlier generation of old bushes of the same species. Each bush stump has coppiced an average of three stems that are of about 5m in height. The bushes form about 80 % vegetation cover and were intercepted by a dense shrub vegetation cover that formed a thicket of shrub layer dominated by a few trees and bushes that include *Ficus thonningii, Euphorbia candelabrum*, *Lantana camara, Combretum molle, Leucaena leucocephala, Rhus natalensis, Striga sp., Teclea tricocarpa, Carissa edulis, Combretum sp.*, *Euclea divinorum*, *Maytenus heterophylla, Elaeodendron buchananii, Harrisonia abyssinica, Psiadia punctulata, Melhania ovate, Turraea sp.*, *Asparagus racemosa* and *Rhus vulgaris.*

7.1.8.3 SOKLO HILL-MFANGANO ISLAND

Highly disturbed Open Bushland

This is a hill that has experienced heavy degradation of the original vegetation as observed in this study. Few original bushes and scattered trees were enumerated; *Prosopis juliflora (Mathenge)* that is an invasive species is also recorded here (Suppression of Noxious Weeds Act CAP 325) and few other exotics. Other species include *Ipomoea kituiensis*, *Acacia brevispica, Acalypha fruticosa*, *Acacia sp.*, *Grewia bicolor*, *Harrisonia abyssinica, Psiadia punctulata, Capparis tomentosa, Thevetia peruviana, Balanites aegyptiaca, Euclea divinorum*, *Ficus thonningii, Markhamia lutea* and *Leucaena leucocephala.*

It should be noted that during the seismic exploration, equipments from this site should be cleaned off to avoid the spreading of *Prosopis Juliflora* seeds to other sites in the project area.

Plate 7.7: Open shrublands in Soklo hills of Mfangano Island

7.1.8.4 RAMBA AND NYAKWERI -MFANGANO ISLAND

Open bushland / settlement

This is a patch of open bushland/settlement with open gaps that together are filled with scattered indigenous and exotic trees and shrubs that include *Olea europaea, Ficus thonningii, Grevillea robusta, Acacia sp., Obelia sp., Euphorbia candelabrum, Markhamia lutea, Melia sp, Pinus patula, Cupressus lusiatica, Eucalyptus sp., Ipomoea kituensis, Thevetia peruviana, Senna didmobotrya, Rhus natalensis, Acalypha fruticosa, Vangueria acutiloba, Achyranthes aspera, Lantana cámara, Acacia brevispica* and *Hyparrhenia rufa* grass**.**

Plate 7.8: Open bushland and settlement in Ramba area in Mfangano Island

7.1.8.5 KANYAMWA, HOMA BAY

Open Bushland / Settlement

The open bushland and settlement comprises mainly a mixture of grass types that dominate the ground cover. This portion of the bushland was recently cleared. Within this open bushland are trees that form stands reflecting remnants of past vegetation types before anthropogenic land use and land cover change impacts. The trees that formed part of the vegetation included *Rhus natalensis, Ficus thonningii, Acacia seyal, Vernonia karaguensis, Rhus vulgaris, Hyparrhenia rufa, Loranthus sp., Elaeodendron buchananii, Bridelia micrantha, Lannea alata, Carissa edulis, Ozoroa insignis, Cussonia holstii, Euphorbia candelabrum, Harrisonia abyssinica, Bauhinia sp., Balanites aegyptiaca, Kigelia africana, Euclea divinorum, Dodonaea angustifolia* and *Cupressus lusiatica* (exotic).

Plate 7.9: Open bushland and settlement in Kanyamwa area in Homa Bay

Open bushland / Riverine thickets –Goyo River, Kanyamwa

This was rather a dry land habitat running parallel to the riverine and open bushland and occupying the space between the riverine bushes and the open bushland edges corresponding to the riverine blocks, ideally the general vegetation comprised of wooded grassland interspersed by open riverine patches of open grassland and bushland with few exotics. The habitat comprised *Leucaena leucocephala, Rhus natalensis, Ficus thonningii, Psiadia punctulata, Dombeya burgassiae, Lantana cámara, Rhus natalensis, Ficus sycomorus, Thevetia peruviana, Albizia gummifera, Eucalyptus sp., Terminalia kilimandscharica, Carissa edulis, Harrisonia abyssinica, Blighia sp., Tithonia diversifolia, and Vernonia karaguensis.*

Plate 7.10: Riverine thickets lining the banks of Goyo River in Kanyamwa

7.1.8.6 LAMBWE VALLEY

Lambwe valley has a mixture of habitats ranging from woodlands, grassland savannahs, and riverine forests. These natural habitats are majorly contained in Ruma National Park, which is the only Protected Area in the Valley. Outside the park, most of the pristine areas have been converted to farmland.

Riverine / Open Bushland -River Kamato

These is a riverine segment along the River Kamato and mainly comprise *Thevetia peruviana*, Bananas, *Ficus sycomorus*, *Albizia gummifera*, *Acacia sp*., *Ricinus communis*, *Acalypha fruitcosa*, *Achyranthes aspera*, *Lantana cámara*, *Eucalyptus sp*., *Cupressus lusiatica*, *Cissampelos sp*., *Dombeya sp*., *Harrisonia abyssinica*, and *Kigelia africana*. The edge margins are covered with dense bushes of predominantly of *Lantana camara* and Ficus species that are common in this riverine system. Clearing the bushes would expose the river to desiccation.

Plate 2.11: Riverine vegetation on the banks of Lambwe River in Ruma National Park.

***Acacia* woodland / Bushland and thickets -Ruma National Park**

Ruma National Park is populous in Nyanza and is home to one of the most threatened antelopes, the Roan antelope, which is one of the rare in the continent. Other animals includes the Oribi, Buffalos, Leopards, Hyenas, Baboons, African hare, Vervet monkeys, Jackson's hartebeest, Rothschild's giraffe, Topi and Impala. Bats are also found in the park.

Birds found in the park included, the Towny Eagle, Falcon eagle, Hawk, Harrier, Vulture and Secretary bird, the African fish eagle, Marabou stork, The Hamerkop, Lilac-breasted roller, Ibis, The African hoopoe, Egyptian geese, and Grey crowned crane.

The vegetation system that occupies most of the Ruma National Park comprises of various vegetation types including pure stands of *Acacia drepanolobium*, open grasslands between woodlands and wooded grasslands and bushland. Each one of these vegetation types is characterized by trees and bushes whose dominance vary from area to area. The list of species enumerated within the Ruma National Park vegetation complex are: *Harrisonia abyssinica, Grewia similis, Balanites aegyptiaca, Rhus natalensis, Carissa edulis, Dombeya burgurssiae, Securinega virosa, Euclea divinorum, Jasminum sp., Acacia brevispica, Senecio discifolius, Hyparrhenia rufa, Scutia myrtina, Panicum sp., Chloris sp., Eragrostis sp., Sorghum sp., Ajuga remota, Acacia drepanolobium* and *Themeda triandra.*

Plate 7.12: *Acacia drepanolobium* shrubland in Ruma National Park

Open Acacia Bushland and Thickets Lambwe River-Godjope village

The bushland species comprised of widely spaced trees of *Acacia sp*., *Abutilon mauritianum*, *Rhus natalensis*, *Harrisonia abyssinica*, *Solanum incanum*, *Lantana camara*, *Securinega virosa*, *Phyllanthus maderaspatensis* and *Cyperus sp*., *Carissa edulis, Rhus vulgaris*, and *Maytenus heterophyllus*. The wooded grassland habitat had previously burned down and newly grown green grass had established. The common grasses were that of *Hyparrhenia rufa* (dominant) and *Panicum maxima*. Scattered trees and bushes were constituted by *Acacia seyal*, *Sapium ellipticum*, *Croton megalocarpus*, *Ficus sycomorus*, *Grevillia robusta* (trees), *Lantana camara* and old matures Eucalpytus trees.

7.1.8.7 KIPASI-MBITA

Mbita area is dominated by human settlement and crop farming. From visual assessment during the ESIA study, the region had approximately 80% spatial coverage in both settlement and crop farming. There were no wildlife conservation areas formally protected areas in the region.

Plate 7.13: Vegetable farming next to the Beach in Kipasi area in Mbita. Note the Bananas planted on the periphery of the *Sukuma Wiki* farm.

Bushland and thickets/Settlement

This is a bushland and thickets in a settlement at Kipasi area in Mbita. The bushland and thickets are in segments that occupy most of the settlements in Kipasi and its environs. There are mature *Eucalyptus* trees in the homesteads. Dense bushes and scattered trees predominantly of *Harrisonia abyssinica, Lantana camara, Grewia similis, Cordia ovalis, Achyranthes aspera, Senna didymobotrya, Terminalia kilimandscharica, Cardiospermum halicacabum, Ocimum suave, Jasminum fluminense, Cyphostemma sp., Rhus natalensis, Euclea divinorum, Acacia brevispica, Capparis tomentosa, Grewia similis, Grewia bicolour, Phytolacca dondecandra, Erythrococca bongensis, Balanites aegyptiaca, Acalypha fruitcosa, Cadaba sp., Vigna minima, Solanum incanum, Acacia sp., Ocimum basilicum* and *Abutilon mauritianum* are recorded in the habitat. The recommended management option is to preserve indigenous trees species that are common in this system to avoid disturbing the bushes that would provide cover to insects and bird life. In some instances, opening the bushes would also expose the river to desiccation.

Plate 7.14: Remnants of indigenous vegetation in Mbita area. Note the *Acacia spp.* in the area.

7.1.8.8 OLARE, HOMA BAY

Settlements/Bushland

This is an area in the settlement that has been invaded by the invasive species of *Prosopis juliflora* commonly referred as *Mathenge*. The tree form patches of open gaps within the bushland. The spread of this invasive species that is alien to the ecosystem is a threat to the ecological and economic well being of the local population. Other gaps that are not occupied by *Prosopis procera* are filled with dense bushes of *Lantana camara* and scattered trees that include *Markhamia lutea, Grevillea robusta Albizia gummifera* and the *exotics of Eucalyptus sp.* and *Mangifera indica*. The cultivated lands are dominated by weed species that included *Solanum incanum, Ipomoea kituiensis, Ricinus communis, Manihot esculenta, Triumfetta sp.* and *Striga sp.* considered as invasive too*.* *Teclea tricocarpa, Hypoestes verticillaries, Waltheria indica, Hibiscus fuscus, Datura stramonium* and *Amaranthus spinosa* while *Euphorbia triculii Turraea sp., Croton dichogamus, Acacia brevispica Capparis tomentosa, Maytenus heterophylla* and *Harrisonia abyssinica* bushes were encountered in areas that were used for grazing. Dominant annual grass species encountered that included *Chloris gayana* and *Eragrostis superba.*

7.1.8.9 HOMA BAY- RIVER TENDE

Riverine / Bushland

In the riverine /bushland the species diversity was characterized by the presence of a group of trees that included the exotics such as *Eucalyptus sp. Grevillea robusta* and *Cupressus lusiatica* among others. *Thevetia peruviana* common as a hedge is abundant in most homesteads. *Markhamia lutea* and *Leucaena leucocephala* are also planted for timber and fodder for livestock and soil enrichment. *Ficus thonningii, Balanites aegyptiaca* and *Acacia sp. Datura stramonium Lantana cámara, Sesbania sesban, Amaranthus hybridus, Ricinus communis, Leonotis nepetifolia, Senna didymobotrya* and *Grewia similis* are the common bushes in the riverine and disturbed ecosystems.

7.1.8.10 ABUNDU HOT SPRING

Open Bushland / Settlement

The Abundu hot spring is located along a valley that has scattered trees of *Terminalia kilimandscharica*, *Euphorbia candelabrum*, *Balanites aegyptiaca*, *Pappea capensis*, *Grewia mollis* and *Acacia seyal*, *Euclea divinorum*, *Rhus natalensis*, *Harrisonia abyssinica*, *Aloe secudiflora*, *Psiadia punctulata*, *Thevetia peruviana*, *Euphorbia triculii* and *Hypoestes verticillaries* form bushes in the homesteads. *Parthenium hysterophorus* was encountered in this habitat. *Parthenium* is an annual herb that colonizes disturbed land or cleared areas and is dominant in pastureland and crop fields. It is unpalatable to livestock.

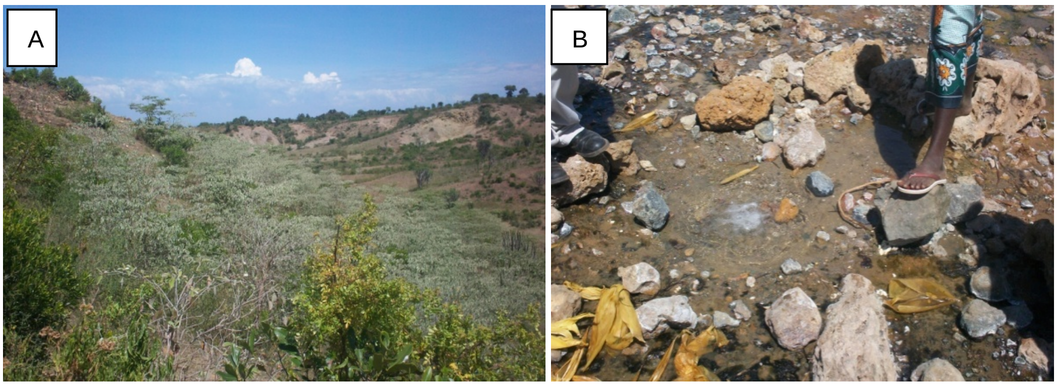


Plate 7.15: (a) Open bushland in Abundu hot spring area and (b) the Abundu hot spring.

7.1.8.11 NYONGONGA AND KENDU BAY

Open Bushland / Settlement

Nyongonga and Kendu Bay are fairly open bushland/woodland of indigenous and exotic trees, shrubs and herbs that include *Balanites aegyptiaca*, *Markhamia lutea*, *Eucalyptus sp.*, *Ipomoea kituensis*, *Gossypium sp.*, *Harrisonia abyssinica*, *Securinega virosa*, *Achyranthes aspera*, *Thevetia peruviana*, *Capparis tomentosa*, *Hypoestes verticillaries*, *Acalypha fruticosa*, *Senna singueana*, *Jasminum sp.*, *Leonotis nepetifolia* and *Monechma debile*. In the settlements the species diversity is very low and this is accounted by the land management practices with some of the species enumerated indicating disturbance.

Such species included *Amaranthus hybridus*, *Conyza bonariensis*, *Senecio discifolius*, *Leonotis nepetifolia*, *Hypoestes verticillaries*, *Ipomoea kituiensis*, and *Senna singueana*. *Zea mays* were recorded together with such weeds.

Plate 7.16: Open bushland and settlement in Nyongonga area in Kendu bay

7.1.8.12 AWACH RIVER-KENDU BAY

Riverine / Settlement

There is a tendency of decreasing species richness from riverine to settlement areas. This is due to the land practice in the settled areas compared to the riverine ecosystems. Most of the taxa enumerated were in the settlement with high percentages of herbaceous taxa indicating disturbed habitat or introduced species. These include *Leucaena leucocephala Datura stramonium, Solanum incanum, Tithonia sp., Ricinus communis, Amaranthus hybridus, Leonotis nepetifolia,* Napier grass, *Triumfetta rhomboidea* and *Ageratum conyzoides. Ficus thonningii, Acacia brevispica* and *Acacia sp.* that were scattered were found among other riverine species. Below the trees are dense bushes dominated by *Lantana camara* and Napier grass.

7.1.8.13 MUKHOBO BASIN, BUDALANGI

Settlement

Mukhobo Basin in Budalangi is on record as an area with frequent floods from River Nzoia. Some of the agricultural activities include *Manihot esculeata, Mangifera indica, Ipomoea batatas*, sugarcane and *Zea mays* cultivation. Few coconut trees were also recorded. The exotics present in the area and recorded include: *Thevetia peruviana,* *Grevillea robusta, Leucaena leucocephala* and *Eucalyptus sp.* There is high abundance of species associated with disturbed ecosystems and they include: *Tithonia diversifolia, Ipomoea kituiensis, Solanum incanum, Hibiscus sp., Biden pilosa, Leonotis nepetifolius, Indigofera sp., Albizia gummifera, Sphaeranthus cylindrica, Abutilon mauritianum, Acacia gerrardii, Vernonia sp., Senna didmobotrya, Blighia sp., Securinega virosa, Achyranthes aspera, Ricinus communis, Clausena anisata, Sesbania sesban, Leonotis nepetifolia, Psiadia punctulata, Vigna minima* and *Hosludia opposite. Ficus thonningii* and *Markhamia lutea* are the only trees recorded here, with *Lantana camara* growing underneath the trees. *Striga sp.,* which is invasive, was abundant in the cultivated land under maize.

Plate 7.17: A dyke built to control flooding in Mukhobo Basin

7.1.8.14 MUSOMA BEACH, NAMABUSI VILLAGE

Bushland

This side of the Namagusi Village borders Lake Victoria (Musoma Beach) and neighbours Mukhobo Basin. This habitat seemed to have gone through different systems of land uses that have determined the current vegetation types. The study observed three distinctive vegetation types namely Eucalyptus trees, open grassland, the beach and scattered bushes. The following is a description of the site characteristic and species composition of each vegetation type. *Solanum incanum, Papyrus sp., Cyperus sp., Casuarina sp., Eucalyptus sp., Sphaeranthus cylindrica, Sesbania sesban, Hibiscus fuscus, Senna didmobotrya, Grevillea robusta* and *Guizotia sp.* Mammals and reptiles were reported by the local communities to occur here and included *Wild pig, Vervet monkeys, Monitor lizard, Green mamba, Python, Puff adder* and *Spitting cobra.* None of the above were observed during the field survey.

Plate 3.18: Wetland vegetation dominated by *Cyperus spp.* on the shores of Lake Victoria

7.1.8.15 URENJE, BONDO

Bushland / thickets / Settlement

This is a bushland/thicket in a settlement area but relatively dry with species of trees that included *Croton dichogamus, Euphorbia candelabrum, Vitex keniensis, Cussonia holstii, Ozoroa insignis, Acacia seyal, Grewia bicolor, Albizia gunnifera, Eucalyptus sp., Ziziphus mucronata and Commiphora emnii*. The area is dominated by bushes and thickets with few exotics that included *Thevetia peruviana*. The bushes and thickets included *Acacia brevispica, Lantana cámara, Ipomoea kituiensis, Aloe secudiflora, Senna occidentalis, Euphorbia triculii, Psiadia guajava, Phytolacca dodecandra, Lantana trifolia, Cissus sp., Maytenus heterophylla, Harrisonia abyssinica, Rhus natalensis, Acalypha fruticosa, Allophylus sp., Phyllanthus maderaspatensis, Tinnea aethiopica, Plectranthus barbatus, Capparis tomentosa, Kalanchoe sp. and Indigofera bogdoni*. Osieko beach in Bondo is characterised by open bushland and thickets. The site comprises *Cissus quadrangularis, Euphorbia triculii, Thevetia peruviana, Lannea alata, Croton dichogamus, Harrisonia abyssinica, Markhamia lutea, Solanum incanum, Senna spectabilis, Tithonia diversifolia, Ageratum conyzoides, Lantana cámara, Opuntia stricta, Achyranthes aspera, Senna singueana, Erythrococca bongensis, Amaranthus hybridus, Acacia brevispica, Phyllanthus manderaspatensis, Ruttya sp., Cyphostemma nierence, Acalypha fruticosa, Gynodropsis gynandra, Ocimum basilicum, Capparis tomentosa, Acacia sp., Abutilon mauritianum, Commicarpus sp., Tamarindus indica, Grewia tembensis and Aloe sp*. Within the wooded grasslands there are, however, unique micro-habitats formed by the relics of indigenous trees.

7.1.8.16 SANDA, USENGE

Bushland / Settlement

This was a rather dryland habitat mostly of bushland and settlement that occupy the spaces between the farmlands and settlements. Ideally, the general vegetation comprises of wooded grassland interspersed by open patches of open grassland and bushland. The wooded bushland and grassland was characterized by a dense thicket of bushes. In other words, the vegetation type was closely similar to that of adjacent areas with dense bushland species comprising of widely sparse trees. The bushes were constituted by habitat newly grown green grass had established. *Croton dichogamus, Albizia gummifera, Harrisonia abyssinica, Senna spectabilis, Gutenbergia cordifolia, Solanum incanum, Ipomoea kituiensis, Acacia brevispica, Euphorbia triculii, Capparis tomentosa, Waltheria indica, Aloe sp., Senna singueana, Achyranthes aspera, Acalypha fruticosa, Terminalia kilimandscharica, Allophylus sp., Tamarindus indica, Ricinus communis, Vernonia brachycalyx, Phytolacca dodecandra, Boerhavia sp., Cordia ovalis, Lantana camara, Abutilon mauritianum, Kigelia africana, Ficus sycomorus* and *Markhamia lutea. Eucalyptus sp.* and *Grevillea robusta* are the only exotics recorded. Animals**:** *Wild pigs, Hippos, African hare, Porcupines* and *Vervet monkeys* have been recorded.

7.1.8.17 KAPIYO, BONDO

Bushland / Settlement

This site is dominated by closed bush lands and settlement. The dominant woody plants species encountered included; *Euclea divinorum, Rhus natalensis, Grewia tembensis, Lantana camara, Grewia similis, Acacia seyal, Teclea simplicifolia, Terminalia kilimandscharica, Flacourtia indica, Capparis sp., Jasminum sp., Carissa edulis, Acacia brevispica, Psiadia punctulata, Balanites aegyptiaca, Euphorbia candelabrum, Striga sp, Ipomoea kituiensis, Markhamia lutea, Melhania ovate, Triumfetta sp., Ocimum basilicum, Cyphostemma nierence, Commiphora emnii, Boscia coreacea, Scutia myrtina, Maytenus heterophylla, Ormocarpum tricocarpum, Dichrostachys cinerea, Pavonia patens, Psiadium guajava, Ageratum conyzoides* and *Tephrosia sp*. The animals observed in the area included African hares and Vervet monkeys.

7.1.8.18 KIBOS MUHORONI AND AHERO- LARGE SCALE PLANTATIONS

Sugarcane and Rice / Settlement

This expansive area is under sugarcane and rice production. From the farm land edges of the Muhoroni sugarcane plantations, there are remnant indigenous species such as *Balanites aegyptiaca, Grewia bicolor, Harrisonia abysinica, Hosluidia oposita, Ipomea kituiensis, Makhamia lutea, Phylanthus mandalaspatensis, Psidia punctulata, Rhus natalensis, Scutia myrtina* and *Securinega virosa.*

No indigenous vegetation remnants were encountered in the Ahero rice irrigation farms. Both plantation sites had a high representation of weeds and invasive plant species, including *Parthenium hysterophorus* (which has since been included in the list of Noxious Weeds in the Supression of Noxious Weeds Act, Cap 325, and Section 3 of the Laws of Kenya), *Caecalphinia decapelata, Lantana camara, Solanum incanum* and *Striga sp.*

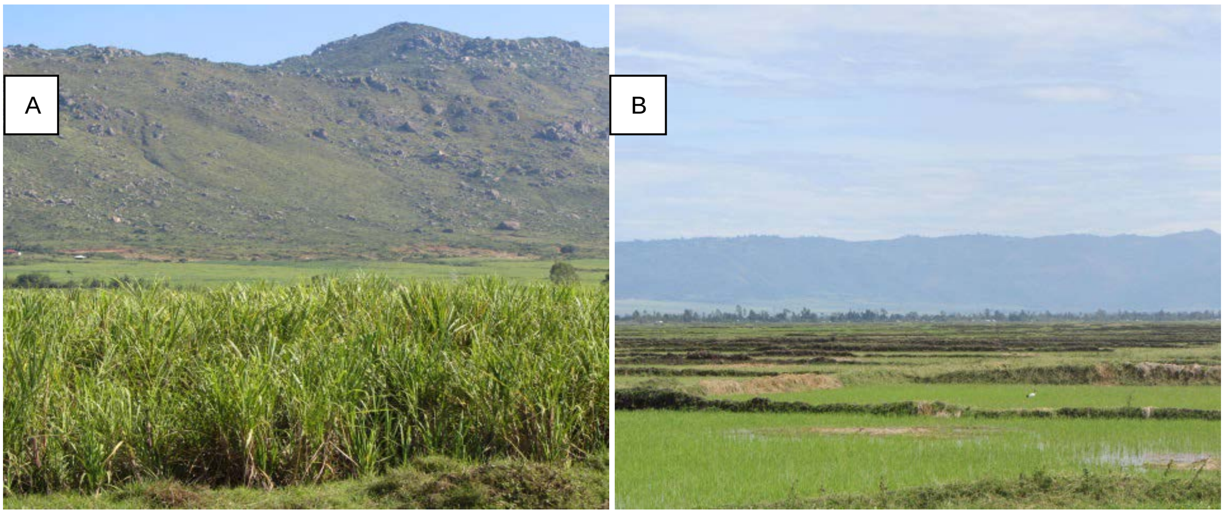


Plate 7.19: (a) Sugarcane plantations in Kibos and (b) rice farms in Ahero area

Table 7.4: Block 12B Regional, National and International habitat significance.

Habitat	Significance		
	Regionally	Nationally	Internationally
Acacia woodland	• 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.	• Maintaining the water cycle. • Check global warming by using carbon dioxide in photosynthesis. • Support diverse animal species. • Scientific and ethical knowledge.	• Maintaining the water cycle. • Check global warming by using carbon dioxide in photosynthesis. • Scientific and ethical knowledge.
Acacia shrubland	• Provide land cover and soil protection. • Ornamental plants. • Source of timber and non-timber products • Some shrubs are used by the locals as medicines. • Source of Wood fuel and Charcoal. • Provide an abundance of berries and	• 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.	• 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

Habitat	Significance		
	Regionally	Nationally	Internationally
	fruit, eaten by many different birds and mammals.		
Grassland	• 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	• 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	• Maintaining the water cycle • Check global warming by using carbon dioxide in photosynthesis. • Scientific and ethical knowledge
Riverine forest	• Resting and recreational options to the locals due to their ability to provide shaded grounds. • Have sites of religious significance	• Maintaining the water cycle • Check global warming by using carbon dioxide in photosynthesis.	• Maintaining the water cycle • Check global warming by using carbon dioxide in photosynthesis.

7.2 OFFSHORE BASELINE

7.2.1 PHYSICAL FEATURES OF LAKE VICTORIA AND OTHER WATER BODIES

Lake Victoria, the largest of all African Lakes, is also the second largest freshwater body in the world. Its extensive surface belongs to the three countries; the northern half to Uganda, the southern half to Tanzania, and part of the northeastern sector to Kenya. The lake occupies a wide depression near the equator, between the East and West Great Rift Valleys, but its drainage basin is relatively small, being slightly less than three times the lake's surface in area. Lake Victoria has a surface area 68,800 km^2 and a volume of 2,750 km^3. The maximum depth of the lake is 84m while the lake shoreline is 3,440km. The Lake has a catchment area of 184,000 km^2. The lake shore is highly indented, and there are many isles in the lake. There are also many satellite lakes (e.g. freshwater lakes Kanyaboli, Sare, and Namboyo, as well as the saline-alkaline crater lake Simbi) which are less studied, more sensitive to fluctuating environmental conditions, and that are considered relatively undisturbed compared to the main Lake Victoria ecosystem (Mwamburi, 2009). Lake Victoria has a number of Islands within it. Those that fall within the project area include: Mfangano Island, Ndere Island and Rusinga Island. These islands are rich in biodiversity and are also settlement areas.

The mean annual water mass temperature of Lake Victoria is 25°C (Muyodi et al., 2010). The lake has a season of deep vertical mixing when in fact it becomes isothermal. During June and July the established thermocline breaks down under the seasonal onset of the south-east trade winds and for a brief period at the end of July the main body of the lake becomes isothermal with respect to depth (Talling, 1966). The depth and stability of the thermocline depends upon the duration of the calm, warming period and the frequency and magnitude of mixing events. In Lake Victoria where the thermocline most often occurs at 30-40 m depth, complete mixing of this enormous water body occurs once a year and partial mixing occurs at other times.

7.2.1.1 QUALITY ISSUES FOR SURFACE, GROUND WATER AND ASSOCIATED WETLANDS

Lake Victoria has a flushing time of 140 years and a residence time of 23 years (Bootsman and Hecky, 1993). The longer the flushing time, the more vulnerable a lake is to damage from the effects of human activities and development in its catchment (Spigel and Coulter, 1996). Moreover, the longer the residence time, the less likely the damage can be reversed once it has occurred.

Threats to the quality of lake and river waters include poor land use and agricultural practices, catchment deforestation, destruction of wetlands, pollution loading, fishing malpractices, and invasion by exotic aquatic weeds (Muyodi et al., 2012). Water samples that were analysed for selected pesticide residues indicated that aldrin and dieldrin were above WHO recommended values in the lower Nyando/Sondu-Miriu river, and this was attributed to pesticide use in agriculture and the control of vector borne diseases (Musa et al., 2011). In two sub-catchments of the Nzoia River, it was found that the over-use of riparian areas, sewage discharges, and agricultural activities affected the quality of the riparian zones, banks and substrate quality (based on water sample analysis) and that macroinvertebrate communities in the river also responded to these influences (Aura et al., 2010). The anthropogenic threats have resulted in rampant land and wetland degradation, leading to poor water quality and consequent water loss, a decline in the diversity of the commercial fisheries and the lakes biodiversity in general, unsustainable use of natural resources, increased poor human health and food insecurity, with high levels of poverty among the riparian communities (Muyodi et al., 2010).

A host of measures have been taken to address these issues, for example, the LVEMP (see Muyodi et al., 2010) has initiated some pilot projects that have addressed, amongst others, the following issues: water quality and quantity monitoring; industrial and municipal management; fisheries studies; water hyacinth control; wetlands; land use; catchment afforestation, and; micro-projects for poverty alleviation (Muyodi et al., 2010). All these efforts are ultimately intended to improve the surface and ground water quality in the region as a basis for healthy ecosystem function and sustainable provision of goods and services from the natural water resources.

Heavy metals analysis in the water and sediments of the satellite lakes within the Kenya portion of Lake Victoria indicate that the level of contamination is low as compared to Lake Victoria (Mwamburi, 2009).

In the Kenya sector, the groundwater is of excellent chemical quality (total dissolved solids concentration is of the order of 500 ppm but often below 1000 ppm) and can be put to a variety of uses: the only problem is that in places it contains excessive fluoride concentrations far in excess of the 1.5 ppm stipulated for drinking water purposes (Ongwenyi, 1979).

7.2.1.2 LAKE SEDIMENTS

Surface wave activity inhibits the accumulation of fine-grained sediments in water depths shallower than about 50m, and where the fine-grained sediments occur they are rich in organic matter, reflecting the high biogenic productivity in the lake (Johnson et al., 2000). Analysis of lake sediment samples from the gulf area indicate that some banned organochlorines are still being used in the catchment and are attributed to agricultural activities within the catchment (Musa et al., 2011).

7.2.2 **AQUATIC FLORA AND FAUNA**

7.2.2.1 FISH

Lake Victoria supports a multispecies fishery that includes tilapiine and haplochromine cichlids and is home to a variety of fish species which include: *Oreochromis niloticus, Oreochromis leucostictus, Oreochromis melanopleura, Tilapia zillii, Tilapia rendalli, Lates niloticus and Cyprinus carpio. Oreochromis niloticus, Oreochromis leucostictus, tilapia zillii* *and Tilapia rendalli* are non indigenous species of Tilapia that were introduced into the lake. *Rastrineobola argentea* is a native fish species found in the lake while *Lates niloticus* and *Oreochromis niloticus* are major commercial fish in the lake although *Lates spp*. is an introduced species within the lake (Reynolds et al., 1995). *Labeo victorianus* is an endemic fish species of the Lake Victoria catchment while *Oreochromis variabilis* is one of the endangered species found in Lake Victoria. Non cichlid species in the lake include catfish (*Bargus docmak*), *Clarias gariepinus*, *Synodontis spp*., lungfish (*Protopterus aethiopicus* and *Labeo victorianus*. Major threats to the fish biodiversity in the lake include overfishing, use of inappropriate fishing gears and introduced species which dominate the lake and prey on other fish species. The Nile perch for example, found its way into the Nyanza gulf in 1982 and colonised the lake (Witte et al., 1995) and preys on most fish species in the lake including *Oreochromis spp*. in the lake.

Lake Kanyaboli has been suggested as a potential refugium for haplochromine cichlids that have gone extinct in the main basin of Lake Victoria, and thus it and similar satellite lakes provide an opportunity for conservation of both genetic and trophic diversity threatened by the introduction of exotics in Lake Victoria (Abila et al., 2008).

7.2.2.2 AQUATIC MACROINVERTERBRATES

Aquatic invertebrates found in Lake Victoria include: Weevils (Curculionidae), *Neochetina bruchi and Neochetina eichhorniae*. Others include *Alma emini* (swamp worm), *Achatina spp*. and Lake flies. Aquatic macroinverterbtates play an important role in the lake ecosystem. Gastropods and bivalves are prey for lungfish, chironomid and chaoborid larvae are food for fish while the freshwater prawn (*Caridina nilotica*), Mayfly and Dragonfly nymphs are food for young Nile perch.

7.2.2.3 ZOOPLANKTON

Zooplankton biodiversity in Lake Victoria includes:

Copepoda

Is inclusive of Calanoida, Cyclopodia and Nauplii;

Cladocera

Includes: Bosmina longirostris, D. Lunholtzi, Ceriodaphnia cornuta, Diaphanosoma exiscum and Chironomid larvae;

Rotifera

Includes: Brachionus calyciflorus, B. angularis, B. falcatus, B. Caudatus, Platyias patulus, Trichoceria spp., and Keratella tropica; and

Epiphanes

Includes: Proales spp., Lecane spp., and Asplanchna spp.

7.2.2.4 BENTHOS

Benthic species in Lake Victoria include: *Melania tuberculata, Bellamysa* sp., *Corbicula* sp., *Caelatura* sp., *Chaoborus* sp., *Chironomus* sp.

7.2.2.5 MACROPHYTES

Macrophytes in Lake Victoria are mainly found along river mouths and bays. The species of mychrophytes in the lake are both exotic and indigenous. Exotic species of macrophytes within the lake are *Pistia stratiotes* (Water Cabbage) and *Eichhornia crassipes* (Water Hyacinth). Common macrophytes that were found in abundance in the lakes wetlands before the invasion of the water hyacinth include: *Azolla spp., Vossia cuspidata, Pistia spp., Cyperus spp., Aeschynomene spp., Phragmites spp*. and *Typha spp*. Macrophytes are important in our ecosystem as they form the base of food pyramids, act as filters of excessive nutrients from catchment areas and act as physical substrates for insects. Macrophytes have also been known to provide incubation for juvenile fish (Sculthorpe, 1976), and have also been found to be strongly associated with two types of snails (*Biomphalaria sudanica* and *Bulinus africanus*) that are common hosts for schistosomiasis and hence those working along the lake shores are at higher risk of contracting the disease (Ofulla et al., 2010). Macrophytes in Lake Victoria are also used for making handicraft such as mats and baskets. Papyrus reeds are even used for construction of houses not to mention some being herbal remedies to humans and livestock.

7.2.2.6 PHYTOPLANKTON

Phytoplankton in Lake Victoria mainly consists of diatoms which are very rare, and blue green algae which have presently dominated the lake (Ochumba et al., 1989). The blue green algae are associated with increased nutrient levels in the lake as a result of pollution from agricultural, municipal and industrial effluents. Other phytoplankton found in the area includes *Euglenophyta, Dinoflagellates and Bacillariophyta.*

7.2.3 BIODIVERSITY

Lake Victoria, which occupies a large portion of Block 12B, is an important warehouse of fisheries resources both in diversity and numbers. In the early 1960s, there were about 400 to 500 species of fish comprising of 12 families and 27 genera, including over 100 identified species of the *Haplochromis* taxon, alone, in Lake Victoria (Greenwood 1965). However, 40 years after the introduction of the Nile perch into the lake, it is estimated that the number of fish species has been reduced to about 200, the rest having been decimated through predation by the Nile perch and competition from the introduced tilapiines (*Tilapia zillii, T. rendallii, Oreochromis niloticus, O. melanopleura and O. leucostictus).* Over fishing has also contributed to depletion of the fish species. Reptiles found in the area also include the Nile monitor and crocodiles.

Some parts of the Basin have also been designated as an Important Bird Area (IBA). They include Koguta Wetland and Sondu Miriu Delta. Birds such as the pink backed pelican and Egyptian geese have been identified in these areas. The endangered bird species in the Lake Basin include the vulnerable papyrus yellow warbler (*Chrolopeta gracillostris)* and papyrus gonolek (*Laniarius mufumbiri).*

Other biodiversity in Block 12B are within the conservancies in the area. Ndere Island has recorded presence of Dik diks, Baboons and Impalas. During the ESIA study, animal paths were observed indicating their presence. The Sitatunga (*Tragelaphus spede*), which is an endangered species, has been recorded in Yala swamp and is also found within the Impala Sanctuary.

Though the proposed project area has a high potential for biota conservation, change in land use and land fragmentation has led to depletion of what could have been pristine ecosystems and their biodiversity.

The few protected areas in the proposed project area have reported a high biotic diversity. Ndere Island National Park, for example, has recorded over 35 tree species, 8 large mammal species and over 400 bird species. Roan antelope, black rhinos, leopard, buffalo, hyena, Rothschild's giraffe, Oribi, Jackson and Lelwel hartebeest, Impala, Bohor reedbuck, Serval cat, Topi, Baboons, Vervet monkey, Honey badgers, and Bush pig are some of the mammal species in Ruma National Park. While Lions, white rhino, cheetah and zebra are among the large mammal species in Impala sanctuary. Sitatunga, Water buck, Bushbuck, Reedbuck, Vervet monkey, Wild pig, Hippopotamus, Warthogs, Hyena, Leopard, Common duiker, Bush pig, Otter, Duiker, Dik dik, Mongoose and Serval cats are the mammal species in Lake Kanyaboli National Reserve outside but adjacent to the proposed project area, but shares a similar ecosystem with Yala swamp which is within the project area.

The proposed project area hosts more than 400 bird species including; Papyrus gonolek, Carruthers cisticola, Red-chested sunbird, Northern-brown throated weaver, Papyrus canary, Papyrus yellow warbler, African fish eagle, Black headed gonolek, Grey-headed kingfisher, Hamerkop, African pied wagtail, and Double-toothed barbet among others. Of importance to mention is that the project area hosts the papyrus gonolek, papyrus yellow warbler and the blue swallow which are globally threatened species. In block 12B also lies 6 gazetted Important Bird Areas (IBA), namely; Ruma National Park, Yala swamp, Dunga swamp, Koguta swamp, Sio port swamp and the Kusa swamp. Insect's species include termites, beetles, butterflies, ants, scorpions, spiders, bees, spiders, wasps, grasshoppers, locusts and ant lions.

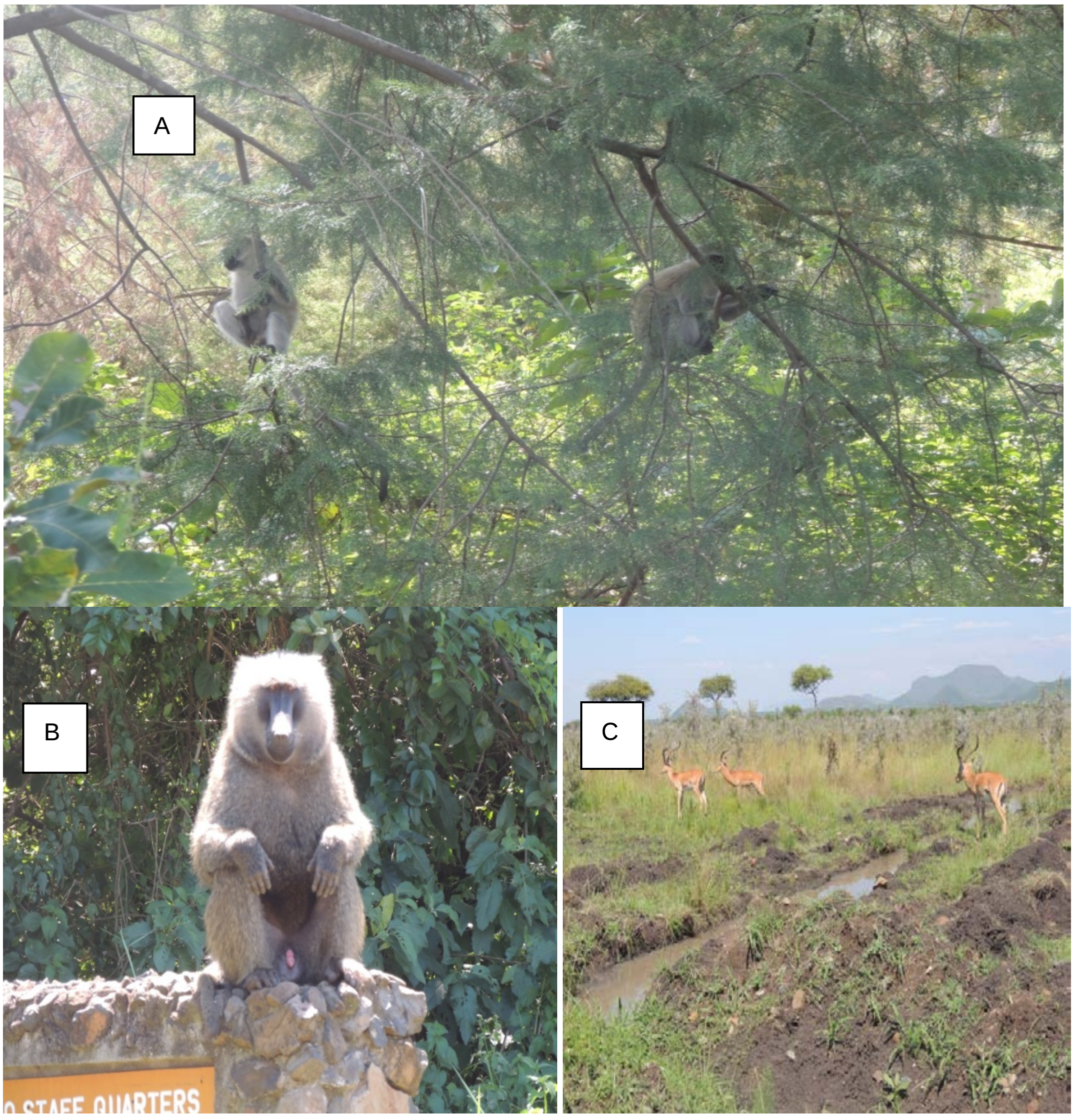


Plate 7.4: (a) Vervet monkeys on a Cupressus tree (b) a baboon and (c) a bachelor herd of impalas at Ruma National Park in Lambwe valley.

Plate 7.21: (a) A giraffe browsing on *Acacia drepanolobium* (b) a Topi grazing in Ruma National Park, (c) an egret (red arrow), a plover (yellow arrow) and stilts in Lake Sare swamp and (d) male and female window birds in Sindo.

Table 7.5: Wildlife species listed as endangered or declining populations in the project area

Scientific name	Common name	Phylum / Division	Conservation status (IUCN)	Location in project area
Diceros bicornis michaeli	African Black Rhino		Critically endangered	Ruma NP
Ceratotherium simum	White Rhino		Near threatened	Impala sanctuary
Giraffa camelopadalis rothschildi	Rotchild's giraffe	Mammal	Endangered	Ruma NP
Tragelaphus spekii	Sitatunga		Least Concern	Yala swamp
Hippotragus equinus	Roan antelope		Least concern*	Ruma NP
Laniarius mufumbiri	Papyrus Gonolek		Near threatened	
Chloropeta gracilirostis	Papyrus yellow warbler	Bird	Vulnerable	
Hirundo atrocaerulea	Blue swallow		Vulnerable	
Osyris lanceolata	African sandalwood	Plant	No information	Rusinga island

***The species in Listed as Least concern by IUCN but only found in Ruma National Park in Kenya**

7.2.3.1 NESTING LOCATIONS

Different bird species in the project area had different nesting preferences, from grasslands, open acacia woodlands and riverine forests. It is, however, worth noting that due to the present anthropogenic degradation of the natural habitat in the proposed project area, birds were observed to cluster their nests in the little remnant indigenous vegetation (Plate 7.30).

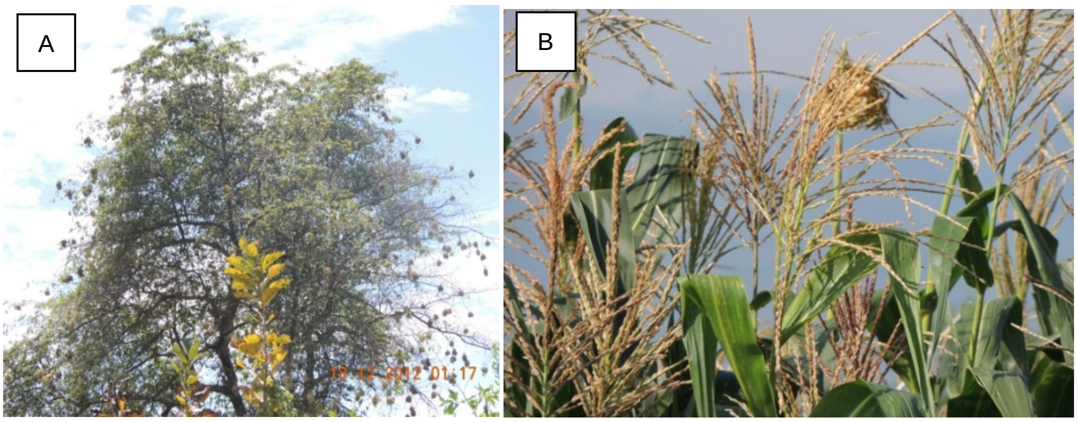


Plate 7.22: (a) Weaver bird's nests clustered in an indigenous tree in Kapsigilei area, Nandi west District and (b) a weaver bird's nest in a maize plantation in Mbita District.

Table 7.6: Block 12B Regional National and International habitat significance

Biodiversity	Significance		
	Regionally	**Nationally**	**Internationally**
Birds	• Visual quality of the area • Source of food to the locals, birds 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 • Good sources for bird predators thus enhancing species diversity in the area • Help in fertilizing the soil with the nutrients from their droppings.	• Bird feathers are used to decorate jewellery, clothing, and hats which are sold to earn revenue. • Facilitate tourism such as bird watching	• Facilitate tourism such as bird watching
Insects	• Insects such as bees helps in plant pollination to -facilitate the process of reproduction, thus improving the area vegetation. • Helps in improving the bids species in the area as some birds feed on insects.	• Scientific and ethical knowledge	• Scientific and ethical knowledge

Biodiversity	Significance		
	Regionally	**Nationally**	**Internationally**
	• They also decompose dead materials, thereby reintroducing nutrients into the soil. • Burrowing insects such as ants and beetles dig tunnels that provide channels for water, benefiting plants.		
Mammals	• 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.	• Important to the fur industry • Scientific and ethical knowledge • Source of food pelts and meat	• Used as laboratory subjects for the study of human-related physiology, psychology, and a variety of diseases • Scientific and ethical knowledge
Reptiles	• Reptiles are natural carnivores, and in this capacity they are able to eliminate many creatures are consider to be undesirable in the area.	• Scientific and ethical knowledge	• Scientific and ethical knowledge • Pets

7.3 LAND-USE

There are a number of coastal town's bordering the lake, including Kisumu which lies within the project area. In the context of land use, this analysis identified land degradation as a widespread problem in the Block 12B and the Lake Victoria Basin as a whole. Land degradation is perceived to be a consequence of many complex and interrelated factors which include; increasing pressure on land resources particularly from rapidly increasing population, low technological innovations and adoption to match the demand on natural resources, inappropriate governance structures and mechanisms as well as constraint livelihood sources and levels. The high demand for land has led to unsustainable land use practices such as land fragmentation and cultivation on marginal and fragile areas including steep areas, river banks; watersheds and wetlands, among others. Stocking of livestock beyond the carrying capacities has also contributed to land degradation. The ultimate consequences of poor and inappropriate farming practices and patterns are; flash floods, severe soil erosion, siltation of water bodies and excessive nutrient enrichment of the Lake. Land degradation is a common problem throughout the region, but particularly acute in the Rachuonyo District which lies within the Block.

The project has a wide range of land use such as agriculture, settlement, grazing, urbanization, infrastructural developments (Sondu Miriu Hydro- Plant, Sugar factories etc) and fishing in the lakes and rivers. In Homa Bay County agriculture is the major land use practice Fishing is also a popular economic activity in the area with a few people. The agricultural crops grown are maize, sorghum, groundnuts, cassava, sweet potatoes, capsicum, kales, cowpea, green grams, sunflower, beans, papaw, banana, mangoes, sugarcane and cotton. The following use patterns were observed in the block and are captured in the land use map (Figure 7.6).

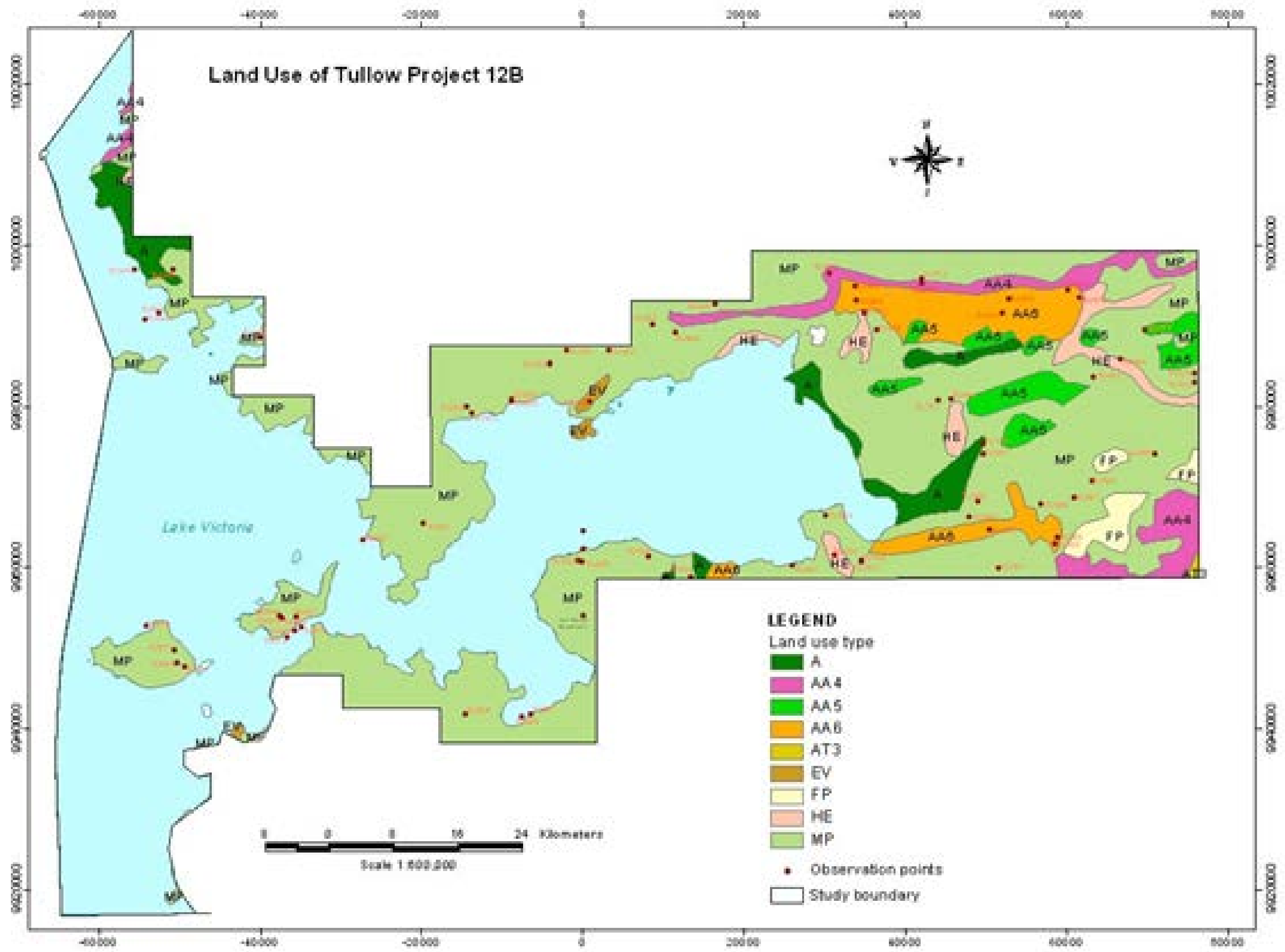


Figure 7.6: Land use patterns in Block 12B(A - Agriculture; AA4 - Rain fed arable cultivation; AA5 - Wet rice cultivation; AA6 - Irrigated cultivation; AT3 - Non-irrigated shrub crop cultivation; EV - Exploitation of natural vegetation; FP - Plantation forestry; HE - Extensive grazing; MP - Agro-pastoralism (crop and livestock system)

7.3.1 ADMINISTRATIVE STRUCTURE

The area under review is administered from the local grassroots level known as the sub-location, with the hierarchy ascending to Location, Division, District, and finally County level, all of which are currently under the provincial administration managed through the central government by, District Commissioners (DC), District Officers (DO), Chiefs, Assistant Chiefs and a network of village elders. There are also local governments managed by municipal and county council officials through the Ministry of Local government. This system of administration will however change after the next general election, when County governments will come into effect.

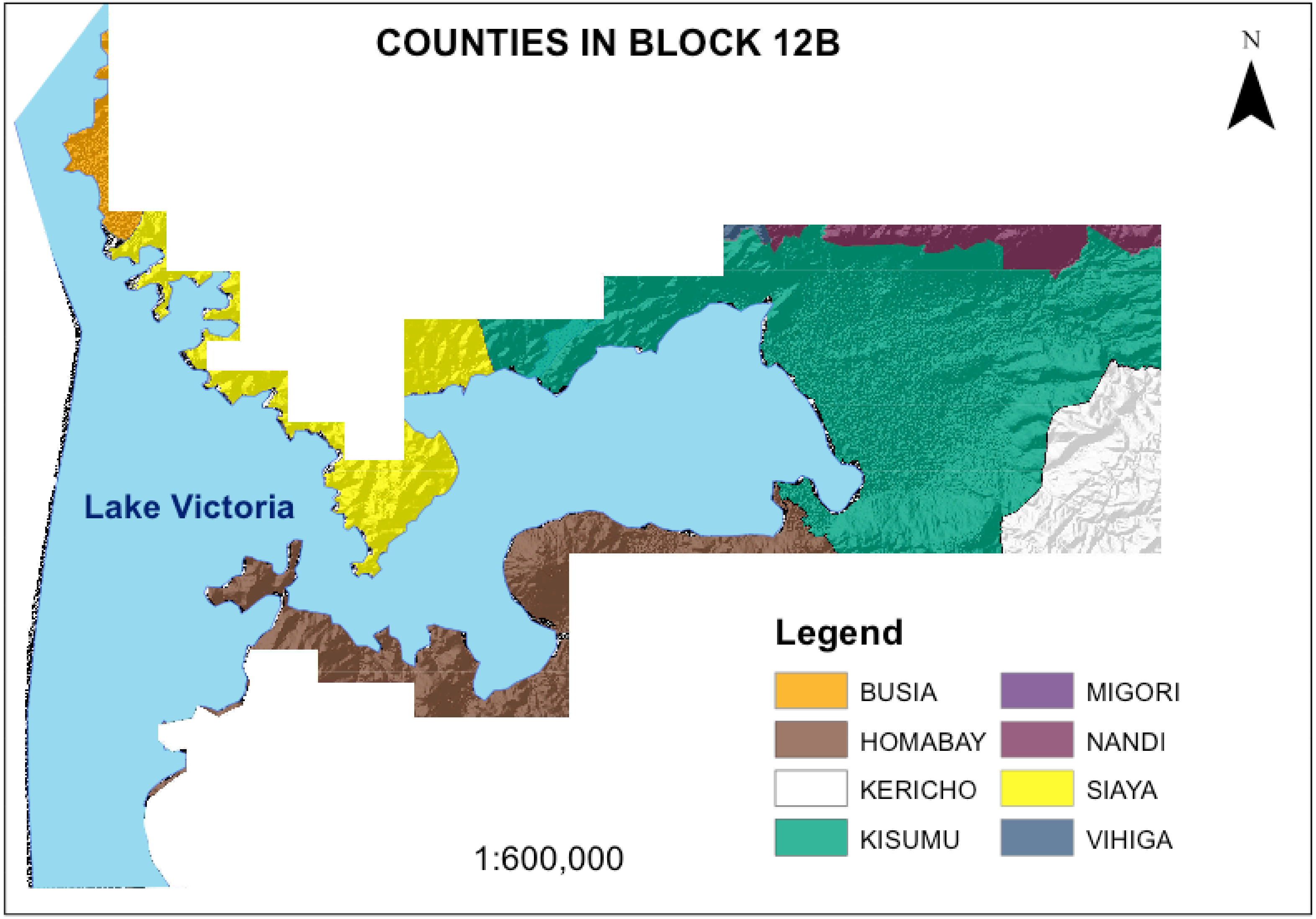


Figure 7.7: County administrative structure of Block 12B

7.3.2 POPULATION DISTRIBUTION

The area under area within Block 12B has an average household density of 4.4 and a population density of 475 people per square kilometre. The districts covered by Kisumu county have the highest average population density (686.7 people/sq km), while Mbita and Nyatike areas have the lowest (264.72 and 213.41 people per sq, km. respectively) (KNBS 2009 Census).

Table 7.7: Population distribution in Block 12B

District	Male	Female	Total	Households	Area in Sq. Km	Density
Kisumu East	235,676	237,973	473,649	115,502	559.2	847
Kisumu West	68,814	76,093	114,907	32,992	358.7	404
Nyando	170,270	180,083	350,353	78,225	1,168.0	300
Homa Bay	174,306	192,314	366,620	79,540	1,169.9	313
Rachuonyo	182,967	199,744	382,711	81,395	950.7	403
Rarieda	64,473	70,085	134,558	31,033	403.4	334
Bondo	76,468	81,054	157,522	37,296	593.0	266
Vihiga	105,111	116,183	221,294	48,221	201.0	1,101
Bunyala	31,718	35,005	66,723	15,245	188.3	354

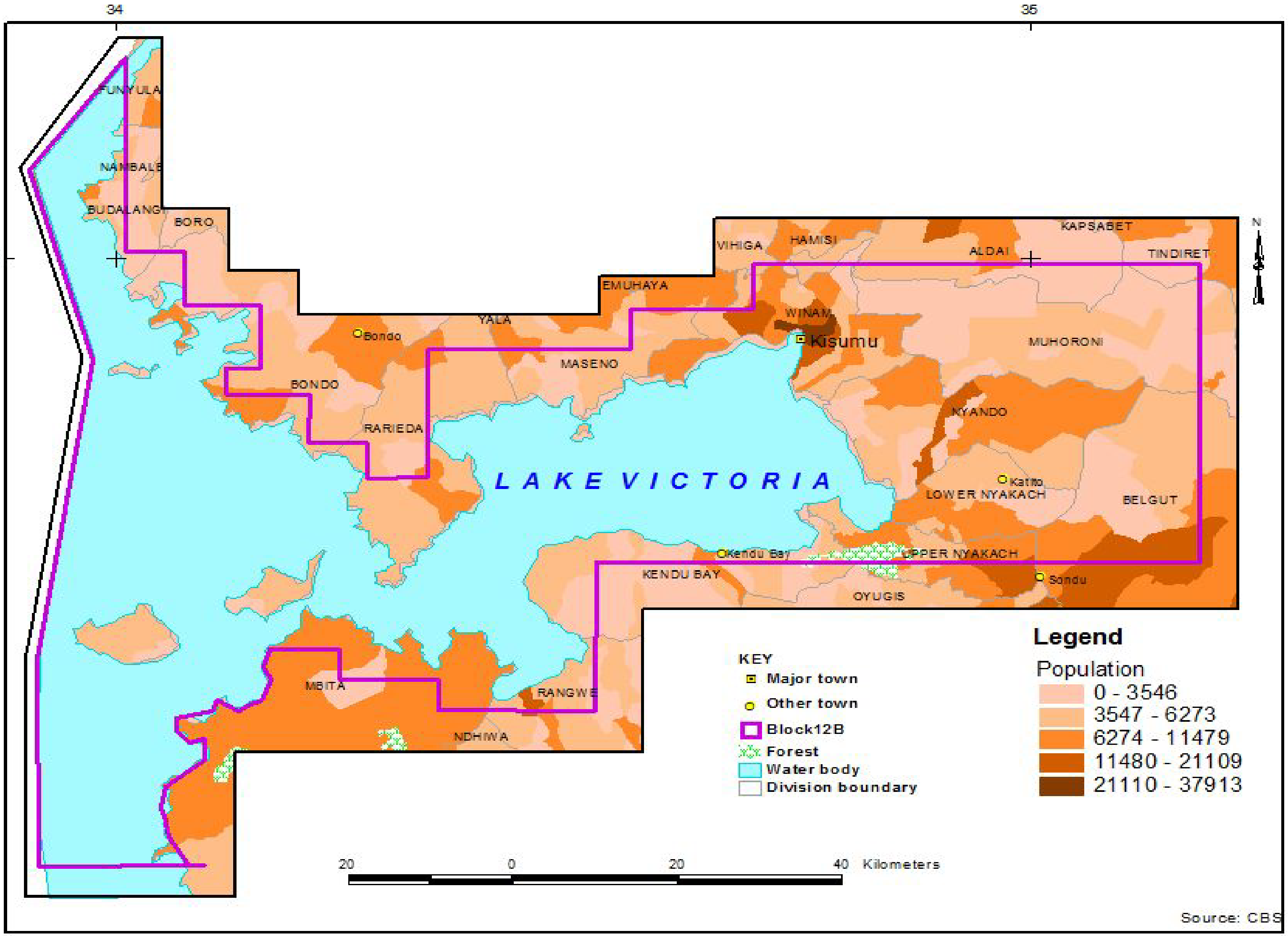
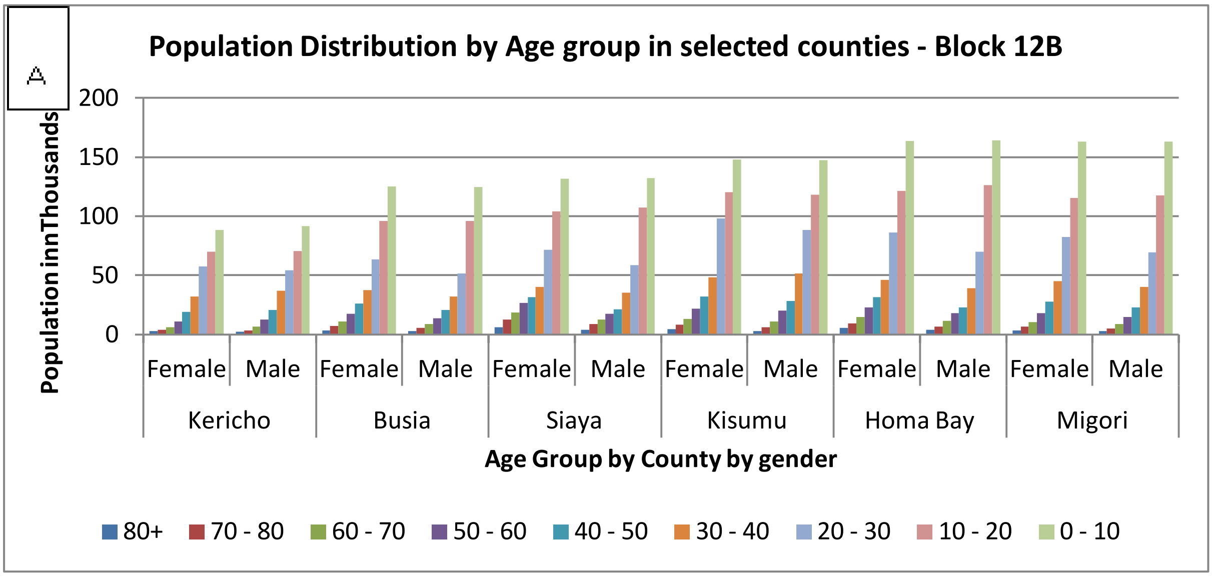


Figure 7.8: Population distribution in Block 12B

Migori County has the highest number of children 0-10 years old, followed by Homa Bay, Kisumu, Siaya, Busia and Kericho counties (Figure 7.9a). Kisumu has the highest population of youth 20-30 years (both sexes); presumably because it is the provincial town and youth feel there are more employment opportunities than in other counties. In terms of a combined age a pyramid, Figure 7.9b below indicates that this age distribution within block 12B reflects the national age pyramid.



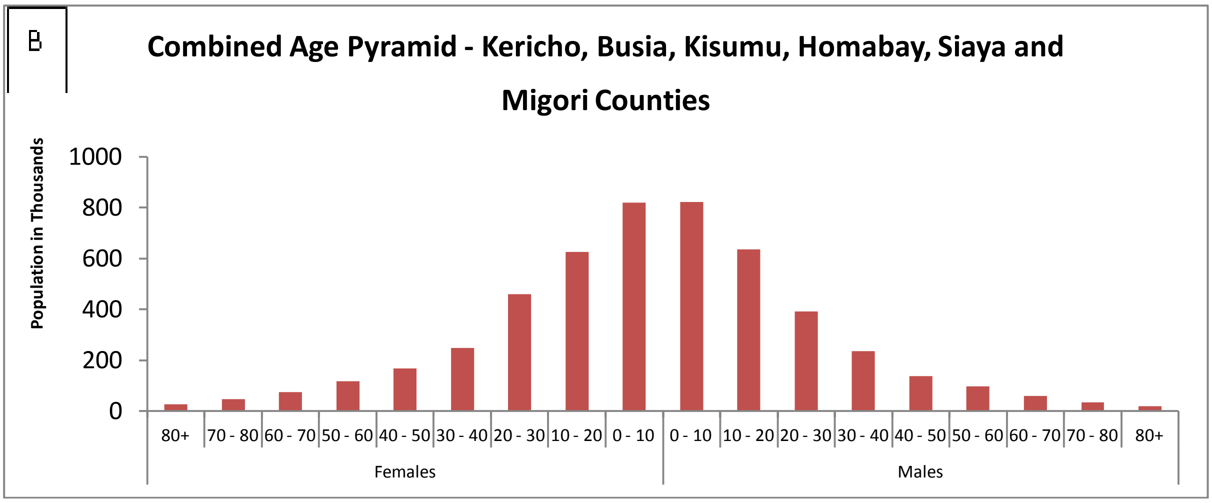


Figure 4.9: (a) Population distribution by age group in selected counties - block 12B and (b) Combined county age pyramid - block 12 B Sources: opendata.go.ke

7.3.3 EDUCATION

There are a total of 1121 primary and 308 secondary schools in the project area. On average, less than 8% of all children aged 6-17 are reportedly currently not in school (opendata.go.ke, 2005-2006 data). More than 85% of the population in this region has attained primary school education (Kenya Counties Fact Sheets, CRA, 2011).

7.3.4 HEALTH

The proposed project area has a total of 522 health facilities including dispensaries, Sub-district Hospitals, Medical clinics, Health Centres and other health facilities, with Nyanza Provincial Hospital being the main referral facility in the area as indicated in the table below. The most prevalent diseases include malaria; Respiratory Transmitted Infections (RTI), and diarrhoea. On average, more than 50% of the population of children less than a year old have been fully immunized, 70% have access to improved sanitation (County fact sheets, CRA, 2011).

Table 7.8: Number of health facilities by type and ownership

Facility type	**Ownership/management**								**Total**
	GOK	**Local authority**	**Community**	**Faith based**	**Private**	**NGO**	**Parastatal**	**Armed forces**	
Provincial Hospital	1	7.4	7.5	7.6	7.7	7.8	7.9	7.10	1
District Hospital	15	7.11	7.12	7.13	7.14	7.15	7.16	7.17	15
Sub district Hosp.	19	7.18	7.19	7.20	7.21	7.22	7.23	7.24	19
Medical clinics	1	7.25	7.26	6	46	9	1	7.27	19
Dispensaries	283	11	13	13	53	7.28	7.29	1	374
Nursing Homes									15
Stand alone VCT				3	13	7.33	7.34		16
Other Hospital				6	13	7.35	7.36	7.37	19
Total by Ownership	319	11	13	25	130	22	1	1	522

7.3.5 LAND TENURE

Land tenure systems in the project area include private land, community trust land. Private land includes land held under freehold or leasehold tenure and are mainly owned by individuals with title deeds. Settlement schemes also fall under the category of private land. This is land which was acquired through Settlement Fund Trustee (SFT) at subsidised costs. Ancestral land in the project have been legislated and registered in the siblings' names hence most people now have private lands owned by individuals with title deeds.

Community land in the project area includes land lawfully held, managed or used by specific communities as community forests, grazing areas or shrines. Examples are communal and trust lands in Rachuonyo that include Sanda Kobada community trust land, Kajiei community land, and Nyadoto delta along the beach in Rachuonyo. Although the constitution gives both gender the opportunity to inherit land, this is still not common as the community reports men having control over land sale and use.

7.3.6 EXISTING INFRASTRUCTURE

Some of the infrastructure in Block 12B includes the Kisumu International Airport in Kisumu City. The road network in the area includes the Kisumu - Kisii - Isebania road, the Kisumu - Busia road, the Kisumu - Kakamega road and the Kisumu - Kericho road which connects various sections of Block 12B. These roads are in good condition except in a few places such as parts of the Kisumu - Kericho road which are still undergoing construction. The roads in the hinterland which connect to these major roads such as the Maseno-Siaya road are however in bad condition due to presence of potholes.

Other infrastructure in the area includes telecommunication and mobile telephony, with major stakeholders being Safaricom, Airtel, Orange Telkom (Kenya) and the Postal Corporation of Kenya. It was also noted that each district within the Block has at least one market managed by the Local Authority.

Existing infrastructures include roads, bridges, stadiums and waste management facilities etc. The road networks in three of the six counties, for which such data was available, are as follows:

Table 7.9: The documented total coverage in Km of road network in parts of Block 12B

County	Tarmac/Bitumen roads in Km	Gravel/Murram roads in Km	Earth surface Roads in Km	Total road coverage in Km
Migori	72	324	514	910
Homa Bay	101.8	415.4	604.6	1121.8
Kericho	184.9	96.4	846	1127.3

7.3.7 WAGE EARNING ACTIVITIES

Key economic activities in the area include agriculture (both commercial and subsistence). Commercial agriculture includes sugarcane and rice farming. Sugarcane farming is mainly practiced on the foot slopes of Kajulu hills in Kibos area stretching along the foot slopes of the Nandi escarpment to Miwani, Chemelil and Muhoroni areas. Rice farming on the other hand is mainly done on the Kano plains and Yala swamp areas. Horticulture is also practiced along the Lake in Homa Bay. Fishing in Lake Victoria is another major wage earning activity with the major fish species harvested being Nile perch, Tilapia and Omena. Fish farming is also practiced in selected places in the project area, particularly near swampy areas. Livestock farming of indigenous cattle breeds known as zebu is also practiced in the project area.

Other than farming, other wage earning activities include pottery and brick making which are mainly practiced in Nyakach area due to the availability of organic peat soils. A number of individuals have invested in the transport sector. Motor bike transport is a common wage earning activity for youth in the area. Retail shops and petty trading are also common in the area.

There are a number of economic activities that harness the natural resources in the area. They include weaving of mats and baskets including making of chairs using locally available materials such as papyrus reeds and water hyacinth which are found in abundance in the wetlands and in the Lake. Quarrying of dimensional stone and sand harvesting is carried out in the area, especially in Awasi in Nyando District area, and along river banks respectively.

7.3.8 SETTLEMENTS, HOMESTEADS, BUILT ENVIRONMENT

Settlements in Block 12B can be categorized into two: settlement schemes and ancestral lands. Settlement schemes are found around Muhoroni and Koru and are allocated by the government through Settlement Fund Trustee (SFT) at a subsidised fee. The ancestral settlements are those that have been adjudicated as per the original ground occupation.

The Block has both urban and rural settlements. However, the rate of urbanisation is high and it has been estimated that 50% of the population in the lake basin will be living in urban settlements by 2050 (LVEMP, 2005). Major urban centres within Block 12B include Kisumu, Muhoroni, Homa Bay, Kendu Bay, Ahero and Mbita. Other smaller centres in the area include Pap Onditi, Katito, Awasi, Maseno, Budalangi Funyula, Koru and Miwani. The homesteads are scattered but tend to be nucleated especially in fertile areas. Most homes in the rural set up have semi permanent structures with mud walls and iron roofs. Modern houses dot the urban settlements with the real estate industry in Kisumu town area growing exponentially. This has seen the built environment in the City expand all the way to Riat area.

Schools within rural areas in Block 12B are located along the roads and are now in the process of being transformed from mud walled structures into permanent and semi-permanent structures. The primary schools have pupils on week days with exception of weekends and holidays. Hospitals are mainly found in urban centres and district headquarters.

Plate 7.25: A typical rural health facility in Block 12B

7.3.9 MAIN CROPS

The project area has both cash and food crops. The main cash crops cultivated in the area are sugarcane and rice. Other cash crops cultivated in the area include sunflower, tobacco and cotton in Homa-Bay, Pineapple around Kochia in Homa-Bay, and coffee in Nyakach. Maize, sorghum, groundnuts, cassava and sweet potatoes are some of the main food crops cultivated in the area.

Plate 7.24: (a) Maize farming in the proposed project area and (b) rice farming in Kano Plains. The two are some of the major crops grown in the area.

7.3.10 GRAZING AREAS

Grazing is practiced in designated areas along the lake shore in Rachuonyo, Mbita and Nyakach, on fields in Karungu and Kanyamwa around Ndhiwa and in certain cases on hills during rainy seasons. The use of wetlands (Siany), as grazing lands, especially during dry seasons is common in the region.

Plate 7.25: Acacia woodlands with grass undergrowth are used as grazing areas in Mbita.

7.3.11 OTHER INDUSTRIES

The major industries within the Block include Capital fish industry in Homa-bay, Fish processing industries in Kisumu, sugarcane industries in Miwani, Muhoroni, Chemelil and

Kibos; molasses industry (Agro-Chemical and Food Company- AFC), Homa Lime Company Limited situated at Koru in Muhoroni district. Homa Lime Company Limited also owns a jaggery processing industry. There are several rice milling companies in Nyando, Nyakach and Yala including the National Irrigation Board, Nyando millers, Lake Side millers and Dominion millers. Tea processing industries are found in Kericho. Other minor industries include mining for iron ore in Kotieno, ballast in Adhiambo hill, mining for gravel used to “clean” water – in Karachuonyo, sand and stone harvesting in Nyakach and mining for gold dust in Macalder, Nyatike. Salt lick (*Bala*) is mined at Simbi and in Rachuonyo District and in the hot springs at Homa hills. Murram is also harvested in small scale in Awasi area in Nyando District as well as in Mamboleo area in Kisumu. Local brick making industries are found Nyakach area where there is an abundance of brick clay. Quarrying of dimensional stones is practiced in Koru and Fort Ternan. A mat making industry is located in Ombeyi area, a wetland situated in the Nyando delta area in Nyando district.

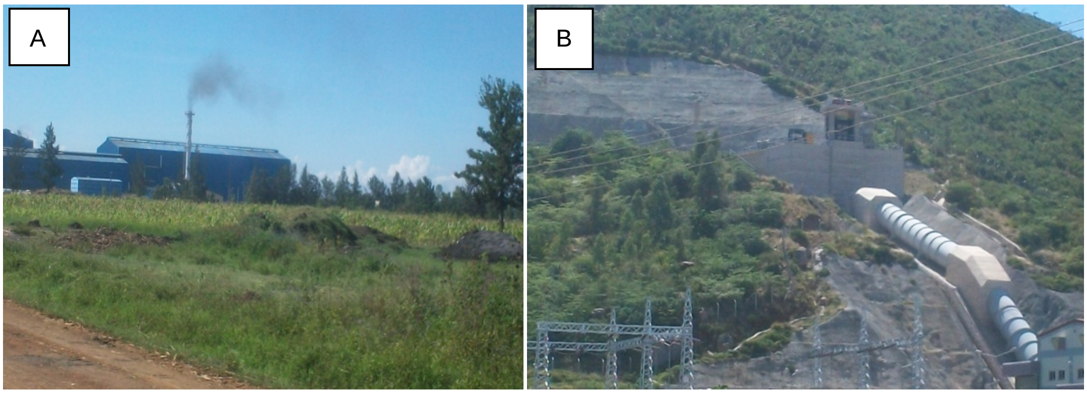


Plate 7.26: (a) Kibos sugar factory in Kibos area and (b) Sondu Miriu hydroelectric power plant in Pap Onditi.

7.3.12 SUBSISTENCE ACTIVITIES

These include small scale cereal farming entirely across the project area. The cereals include maize, sorghum, groundnuts and legumes such as ground nuts and beans. Other subsistence crops include sweet potatoes in South Nyanza region of Homa Bay, Kanyamwa, and Sondu and bananas around Kericho. Other subsistence activities include brick making, mat and basket weaving, stone harvesting as well as smithery by Ogolla Jwenge clan – in Nyakach. Casual labour in the agro-based industries, jua kali (self-employment) sector, *boda boda* transportation (cyclists) and petty trade in towns are also some of the subsistence activities carried out in the area. There is also cash crop farming such as tea in Kericho County, sugarcane in Kisumu County and rice in Busia and Kisumu County.

Plate 7.6: (a) Water melon farming in Nyatike (b) boat making in Usenge beach and (c) fish being prepared for sale at Namabusi Beach in Budalangi.

7.3.13 COST OF LIVING

The cost of living is varied between rural and urban. The urbanites generally have a higher cost of living. Proportionally, residents in the cosmopolitan area of Kisumu East appear to own the various assets listed in table 7.20 below. An average of 57% of households in the area within block 12B owns mobile phones, while 76% and 18% of households within block 12, own a radio and TV respectively. An average of 39% of households within the block under review own bicycles. Census 2009 data indicates that an average of 45% of residents in the counties within block 12B used a mobile phone during the last month preceding the survey, and 3.6% use the internet at least once a month (Table 7.22).

Table 7.10: Mobile and internet usage level, by county

County	Percentage of the population using the resource	
	Mobile (monthly)	Internet (monthly)
Busia	36.3	2.6
Homa Bay	45.7	3.0
Kericho	45.4	3.9
Kisumu	54.2	6.6
Migori	42.2	3.1
Siaya	47.6	2.6
Average	45.2	3.6

Source: 2009 Population and Housing Census

Table 4.11: Ownership of household assets by District – Block 12B

District	Proportion of households owning various assets in %						
	Radio	TV	Mobile Phone	Computer	Bicycle	Motorcycle	Car/Truck/Tuk Tuk
Bondo	77. 1	4	58.7	1.4	55.8	3	2
Rarieda	77.3	13.2	54.1	1	50.7	2	1.5
Siaya	71.1	13.9	52.3	1.2	49.2	2.2	1.7
Kisumu East	80.5	40.6	74.2	6.6	37.9	3.4	6.7
Kisumu West	77.1	17.2	54.3	1.8	35.5	2	2.1
Nyando	80.9	21.2	59.6	1.5	41.1	2.5	2.4
Homa bay	72.5	14.8	51.3	1.3	36.2	3.1	1.7
Rachuonyo	76.2	17.6	56.3	1.3	34.1	2.8	1.9
Suba	72.2	10.7	53.2	1	26.4	2.9	1.2
Bunyala	67.6	12.4	51.9	1	51.9	1.7	1.4
Kericho	79.9	20.4	61.2	1.9	9.5	1.9	4.3

Source: 2009 Population and Housing Census

7.3.14 UNIONS, CO-OPERATIVES, FARMING ASSOCIATIONS

There are a number of farming societies in the project area as well as fish marketing cooperatives. The farming societies have mainly been formed based on sugarcane farming. Sugarcane is a major cash crop in the project area. Tea based cooperatives have also been established in Kericho County for value chain services. The fishing and marketing cooperatives in the project area are mainly found along the beaches in the lake region. The main cooperatives identified were the Dunga Beach Fishermen Cooperative Society in Kisumu, Nyakach Multipurpose Cooperative Society, Nyapako Farmers Cooperative Society, Nyabondo Coffee Farmers, Nyakach Fishermen Society and Siany Multipurpose Society – all in Nyakach.

Plate 7.7: Homa Bay Environmental Bio-centre Initiative community based organisation offices in Homa Bay.

7.2.15 VALUE CHAINS

The main products in Block 12B with significant value chain include rice, sugarcane, fish and tea in Kericho County. Rice is Kenya's third staple food after maize and wheat. Its consumption has been growing rapidly and it is likely to overtake wheat. All these products are channelled through cooperative societies and SACCOs for production and marketing purposes except for fish that still lack well established cooperative societies.

Rice

Local production of rice is estimated at between 33,000 and 50,000 metric tonnes, while consumption is between 180,000 and 250,000 tonnes (Softkenya 2012). Rice is milled and sold locally through companies such as Lake Side Millers and Nyando Millers. The husks and stalk are used as animal food. The stalk is left on farms and act as grazing stalk for livestock.

Fish

The fish catch within the Block is sold directly on the beach to various traders. Industrial Fish Processor (IFP) agents buy the Nile perch that meets the processors' criteria (e.g., size, freshness) who take the IFP's ice-laden trucks to the mainland beaches. Lower quality grade Nile perch, tilapia and omena are sold to a number of successive intermediaries along the supply chain: collecting traders, regional traders, wholesalers, and retailers in urban open air markets and through street vendors. Sales of domestic fish products in modern retail outlets such as supermarkets are limited. Grading and the use of ice are minimal in these domestic end-market channels, resulting in high spoilage levels.

Throughout the value chain, actors behave individualistically. Groups are formed mostly to provide entry points for larger buyers (IFPs) and government and donor programs. There are BMUs on all the beaches and many associations and cooperative societies for fisherfolk, fish traders and fishmongers, but these are weak and not properly managed. Especially at the level of the fisherfolk, there are few if any economies of scale and market power is low, leaving them at the mercy of the potentially exploitative practices of the fish traders.

Overall, vertical power imbalances result from the well-capitalized larger traders initiating a wave of supplier credit that ripples through the value chain and creates buyer dependency (viscous cycles of debt). On the beaches, the imbalance between low fish supplies and many women traders trying to secure these supplies has led to the *jaboya* system of fish-for-sex whereby the women are forced to pay an “in-kind” premium on top of cash. Vertical power imbalances play out strongly in the Nile perch channel. The dominant players in this value chain are the IFPs who via their buying agents exert market power over the fisherfolk. They also create dependencies by providing equipment on (low-cost) credit to boat owners, which puts the latter in a debt position and locks them in. The greatest dependencies however play out in the artisanal fish processing channel where governance mechanisms keep the small processors of Nile perch offal in a highly dependent position with little or no room for upgrading and growth.

Sugarcane

Sugarcane is received in sugar processing companies through cooperatives which in most cases have the challenge of mismanagement. The canes are cut and transported to the manufacturing companies either by individuals or farmers cooperatives. The cane is processed into sugar where lime produced at Homa Lime is used in the effluent treatment process. Molasses a by-product of sugar processing/ mother liquor from which little or no additional sugar can be obtained economically is used to manufacture baker’s yeast, rectified spirit, neutral alcohol, industrial methylated spirit, Kenya methylated spirit, active dry yeast and fodder yeast. This is done by molasses processing company –Agro-Chemical and Food Industry (ACFC).

There is a Jaggery industry in Koru operated by Homa- lime which uses the cane from the nucleus and produce by-products such as bagasse and liquid wastes. The bagasse is used for firing boilers in sugar factory.

7.3.16 CULTURAL PROPERTY

Natural heritage sites within the proposed site include: Luanda Magere sanctuary in Miwani Division, Fort Ternan prehistoric site in Muhoroni, Lake Simbi Nyaima in Karachuonyo and Kit Mikayi in Kisumu District.

Another archaeological site around Homa Bay is Kanjera archaeological site. Rusinga Island within Homa Bay County is also one of the famous archaeological site .This is the archaeological site where Dr. Mary and Louis Leakey found the skull of a proconsul *Africanus* which is believed to be approximately 18 million years old and was among the earliest ancestors.

A traditional worship place- Kit Mikayi is one of the important cultural as well tourist attraction site. The place has been used to offer prayers and rituals especially during droughts. Burial grounds within the Block 12B region are revered places and have cultural attachments especially to the ancestors.

Plate 7.29: (a) The legendary Luanda Magere stone in Muhoroni and (b) the Kit Mikayi cultural site in the project area.

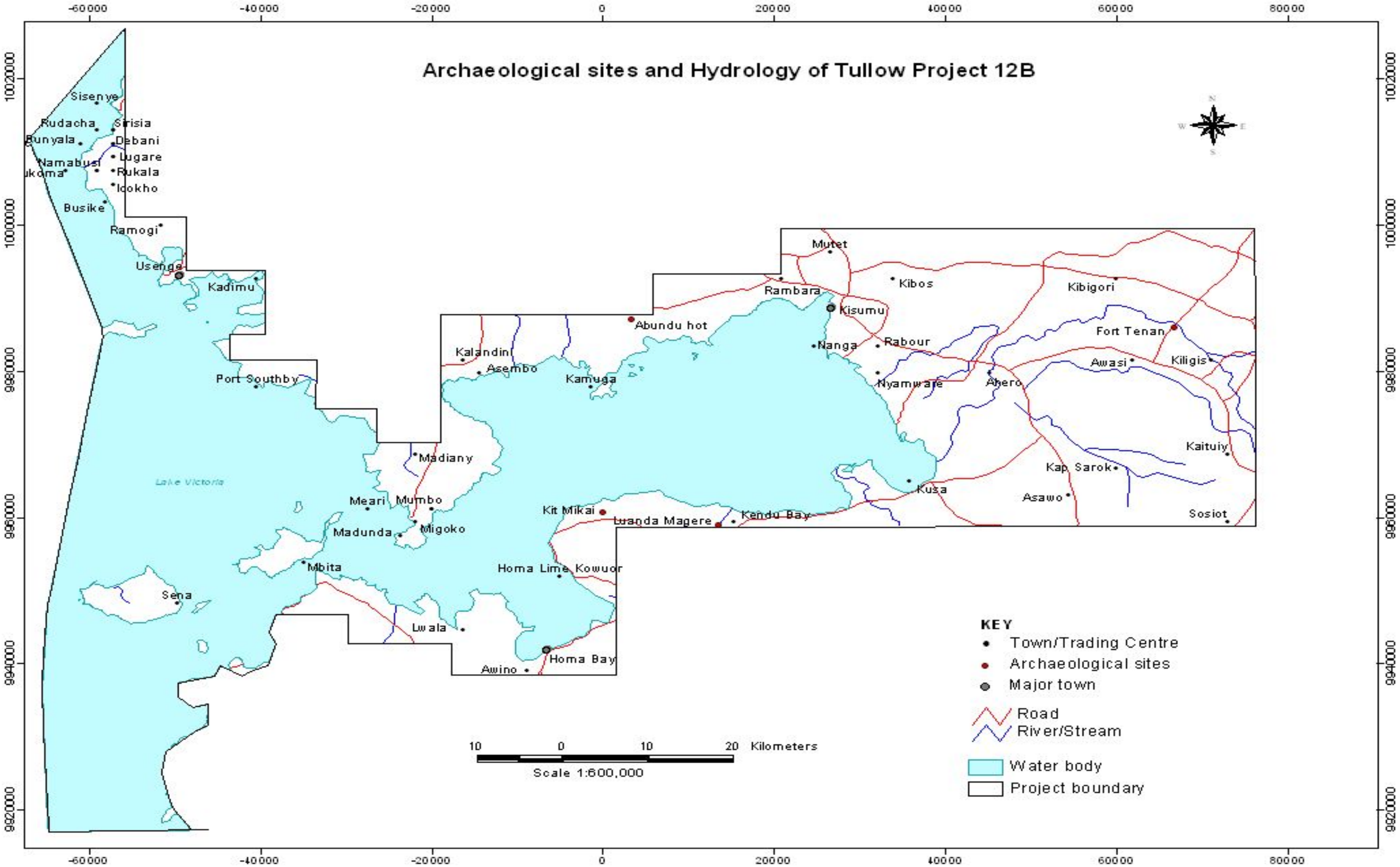


Figure 7.10: Cultural and archaeological sites in Block 12B

7.3.17 ECOSYSTEM SERVICES

There are a number of natural resources in the project area which the community utilises to make valuable products. These include water hyacinth and papyrus reed which are used to make furniture, mats and baskets. Papyrus is also used for house thatching and making fishing lines. Water hyacinth has been used even in making coffins.

Other plants in the proposed project area are used as concoctions in herbal medicine. Other ecosystem services include rivers which provide water for domestic and industrial use, wetlands which provide grazing lands during the dry season, brick clay used for making bricks and *bala* used for making salt lick.

Plate 7.30: Papyrus reeds harvested from the wetland near Namabusi Beach in Budalangi area. The reeds are used in making mats.

7.3.18 DESIGNATED LANDS

Designated lands in the project area include cultural sites, pre-historic sites, historic sites, archaeological sites, sacred sites and grazing lands. Other designated lands in the area include national parks, wildlife sanctuaries, museums and mausoleums. There are also a number of hills and forests in the project area which are protected areas by Kenya Forest Service. Examples of parks in the project area include Ruma National Park and Ndere National Park as well as the Impala Park Sanctuary. Archaeological sites include Kanjera, while a pre historic site is found in Fort Ternan in Muhoroni District. Forests in the project area include Kodera Forest in Nyakach, Homa Hills forest in Rachuonyo and Got Ramogi Forest in Bondo to mention a few. Cultural sites in the project area include Luanda Magere site in Muhoroni, Kit Mikayi site in Kisumu West and Simbi Nyaima Lake in Rachuonyo. Mausoleums include the Jaramogi Oginga Odinga Mausoleum in Bondo and Tom Mboya Mausoleum in Mfangano Island.

7.3.19 FISHERIES AND OTHER WATER RESOURCE USES

The fisheries industry is one of the major industries in the area. The introduction of the Nile perch transformed the fisheries from a locally based artisanal fishery to a national and international capital investment industry that produces an annual income of USD600 million, and provides employment for over 3 million people (Njiru et al., 2008a). Several challenges face the lake fishery, including environmental degradation, the introduction of exotic species, overfishing, and occasional fish export bans (Njiru et al., 2008a). The current fish population characteristics suggest a population under stress, attributable to intense catch exploitation; however, commercial catches are still high, suggesting a very resilient fishery (Njiru et al., 2008b). However, despite this resilience, the future of Oreochromis fishery is threatened by increased fishing capacity in the lake and this requires re-evaluation of current fisheries management measures, adoption of alternative livelihoods for lake fishers, as well as reduction in fishing capacity and illegal fishing methods (Njiru et al., 2008b).

7.4 PUBLIC CONSULTATIONS

7.4.1 AREAS COVERED

Public consultations were carried out in different sections of the project area. In particular, consultations were carried out in Mbita, Ndhiwa, Homa Bay, Nyakach, Kericho West, Nyando, Kisumu, Bondo and Bunyala (Table 7.24).

Table 7.15: Public consultations meetings in Block 12B

No.	Location	Venue	GPS Coordinates
1.	Mbita	Mbita Boys High School	S 00.43860^0 E034.20538^0
2.	Rachuonyo	Rachuonyo District Headquarters- Homa Bay	S 00.37913^0 E034.65482^0
3.	Nyakach	Nyakach District Headquarters- Pap Onditi	S 00.31406^0 E034.93656^0
4.	Kericho West	Sigowet SDA Church	S 00.39769^0 E035.04859^0
5.	Kisumu	Kisumu Social Hall	S 00.10115^0 E034.76258^0
6.	Bondo	Tintoler Conference Hall	S 00.07098^0 E034.37872^0
7.	Budalangi	Budalangi District Headquarters	N 00.12983^0 E034.02568^0
8.	Nyando	Nyando District Headquarters- Awasi	S 00.16475^0 E035.07976^0

Plate 7.31: (a) A Public consultation meeting in Nyakach and (b) a public consultation meeting in Rachuonyo.

7.4.2 BACKGROUND INFORMATION

Block 12B is located on the eastern part of Lake Victoria and covers parts of Kisumu, Homa Bay, Siaya, Busia, Migori and Kericho Counties. The Block covers approximately 300Km of the Kenyan side of the Lake Victoria shoreline. The project area has both rural and urban centres. The major urban centre in the Block is Kisumu which is a metropolitan City and has many inhabitants from all areas in the country. The rural areas are mainly inhabited by the Luo community. The Luo community live as extended families in the rural set up and as nuclear families in the urban set ups. The extended family comprises of man, wife, children, grandchildren and other relatives while the nuclear family comprises man, wife and children. Land is mainly owned by men who are also the decision makers in the family. Roles are divided according to gender. Women mainly take care of children.

The Luo community has many revered areas including graveyards and cultural sites such as the Luanda Magere and Kit Mikayi sites. 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.

7.4.3 COMMENTS AND CONCERNS

During the public participation process the opinion of community members on the proposed project were sought. The comments included effects of the 2D seismic survey on their social lives and surroundings. The comments are listed below:

Effects of the proposed 2d seismic survey to organisations/departments

- Increased work load to the department of gender and social development due to anticipated social ills in the society;
- Interference with fish and fishing operations;
- The project will most likely require additional security mechanisms be put in place as crime rates may increase as other Kenyans flock to the area to seek opportunities;
- Resistance from some community members hence the need for involvement of the provincial administration in conflict resolution; and
- Potential for increased cases of upper respiratory infections due to air pollution

Main Concerns

- Potential human displacement from individual and community land;
- Where to relocate the community, if the need arises;
- The potential for environmental pollution and degradation;
- Potential for destruction of built structures;
- Potential negative environmental, economic and social effects resulting from population influx;
- Transparency (lack of) in the whole process of execution of the proposed project; and

- The potential for corrupt land deals as a result of increased demand for and value of land

Anticipated Positive Impacts

- Improved infrastructure
- Improved livelihoods through employment, economic and social development
- Reduced deforestation resulting from access to available and affordable alternative fuel sources
- Will make Kenya a globally competitive country

Anticipated Negative Impacts

- Politicization of the whole process,
- Marine wildlife population will be affected
- Uneven revenue distribution
- Social and moral decay
- Increased insecurity
- Environmental degradation

Ways in which concerns can be addressed

- There should be thorough, advocacy, community sensitization, which also includes addressing concerns regarding displacement, and distributive justice. The provincial administration should take lead in this process of mobilization and sensitization;
- Involve the political wing to avoid misrepresentation of facts;
- Employ locals to the extent possible;
- Put in place mechanisms to resettle displaced people; and
- Institute acceptable systems and structures to handle disputes and conflicts;

Ways through which positive impacts can be enhanced

- Locally source unskilled labour;
- Regular and participatory progress and review meetings with stakeholders; and
- The company's corporate social responsibility be energised.

Ways through which negative impacts can be avoided, reduced or mitigated

- Transparent and participatory involvement of the community, administration and the political wing from the initial stages of the process;
- The process of distributive justice needs to be clear to the community and potentially affected persons;
- Assess, anticipate and pre-empt known challenges such as moral decay and its attendant effects;
- Proper waste and effluent disposal;
- Training in sustainable investments after compensation; and
- Use mass media to relay information about the proposed project.

The following issues were however mentioned by the community as requiring careful attention:

Engagement of the community during the execution of the proposed project

Block 12B has a Community Liaison Officer whose mandate is to relay information and concerns from the community to the proponent. The CLO also provides information to the community members within the Block on the activities of the proponent. During the public consultations, community stakeholders expressed concern that Block 12B covers a large area and therefore requires more than just one CLO in order to be able to relay the concerns of the community to the proponent in a timely manner.

Social Investment Initiatives

Block 12B are does not face major crises in terms of basic needs. There are several water courses in the project area which provide the residents with adequate water. However, there are other areas that can be considered in terms of offering social investment initiatives. They include provision of bursaries for needy school going children. As it is Tullow has already rolled out the first phase of bursaries in the area.

Another social investment project that the developer could consider is ensuring that health facilities are well equipped and have sufficient drugs. This can be done in collaboration with the relevant Government Ministries. Additionally where possible and viable, support for infrastructure related to construction and rehabilitation of existing schools also should be considered.

Transparency in employment of locals

The stakeholders of Block 12B requested for transparency during the employment of locals, when the proposed project commences. They mentioned that since Block 12B occupies a large area, the people employed should be representative of the entire area.

Preservation of residential structures and revered sites

While there are no specific burial sites identified, villagers were clear that homesteads, graves and cultural sites should not be interfered with, as much as possible. The stakeholders mentioned that natural vegetation, especially huge trees should also be preserved.

7.4.4 STAKEHOLDERS INTERVIEWED

The ESIA study for Block 12B started off with a scoping study that involved a number of stakeholders within the project area. To inform the local people and their leaders about the proposed 2D 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 have any issues of concern with regard to the proposed project; and
- To identify and document the diverse socio-cultural and economic set-ups in the project area that could be potentially impacted by the project activities.

Some of the major stakeholders interviewed with whom one on one interviews were carried out (see methods in section 5.4.15) during the scoping component of this ESIA study included: Lake Victoria Basin Commission (LVBC), Lake Victoria Environmental Management Project (LVEMP), Lake Basin Development Authority (LBDA), Kenya Marine and Fisheries Institute (KEMFRI), International Centre for Agroforestry (ICRAF), Kenya Wildlife Service (KWS), Kenya Agricultural Research Institute (KARI), Water Resources Management Authority (WRMA), Ministry of Environment and Mineral Resources, Department of Mines and Geology and Ministry of Agriculture. Also interviewed were Cooperatives and Beach Management Units (Appendix4).

7.5 HEAD-LINE ISSUES

Sensitive environmental receptors in the area include Lake Victoria, which constitutes an array of biodiversity and is highly depended upon by the locals for their livelihood through fishing. Wetlands in the project area not only offer breeding sites for fish, but are also act as filters of river waters before entry into the lake. They also have papyrus reeds which are used by local communities for mat making hence earning them income. These include the Yala swamp wetland and the Nyando delta area. Forests such as the Koguta forest and the Lambwe valley forest in Ruma are also sensitive areas within the block. Culturally significant sites such as the Fort Ternan area, Kit Mikayi and Lake Simbi including protected areas such as Ndere, Ruma and Impala National Parks and Sanctuary respectively are also sensitive.

Table 7.13: Environmental and Social Baseline Features, Key Issues and Receptors

Environmental and social baseline features	Key Issues	Receptors
1. Physiography	• Damage to pristine landscapes	Physical Receptors
2. Surface water resources	• Interference with rivers in the project area • Diverting of streams • Obscuring the waterways	Soil, ground- and surface water receptors
3. Ground water resources	• 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	• Interference with biodiversity(plants along cut lines, birds and small mammals)	Biological Receptors
5. Aquatic Environment	•Collision with reptiles, water turtles and fish •Disturbance of aquatic animals and benthic habitats •Physical interference with crocodile and bird-breeding sites •Pollution of habitats • Introduction of exotic aquatic species	Biological Receptors
6. Socio-economic features	• Employment opportunities • Improvement of infrastructure (waste management systems, roads) • Preservation of residential structures and communal sites • Interference with grazing lands	Human Receptors

7.6 SPATIAL AND TEMPORAL CONSTRAINTS

The 2D seismic survey project activities will be constrained by inaccessibility of specific sites during rainy seasons due to flooding of plains, poor terrain in uplands and ridges, and land degradation in some parts of the Block especially in Lower Nyakach areas which have resulted in the formation of big gulleys. Flooding mainly occurs in the rainy seasons from March to June while persistent ponding is experienced in the low lying Kano plains. Such areas can be avoided during the rainy seasons by acquiring seismic survey data in the lake during the rainy seasons and in the land during the dry season.

Rainfall distribution in the project area is bimodal with the main rainfall season occurring from March to May and a secondary season from October to December. Strong winds and deep convection which characterise weather over the lake have led to losses of life and property and continue to threaten the safety of marine and air navigation over Lake Victoria and its basin. However, meteorological monitoring network currently in place is woefully inadequate. There is need to improve observations and to provide weather forecasts, advisories and warnings to ships and other vessels using the lake during the offshore seismic survey for safety of the crew.

Regarding fish catch rates, the rainy season on average has higher catch rates of different fish species than the dry season. This could be explained by availability of food items in the environment and suitable breeding grounds. For example, *Oreochromis niloticus* feeds on phytoplanktons which are also abundant during the rainy season.

Breeding sites for fish species found within the lake vary from one species to another. *Barbus altianalis* and *Clarias gariepinus* breeds 10 Km upstream the Sondu-Miriu River while *Labeo victorianus, Oreochromis variabilis, Synodontis victoriae, Synodontis afrofischeri* and *Oreochromis niloticus* breeds 8 km up the same river. *Schilbe intermedius* breeds some 9 km up the Sondu-Miriu and also breeds in River Nyando (Ochumba & Manyala, 1992). Breeding sites for some fish include river mouths and estuaries. *Gnathonemus longiberbis, Hippopotomyrus grahami, Marcusenius victoriae, Mormyrus kannume, Petrocephalus catostoma* and *Pollymyrus nigricans* breeds in the effluent rivers of Lake Victoria, 2 - 24 km upstream. *Protopterus aethiopicus* breed in Lake Victoria in marginal swamp, *Cyperus papyrus* swamp, semi-aquatic grass and specifically in Nyando and Sondu-Miriu floodplains. *Oreochromis variabilis* breeds in the fringe forming 15 m from shoreline (Ochumba &Manyala, 1992) while *Oreochromis niloticus* breeds at depths of 3-9 m in sandy areas as well as in offshore areas. *Oreochromis leucostictus* breeds in inshore areas throughout the year while several groups of *Haplochromis spp.* breed in the littoral and sub-littoral areas. *Lates niloticus* is thought to breed in the pelagic zone of Lake Victoria. Such breeding sites should be avoided during the seismic survey to avoid interfering with fish spawning grounds and eventually a major livelihood source on the project area.

Table 7.14: Breeding seasons of fish species in Winam Gulf in Lake Victoria Basin

Species	Breeding Season	Breeding area	Country
Bagrus docmac	Protracted/Peaks in Jan/August	Lake Victoria	**Kenya**
Barbus altianalis	Mar-Apr/Aug-Sep/Oct-Nov	10 Km Sondu-Miriu Kenya	
Clarias gariepinus	April-June/Sept-Oct		
Clarias gariepinus	10 Km Sondu-Miriu	Protracted/Peaks	
Labeo victorianus	Jan-Apr/Sep-Nov	Sondu-Miriu	Kenya
Oreochromis variabilis	19 Jun-Aug	Sondu-Miriu	
Protopterus aethiopicus	22 July-Aug/Feb	Nyando floodplains	Kenya
Synodontis victoriae	Apr-Jun/Oct-Dec	8 Km Sondu-Miriu	
Synodontis afrofischeri	25 Jan-Apr/Jul-Sep	8 Km Sondu-Miriu	
Tilapia zillii	Throughout the year		
Oreochromis niloticus	Not recorded	Nyanza Gulf	Kenya

Block 12B is a densely populated area and the available land is mainly used for settlement, farming and grazing. Planting of crops is mainly done once in a season for annual crops such as maize which is also the staple in the project area. In areas neighbouring wetlands such as Nyando Delta in Apondo and Ombeyi areas, maize is cultivated twice in a year (Nyando DEAP). A well thought out procedure for land acquisition for the seismic survey should be put in place in consultation with the stakeholders of the area while adhering to local legislation and regulations guiding land acquisition.

8. ASSESSMENT OF IMPACTS

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

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

Table 6:2D Seismic survey project environmental and social aspects and impacts.

	Environmental or Social Parameter	Impact Source	Predicted Impacts
•	▪ Physiography and Geology	• Vibroseis and associated equipment ▪ Bulldozer	• 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
•	▪ Soils	▪ Vibroseis and associated equipment ▪ Bulldozer ▪ Transport Vehicles ▪ Oil or chemical leaks from vehicles and machinery, garage and storage areas	▪ Compaction of degraded soils along cut lines ▪ Disturbance of soil along cut lines ▪ Cut lines may enhance gullying and erosion (wind and water) ▪ Rutting in loose soils ▪ Contamination of soils ▪ Potential landslips
•	▪ Climate	▪ None	▪ None
•	▪ Air Quality	▪ Vehicles and machinery ▪ Sanitary systems ▪ Waste disposal points	▪ Pollution from exhaust emissions ▪ Fugitive dust generation from traffic ▪ Offensive odours ▪ Health risks
•	▪ Surface and Groundwater Resources	▪ Water supply source for the camp ▪ Heavy vehicles and machinery ▪ Drilling of shot holes & upholes	▪ 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

	Environmental or Social Parameter	Impact Source	Predicted Impacts
•	▪ Water Quality	▪ Liquid effluent discharges from sanitation systems at the campsite ▪ Oil or chemical leaks from garage and storage areas, vehicles and machinery	▪ Contamination of water supply source for the camp ▪ Contamination of underlying aquifers
•	▪ Terrestrial Environment (Habitats, Flora, and Fauna)	▪ Vibroseis and associated equipment ▪ Mulchers ▪ Bulldozer ▪ Transport vehicles	▪ Cutting of vegetation along cut lines ▪ Disturbance of wildlife (physical presence and noise) ▪ Introduced weeds and pests
•	▪ Aquatic Environment	▪ Air Guns ▪ Survey Vessels	▪ Laying of ocean bottom cables on the lakebed ▪ Disturbance of zooplankton, phytoplankton and macrophytes
•	▪ Land Resources	▪ Vibroseis, mulchers and associated equipment ▪ Vehicles ▪ Presence of humans	▪ Cut lines affect land resources ▪ Disturbance of animals and resources
•	▪ Archaeological, Historical and Cultural Sites	▪ Vibroseis and associated equipment ▪ Vehicles	▪ 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
•	▪ Visual Aesthetics	▪ Campsite design ▪ Cut lines	▪ Poor campsite design does not blend in with the environment ▪ Cutline footprints and vegetation cover removal lower aesthetic value of landscape
•	▪ Noise and Vibrations	▪ Vibroseis and associated equipment ▪ Vehicles traversing the area	▪ Disturbance to humans, animals and livestock ▪ Disturbance to workers ▪ Health risks
•	▪ Solid and Liquid Wastes	▪ Campsite ▪ Workplaces in the field	▪ Pollution of surface soils, waters and groundwater ▪ Offensive odours ▪ Health risks

	Environmental or Social Parameter	Impact Source	Predicted Impacts
•	▪ Social Characteristics	▪ Workforce influx ▪ Activities along the seismic survey lines	▪ 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
•	▪ 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
•	▪ 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
•	▪ Security and Public Safety	▪ Workforce security needs	▪ Improvement in security due to security enhancement for project activities

8.2 IMPACTS ASSESSMENT AND MITIGATION FOR THE SEISMIC SURVEY

8.2.1 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 a number of roads in the project area, though some are in poor condition, especially in areas such as Mbita and Bondo. The terrain in hilly and rocky areas such as Bondo area could 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 400m 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 landslip 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.

8.2.2 SOILS

The impact sources from the project operations will include Vibroseis or dynamite charges 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.

8.2.3 **AIR QUALITY**

8.2.3.1 ONSHORE SURVEY

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.

8.2.3.2 OFFSHORE SURVEY

The major emission sources from the proposed project are the seismic vessel and the support vessels. Operational atmospheric emissions may include exhaust fumes from diesel generators and compressors. Emissions will include carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), hydrocarbons, sulphur dioxide (SO_2), and particulate matter. These emissions are not anticipated to be significant. Offensive odours are also likely to originate from improper management of on-board solid and liquid wastes and sanitation facilities.

Mitigation:

- All vessel propulsion systems, exhaust systems, power generation equipment and incinerators shall be well and regularly maintained and operated efficiently;
- Minimizing vapour loss from fuel tanks, and idling of equipment when not in use;
- Use low-sulphur fuels where available;
- Project emissions will not exceed applicable air quality standards;
- Sanitary facilities should be kept clean and a routine established for this;
- Solid and liquid wastes should be properly managed in keeping with the guidelines and regulations for the specified vessel.

Due to the low-level and transient emissions and fugitive dust expected to be raised by the project operations, no residual impacts are envisaged.

8.2.4 SURFACE AND GROUND WATER RESOURCES

Water is a key resource in the project area. It is sourced from boreholes, streams, rivers, and springs and also from Lake Victoria. 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, especially in the low-lying Kano Plains area where the water table is quite high. However, it is highly improbable that the upholes could penetrate artesian aquifers.

Eflluents directed into rivers should be treated to the required standards before release as they eventually end up in the lake. During offshore seismic survey, caution should be exercised not to pollute the lake with oil spills.

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 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 workshops located in the base camps;
- 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 up-hole 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.

8.2.5 WATER QUALITY

8.2.5.1 ONSHORE SURVEY

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 up hole 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.

8.2.5.2 OFFSHORE SURVEY

Potential discharges from the seismic vessel and associated equipment that could impact on lake-water quality include: oil contaminated drainage; accidental release of streamer cable fluid, diesel, lubricant oil, oily sludge; sanitary effluent discharges; chlorinated water discharges; cooling water discharges; and solid wastes. Such discharges, if they occurred, would be on a small scale. Thus, impacts on water quality as a result of oil and chemical leaks, liquid effluent and solid wastes discharges are considered to be localised, short term, and of negligible significance with respect to the aquatic ecosystem.

Mitigation:

- Engineering machinery and components (e.g. engines, pumps, OBCs etc.) will be well maintained and checked regularly for leaks;
- Use of bunded storage areas– spills and surface water will drain into a holding tank and treated;
- Oil spill management kits will be available on board, and emergency response training including drills will be conducted;
- Relevant authorities will be notified (according to the Energy Act) on detection of a spill;
- The location of the spill, prevailing winds, currents and lake state will be identified and recorded;
- All solid and liquid wastes shall be handled as outlined in section 8.2.12 below; and
- 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 (See section 10.10.4).

8.2.6 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 protected areas and riverine ecosystem 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 cut lines; 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.

8.2.7 AQUATIC ENVIRONMENT

Aquatic environment in the project area consists of lakes, wetlands, rivers and springs. Man made water features in the area include dams and water pans. There are a number of potential impacts of seismic survey operations in the aquatic environment. Some of the valued ecosystem components that might be affected include: aquatic birds, fish (including eggs and larvae), invertebrates, phytoplankton and zooplankton. The survey may affect migratory routes; roosting, breeding and foraging sites of aquatic fauna, but the seismic lines can be deviated to avoid such areas. The potential impacts of mobile vessels on aquatic fauna include physical contact (strikes). Birds may also be attracted to vessels as a result of structural stimuli (Tasker et al., 1986), food concentrations (Wolfson et al., 1979; Tasker et al., 1986), and lights (Wallis, 1981). The seismic survey vessel (and other vessels) would have to be imported from other areas, in which case they may introduce exotic aquatic species including pests (i.e. invasive species with competitive abilities and noxious traits capable of causing harm). Reducing the risk of entry and/or spread of potentially invasive species therefore represents by far the most effective and cost-efficient means of avoiding these threats.

8.2.7.1 LAKES AND WETLANDS

Lakes in the project are significant resources which the communities heavily rely on. Some of the uses of Lake Victoria include fishing, abstraction of drinking and irrigation water, transport, energy and agricultural and industrial waste repository. However, fishing is the most significant use of the water resource and is an economic activity that is heavily relied upon by the surrounding community. Seismic survey in the lake will therefore result in interference with the communities' livelihood as fishing will not be carried out in areas where seismic survey is being done. However seismic surveys are a short duration exercise. This will see fishing interfered with on a maximum duration of 24 hours or less in any given locality. The proposed seismic survey will not interfere with wetlands as they are sensitive areas. The use of air guns could also scare fish away resulting in low catches in the waters in which seismic survey is being carried out. This impact is temporary. The use of oil and oil based lubricants could lead to pollution of water resources.

8.2.7.2 RIVERS

Rivers in the project area include Nyando, Sondu Miriu, Awach, Awach Tende, Awach Kibuon, Nyamasaria, Kisat and Kibos. Most of these rivers are used by the residents of Block 12B for domestic purposes such as washing, cooking and drinking. The rivers are also used for watering livestock as well as for irrigation purposes. Industries also use the rivers as waste repositories; rivers Nyando and Kisat in Kisumu are polluted by effluents from the sugarcane processing factories and industries including waste water treatment plants. Some of the rivers in the project area such as Mariwa and Nyando are perennial and the water levels are greatly reduced especially during the dry season. Haring of these water resources with community members could result in conflict. However Tullow has plans of drilling a borehole for its use which after project decommissioning will be handed over to the community.

Mitigation

- The mitigations for water quality (Section 8.2.5) above apply;
- Ensure that fishermen are informed well in advance, the areas in which seismic survey is to be done;
- A borehole should be dug for use in the base camp to avoid staining the available water resources in the area. This will also reduce conflict over resources with community members;
- If feasible, variation in the duration of use of "Air Guns" during onshore seismic acquisition should be done e.g. for 24 hours or only at night or day depending on the fishing patterns in the area;

- If feasible, the use of small volume air guns should be employed to avoid scaring fish away;
- Effluent discharged into any water body should be treated to the required standards according to NEMA Water Quality Regulations;
- Permits for discharge of effluent into a water body should be sought from the regulatory authority, WRMA;
- All seismic survey vessels will carry out visual monitoring and clearance of an exclusion zone around the array and in the immediate vicinity of the survey vessel;
- Emphasis should be placed on proper disposal of food waste to avoid attracting birds to the vessels;
- Surveys will be undertaken during daylight hours only;
- Seismic survey shall be undertaken during non-spawning/breeding seasons;
- Carry out vessel surface cleaning to remove biofouling prior to departure from areas with known or potential aquatic pests. Immersible equipment that has been used in other aquatic settings should also be cleaned (i.e. OBCs, air powered seismic sources, and accompanying cables/ropes/chains) before use in the lake; and
- Coat vessel surfaces with an effective antifouling coating.

8.2.8 LAND RESOURCES

Soil and grazing lands are a significant resourced in the project area and support the farming of crop and rearing of livestock in the area. 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 several protected areas including the Ruma National Park, Ndere Island National Park National Park which are tourism resources, including a number of forest reserves. The proposed 2D seismic survey shall not be conducted within or near the protected areas.

Mitigation:

- As for sections 8.2.1 (Physiography and Geology), 8.2.2 (Soils) and 8.2.6 (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 minimised if the Community Liaison Officer continually engages with the community in advance of seismic operations.

8.2.9 ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

The project area has several known archaeological, prehistoric and historic sites. 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 2D 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 holes 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.

8.2.10 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.

8.2.11 NOISE AND VIBRATIONS

8.2.11.1 ONSHORE SURVEY

The use of heavy road construction equipment, acoustic energy sources, dynamite charges, 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.

8.2.11.2 OFFSHORE SURVEY

The main sound-producing elements used in onshore seismic survey are air-gun arrays, which are towed from marine vessels (Dragoset, 2000). The use of airguns during onshore seismic survey could also result in the generation of noise. Typical source levels can be 204 - 210 dB (Carlifornia Coastal Commission, 2002). Airguns produce a short sound (< 30 ms), with a relatively rapid rise time (time to reach maximum amplitude typically < 8 ms). Sound levels emitted are typically around 250 dB at 1 m distance for an airgun array (Turnpenny and Nedwell, 1994). To place seismic signal levels in perspective, low level background noise in coastal regions is about 60 dB, this corresponds to gentle wave action and little wind. In adverse weather conditions, the background noise increases to 90 dB. Seismic data acquisition and recording vessels also generate noise in the aquatic environment. These effects of noise and vibrations are expected to be short-term, and are expected to vary between species and individuals, and be dependent on the properties of received sound. The ecological significance of such effects is expected to be low, except where they influence reproductive activity (DFO, 2004), and it has been suggested that special consideration should be given to spawning because displacement of populations during spawning may affect recruitment to fish stocks (Mosbech, 2000).

Mitigation

- Avoid unnecessary acoustic energy (noise) generation through source, array, and receiver design optimization;
- To minimize vessel noise, use modern seismic survey vessels and associated equipment, ensure that all equipment including machinery are working well and are regularly serviced and maintained, and machinery that is not in use should not be left idling;
- A sequential build-up of warning pulses (soft start) should be made to deter and warn aquatic fauna immediately before commencement of seismic activity;
- Due to the fact that the breeding, spawning and migration seasons of the lake and lake related fauna (fish, invertebrates, reptiles, water birds, hippos) are all different and are spread throughout the calendar year, avoidance of operations during such seasons is impractical, but particular care will be taken at all times to avoid disturbing the fauna;
- Contractor EHS observers will attend on the seismic source boat to observe and report any unusual wildlife activity during acquisition; and
- Vulnerable ecological communities to be identified through close liaison with KWS, and appropriate mitigations agreed.

8.2.12 SOLID AND LIQUID WASTES

8.2.12.1 ONSHORE SURVEY

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.

8.2.12.2 OFFSHORE SURVEY

Lake water may be polluted as a result of both point and non-point pollution by effluents generated from base camps. Point pollution in the form of oil spills may occur as a result of the use of marine vessels such as boats. Water discharges from ships has led to concerns over the vulnerability of marine ecosystems to such types of waste products. In addition to these are possible oil leaks and chemical spills. These may contaminate the lake water that the communities are dependent upon, with the potential of sewage-caused illnesses, water impacts such as increases in biological oxygen demand, chemical oxygen demand, and total organic carbon, reduced water and sediment quality, adversely impacted aquatic biota, increased turbidity, and raised nutrient levels. Pollution by plastic waste may also occur if dustbins and other waste collecting equipment are not put on the board. Non-point pollution of the lake can occur when untreated effluent is directed into rivers draining into the lake. Contamination of land with oil spills could result in contaminants being washed into the lake.

Mitigation:

- No sewage discharge will be undertaken in the lake
- All wastes generated will be managed (i.e., appropriately stored, handled and disposed of;
- Under no circumstances will solid and hazardous wastes be disposed of in the lake. The wastes will be returned to shore and will be stored, labelled and disposed of in accordance with local authorities legislation (no hazardous waste will be disposed of to a facility that is not fully equipped to receive, store, treat and dispose the waste, and local authorities will be notified as to the type and quantity of waste to be disposed);
- The proponent must adhere to the: Water Act 2002; EMCA, 1999; Environmental Management and Coordination (Waste Management) Regulations, 2006; the Fisheries (General) Regulations and the industry best practices;
- Machinery spaces will be equipped with drip trays, curbs and gutters, and other devices to prevent spilled or leaked materials from entering the water. Such wastes will be collected in a closed system designed for that purpose and transferred onshore for disposal;
- Waste materials and equipment lost overboard will be recorded and recovered (where possible);
- Accurate and detailed waste manifests and safe disposal records shall be maintained
- The residual impact of liquid waste discharges in particular would be similar to that outlined under water quality (section 7.5.2), but would also make the water more unsafe to drink or bathe in as harmful microbiological organisms would

multiply in sewage-enriched waters. The anticipated volumes of such wastes would, however, be quite low and rapidly dissipated and diluted by lake currents.

8.2.13 SOCIAL CHARACTERISTICS

8.2.13.1 ONSHORE SURVEY

Block 12B consists of both rural and urban settings with the urban settings being metropolitan while the inhabitants of the rural areas are mainly from the Luo, Luhya and Nandi communities. Fishing and farming are the major means of livelihood in the project area thus the communities depend largely on land resources for subsistence and cash crop farming and on Lake Victoria for fishing. 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 already undertaken a social investment project in the form of provision of bursaries for needy school going children in parts of the project area with great success. 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;
- In case of any damages to fishing gears, compensation should be done in terms of net for net compensation to avoid destroying their means of livelihood;
- 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.

8.2.13.2 OFFSHORE SURVEY

The proposed seismic survey area lies within offshore waters that support both subsistence and commercial fishing. The survey has the potential to interfere with fishing activities and damage fishing equipment (e.g. nets, lines, fixed gear) in the area. Damage to fishing equipment is a concern from both a safety viewpoint (i.e. potential risk to personnel on the fishing vessel and the survey vessels) and in terms of adverse reactions/complaints and subsequent compensation claims from fishermen whose equipment has been damaged, loss of equipment and temporary loss of earnings/livelihood). Damage to the OBCs from fishing gear and resulting impact on aquatic fauna is also a major concern.

Mitigation:

- The local authorities will be advised of the planned survey including details of participating vessels, survey schedule and locations;
- Tullows CLO will sensitise local fishing communities about the proposed activities and ensure that their concerns are addressed;
- A notice will be issued through the local administration informing fishermen of the proposed seismic survey activities;
- The scout and guard vessels will clear the area of fishing boats and their equipment, and prevent fishing vessels from crossing the seismic array; and
- A radar reflector and flashing lights will be provided on the source array tail buoy should it be required.

No residual impacts are anticipated

8.2.14 **ECONOMIC CHARACTERISTICS**

8.2.14.1 ONSHORE SURVEY

The proposed project is in a rural environment with minimal job opportunities and employment. It is expected that the proposed project will offer more opportunities to the local people. However, it is 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.

8.2.14.2 OFFSHORE SURVEY

Fishing is a major economic activity in the project area. Survey in the lake might affect fishing operations in the lake thus interfering with the livelihood of the residents of the project area. It should be noted that fish catch rate near surveys can be affected by air powered seismic source use, but any reduction in catch rates is not expected to be long lasting as the reason for the reduced catches is probably because fish dive to the bottom or disperse when exposed to high-level sound (Gausland, 2000). Temporary migration of fish populations from spawning areas may be harmful because of the negative effect it would have on fish stocks (Mosbech, 2000). OBC equipment may also entangle nets and other types of fishing gear.

Mitigation

- A support vessel will conduct reconnaissance scouting ahead of the survey vessel;
- Regular communication with fishing groups and provision of coordinates of survey area to fishermen will minimize potential impacts to commercial fishing activity;
- Seismic operations should be scheduled during least sensitive period for instance during low fishing season;
- Liaise with local community leaders during the recruitment process;
- Unskilled and semi-skilled manpower to be sourced locally;
- Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan;
- Where damage occurs, for example, to fishing nets, or when project operations may lead to exclusion of fishing in a particular area, then compensation can be made for those income losses. A complaints and compensation mechanism should be developed by a body comprising of Tullow, Ministry of Energy, and Department

of Fisheries officials, as well as community and relevant stakeholder organisation leaders (e.g. Beach Management Units).

The residual impact in this instance would be positive, relating to improvement of work skills that will be acquired by locals who will be employed in the project as semi- or skilled workers.

8.2.15 OCCUPATIONAL HEALTH AND SAFETY

8.2.15.1 ONSHORE SURVEY

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.

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 firefighting equipment should be available to all crew, and specific crew members should be trained on first aid administration and handling of firefighting equipment;
- Job-specific personal protective equipment to be provided to the workers, training should be given, and their use made mandatory in designated areas;
- Life vests and other marine safety equipment will be put on board and worn by all workers during offshore data acquisition. Life boats will be put on standby to aid in rescue operations in case of any emergencies;
- Onshore seismic acquisition is to be done during periods of low tide and good weather;
- Environmental safety and health regulations and policies/plans must be adhered to, including 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; and
- Provision of an Emergency Response Plan, Evacuation Plan, Medevac Plan, Malaria Management Plan and a communicable diseases education programme to be put in place.

No residual impacts are expected in this case.

8.2.15.2 OFFSHORE SURVEY

The seismic survey crew will be exposed to strong wind conditions on the lake, and may face bad weather when carrying out the marine seismic survey. Accidents between vessels and/or vessels and aquatic animals or grounding on unmapped projecting lakebed topography in shallow areas may occur. Other accidental events could include damage or loss of seismic gear, and entanglement of seismic gear with fishing gear. Accidents may also occur as a result of the use of marine vessels such as boats during offshore seismic data acquisition.

Mitigation

- Monitoring of wind speeds should be undertaken, and the marine-based seismic surveys should be called off should the winds and waves thereby generated begin to reach a pre-determined and established critical threshold that may put the life of the boat crews in danger;
- Watch will be maintained on the survey vessel for other craft;
- The scout and guard vessels shall be used to caution other boats, to protect deployed equipment, and to assist/support the seismic survey vessel during abnormal or emergency situations;
- All deployed equipment will be made highly visible to minimise accidents and to facilitate retrieval in case of loss;
- Survey operations shall be suspended in adverse weather conditions;
- The survey vessel will carry operational, navigation, bathymetry tracking, and warning lights;
- The OBC hydrophone cables will be tracked via GPS to monitor their location (assisting retrieval if one or more become severed).
- Well-stocked first aid kits and firefighting equipment should be available to all crew, and selected crew members should be trained on first aid administration and handling of firefighting equipment as provided in the Occupational Health and Safety and Health Act;

- Appropriate personal protective equipment (e.g. Personal Flotation Devices (PFDs)) and fire-fighting apparatus shall be maintained and be easily accessible on the vessels. The crew shall be competent in the use of firefighting equipment and well-drilled on emergency response procedures as required by the Occupational Health and Safety and Health Act;
- Provisions of environmental health and safety plan (EHS) will be adhered to by all;
- Adequate warning or caution signage, including ‘no smoking’ signs, will be posted as required; and
- Only properly trained and authorised employees shall operate equipment or machinery.

8.2.16 SECURITY AND PUBLIC SAFETY

During the project course, insecurity 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);
- The company should liaise with the Provincial Administration 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
- 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. The security personnel will also benefit by getting some allowance for their services.

8.2.17 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 8.7.1 (Physiography and Geology), 8.7.2 (Soils), 8.7.4 (Surface and Groundwater Resources) and 8.7.6 (Terrestrial Environment), 8.7.10 (Noise and Vibrations) 8.7.14 (Occupational Health and Safety) and 8.7.15 (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.

8.2.18 FUELLING STATION

A parking bay for vehicles will be demarcated within the campsite area, and it will have a fuelling station. This could result in oil spills.

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 (plus 10%) 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.

8.2.19 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. The clinic will result in production of biomedical wastes.

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 0ºC 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.

8.2.20 WATER BOREHOLE DRILLING

The groundwater in the project area is exploited mainly through boreholes and shallow wells and tends 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 7: Existing environmental pressures and potential impacts of onshore (land) and offshore (water) project operations on environmental and social factors in the project area (see Appendix 2 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)	• Active land degradation • Periodic ponding of the piedmont plain in low lying areas	Medium	Regional	Permanent	Definite	Neutral	High	Low	Low
	Project Operations	• 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)	• Climate change leading to higher frequency and intensity of droughts and floods	Medium	Regional	Permanent	Definite	Negative	Medium	Low	Low
	Project Operations	• None								
Air quality (Onshore)	Baseline (Pre-project)	• 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

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	• 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
Air Quality (Offshore)		• Air pollution from industries and automobiles • Foul odour from poor solid waste disposal	Medium	Regional	Short term	Definite	Neutral	High	Medium	Low
		• Pollution from exhaust emissions Offensive odours • Health risks	Low	Site specific	Short term	Probable	Negative	High	Medium	Low
Surface and Groundwater	Baseline (Pre-project)	• Freshwater shortage • Uneven distribution of resource • High demand for water resources	Medium	Regional	Permanent	Highly probable	Negative	Medium	Low	Low
	Project Operations	• 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)	• 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	• 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)	• Land degradation from overgrazing • Invasive species	High	Local	Permanent	Probable	Negative	Low	Low	Low
	Project Operations	• Clearing of vegetation, thereby modifying habitats • Fauna behavioural change	Medium	Local	Long-term	Probable	Negative	Medium	Medium	Low
Aquatic Environment	Baseline (Pre-project)	• Eutrophication of the Lake • Precence of water hyacinth in the lake • Use of lake for fishing	High	Regional	Permanent	Probable	Negative	Medium	High	Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	• Increased turbidity of the lake • Interference with fishing	Low	Site specific to local	Short term	Definite	Negative	Medium	High	Low
Water Quality (Onshore)	Baseline (Pre-project)	• High sediment loads in rivers	High	Site-specific to local	Permanent	Probable	Negative	Medium	Low	Low
	Project Operations	• Contamination of water supply source for the camps	Low	Site-specific to local	Short-term	Probable	Negative	Medium	Low	Low
Water Quality (Offshore)	Baseline (Pre-project)	• Eutrophication of Lake Victoria • Decreasing water quality and quantity (increased turbidity and salinity) • Contamination of water and benthic habitats	High	Regional	Long term	Probable	Positive	Medium	High	Low
	Project Operations	• Changes in water quality - Low level contamination/ toxicity of water and benthic • habitats	Medium	Site specific	Short term	Probable	Negative	High	Medium	Low
Land resources and National Reserves	Baseline (Pre-project)	• Overgrazing • Land fragmentation	Medium	Regional/ Local	Long-term	Probable	Negative	Medium		

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	• Cut lines affect land resources	Negligible	Site-specific Local	Medium-term	Improbable	Neutral	High	Low	Low
Archaeological, Historical and Cultural Sites	Baseline (Pre-project)	• Erosion	Low	Local	Long-term	Probable	Negative	Medium	Low	Low
	Project Operations	• 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)	• On aesthetic value assigned to the project area • Land degradation	Low	Local	Long-term	Probable	Negative	Medium	Low	Low
	Project Operations	• 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 (Onshore)	Baseline (Pre-project)	• Noise from strong winds • Anthropogenic (but not excessive) noise localised in small townships and trading centres	Low	Local	Permanent	Definite	Neutral	High		
	Project Operations	• Disturbance to local residents and livestock • Disturbance to workers • Health risks	Low	Local	Short-term	Definite	Negative	High	Medium	Low
Noise and Vibrations (Offshore)	Baseline (Pre-project)	• Natural strong winds • Anthropogenic (but not excessive, boat traffic)	Low	Local	Short term	Probable	Negative	Medium	Medium	Low
	Project Operations	• Disturbance to fish, reptiles and zoo benthos • Disturbance to water birds • Changes to behavioral ecology of species (feeding, breeding, migration patterns). Species would include marine flora and fauna (including water birds). • Physical damage to aquatic flora and fauna	Medium	Site specific	Short term	Highly probable	Negative	Low	Medium	Low
Liquid and Solid Wastes (Onshore)	Baseline (Pre-project)	• Poor liquid and solid waste management in trading centres	Low	Local	Short- to long-term	Probable	Negative	High		

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
	Project Operations	• Land degradation • Pollution of ground water • Offensive odours • Health risks	Low	Local	Short-term	Probable	Negative	Medium	Medium	Low
Liquid and Solid Wastes	Baseline (Pre-project)	• Effluent from industries • Solid waste from residential areas, business premises and hotels	High	Local/ Regional	Long term	Highly probable	Positive	Medium	Medium	Low
	Project Operations	• Pollution affecting aquatic flora, fauna, water and sediment quality	High	Site specific/ Local	Long term	Probable	Negative	Medium	Medium	Low
Social Characteristics (Offshore)	Baseline (Pre-project)	• High literacy levels • Availability of skilled and semi-skilled labour force	High	Local /Regional	Long-term	Definite	Negative	High	High	High
	Project Operations	• 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

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Social Characteristics (Offshore)	Baseline (Pre-project)	• Subsistence and commercial fishing • Tourism in and around the islands • Research in some parts	High	Local	Short term	Probable	Negative	Medium	Medium	Medium
	Project Operations	• Interference with other water users in the area because of exclusion zones • Risk of accidents with other water users • Breaking or entanglement with fishing nets	Medium	Local	Short term	Probable	Negative	Medium	Medium	Low
Economic factors (Onshore)	Baseline (Pre-project)	• Few job opportunities • Poor access to markets • Slow economic growth rate	High	Regional	Long-term	Definite	Negative	High	Medium	Low
	Project Operations	• 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
	Baseline (Pre-project)	• Few job opportunities	Medium	Regional	Medium term	Probable	Negative	Medium	Medium	Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Economic factors (Offshore)	Project Operations	• Interference with shipping, boating and fishing in the area, diminishing economic returns • Employment opportunities for locals • Improvement of businesses and living standards Social Investment Initiatives project benefits	Low	Local/ Regional	Short term/ Long term	Probable/ Definite	Negative / Positive	Medium/ High	Low/ Medium	Low
Occupational Health and Safety	Baseline (Pre-project)	• Low occupational health and safety issues	Low	Local	Short-term	Probable	Negative	High		
	Project Operations	• 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
Occupational Health and Safety	Baseline (Pre-project)	• Lake users exposed to bad weather conditions • A majority of boats lack proper safety gears	Medium	Local	Short term	Probable	Negative	Medium	Medium	Low
	Project Operations	• Potential vessel to vessel accidents • Personal injury • Fire hazard	Low	Site specific	Short term	Probable	Negative	Medium	Medium	Low

Parameter assessed		Pressures/Impacts	Intensity	Extent	Duration	Probability	Status	Degree of confidence	Significance without mitigation	Significance with mitigation
Security and public safety (Onshore)	Baseline (Pre-project)	• Political conflicts	Low	Regional	Long-term	Highly probable	Negative	High	Low	Low
	Project Operations	• 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
Security and Public Safety (Offshore)	Baseline (Pre-project)	• Safe	Medium	Local	Short term	Probable	Negative	Medium	Medium	Low
	Project Operations	• Provision/ deployment of security personnel • Prior warning and information transfer of the intend seismic survey schedule	Medium	Regional	Medium term	Probable	Positive	High	Medium	Low

8.3 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 use of mulchers which allow quick regeneration of vegetation as well as the avoidance of the destruction of large trees. The direct impact of the activity on threatened species of fauna is considered insignificant as there are minimal threatened species within the project area. The scale of fugitive particulate material generation and their impacts on the surrounding environment is generally negligible as adequate mitigation measures are 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.

8.4 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 appendix2). The relationship between the significance rating and decision-making is also classified as “low” (see appendix 2), 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 ESIA 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 Block 12B licence area. If the project does not go on at this stage, then the potential benefits that have been outlined in Chapter 1, section 1.5.2, 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, Nyanza 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 12B 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.

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 3. Approximately 500 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 12B. 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 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 ESIA study, and will be subject to adjustments based on specific issues or conditions encountered when the operation is ongoing. For this project, methods that will be used to generate the seismic waves include: Truck mounted Vibroseis units and dynamite charged shot-holes for land-based seismic data acquisition, and Air Guns for water based seismic acquisition.

The following equipment which will be dedicated solely to the proposed seismic survey activity that will be carried out in Block 12B:

- Seismic source generators (Vibroseis, dynamite charges for land-based data acquisition, and air guns for lake-based data acquisition);
- geophone strings and data recording truck (onshore) / lake (ocean) bottom hydrophone array and vessel (offshore);
- 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 offshore survey, truck-mounted “vibrators” known as vibroseis are used to provide the primary source of energy. Vibroseis vehicles are specialist vehicles that have an adjustable base plate on the under-carriage through which a hydraulic piston transfers+ acoustic energy into the earth.

Plate 7.32: A Vibroseis truck

9.3.1.2 AIR GUNS

In offshore surveys, the energy source used to generate and transmit this acoustic pulse is a seismic pulse. This is a compressed point-source that releases bursts of compressed air under water to create sound waves that travel down through the water column and into the earth’s crust and generate the necessary seismic reflection signal.

Alternative Technologies

The Vibroseis technology 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 9.3.2.1 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. The proposed project area consists of bushland and thickets, low lying flood plains as well as hilly ridges. The area is also densely populated, with most of the land being under private ownership. 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.

9.3.2 IMPULSIVE ENERGY SOURCES

9.3.2.1 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 9.3.1.1 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 may leave a shallow indentation on the surface which is backfilled 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.

9.3.3 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.

9.3.4 ACCESS ROAD CREATION 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.

10. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

10.1 INTRODUCTION

The environmental and social aspects identified in this impact study concerns in the ESIA must be properly managed. The tool for achieving this is the incorporation of an ESMP into the ESIA 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 ESIA study report. The ESMP should therefore indicate how the environmental and social concerns highlighted in the ESIA 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 ESMP. The ESMP 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 ESIA);
- 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 ESIA are effectively mitigated by way of design, construction, operational and decommissioning stages of the project.

10.3 PROJECT DESCRIPTION

Tullow will acquire 500 Km of 2D 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 250 and 350 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 ESMP. 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 2.6).

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 ESIA 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 ESIA 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

ESMP developed during the ESIA 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)
- Aquatic Environment
- 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 ESMP 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 8);
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
▪ 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	• 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 40^0 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 landslip and topple hazards; and • Decommissioning will be carried out according to the Tullow Site Restoration Plan.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Residual impacts of cut lines minimized to the extent possible ▪ Landslips and rock	▪ 100% of seismic cut lines pre-surveyed on the ground ▪ Actions taken to minimise cut line	▪ During seismic operations	▪ The Seismic contractor will be responsible for the day-to-day monitoring and management, and will report to the Tullow Oil	Low

topples do not occur	impacts are recorded ▪ No project- ▪ related landslips or rock topples recorded		Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, or immediately in case of an incident occurring.	

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
▪ Compaction and Disturbance of soils along cutlines ▪ Cut lines may enhance gullying and erosion (wind and water) ▪ Rutting in loose soils ▪ Contamination of soils	• 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 suitable 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Minimal, (if any) , compaction of soft sediments where applicable ▪ Minimal disturbance of soils along cut lines ▪ No contamination of soils	▪ 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	▪ Continuous during survey ▪ Continuous during survey, ▪ Onetime assessment and site selection ▪ All incidents to be reported immediately to the Seismic QC Representative	▪ Seismic contractor will be responsible for the day-to-day monitoring and management, and will report to the Tullow 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

10.9.3.1 ONSHORE SURVEY

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

Potential Impacts	Mitigation
▪ Pollution from exhaust emissions; ▪ Fugitive dust-generation from traffic; ▪ Offensive odours; ▪ Health risks.	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Minimal pollution from exhaust emissions ▪ Minimal dust generation from traffic	▪ Use of low sulphur versus other fuels wherever possible ▪ Adherence to equipment maintenance schedule	▪ Malfunctioning equipment removed immediately from operations for repair ▪ Speed limit violations	▪ 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	Low

▪ No offensive odours ▪ No health risks	▪ Set speed limits are not exceeded (records of exceeded incidents) ▪ No offensive odours recorded ▪ No violation of OHS requirements for dust impact mitigation (violations recorded).	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	will liaise with the Seismic QC representative on site on any issues arising and will report to the Tullow Oil Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, and will immediately report on health risk incidents.	

10.9.3.2 OFFSHORE SURVEY

The impact sources from the project operations will include: vessels and machinery, on-board sanitary systems, poor waste storage and disposal.

Potential Impacts	**Mitigation**
• Pollution from exhaust emissions • Offensive odours • Health risks	• All vessel propulsion systems, exhaust systems, power generation equipment and incinerators shall be well and regularly maintained and operated efficiently (section 4.4.8); • Minimizing vapour loss from fuel tanks, and idling of equipment when not in use; • Use low-sulphur fuels where available; • Project emissions will not exceed applicable air quality standards or guidelines such as the MARPOL Annex VI, Regulations for the Prevention of Air Pollution from Ships; • Sanitary facilities should be kept clean and a routine established for this;

	• Solid and liquid wastes should be properly managed in keeping with the guidelines and regulations for the specified vessel.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
• No pollution from exhaust emissions • No offensive odours • No health risks	• Number of equipment with low emissions • Use of low sulphur versus other fuels • Adherence to equipment maintenance schedule • Proper waste-handling apparatus and facilities installed and procedures established prior to commencement of	• Malfunctioning equipment removed immediately from operations for repair • Compliance with use of low sulphur fuel if available (fuel supply tenders) • Monitor installed equipment and facilities • Daily inspection of sanitary facilities and waste disposal points • Regularly clean waste disposal facilities.	• The Tullow EHS representative shall be responsible for ensuring that air quality is maintained at work and living sites, and that EHS policies regarding handling of wastes and their disposal are adhered to.	Low

	work •No offensive odours recorded			

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
▪ 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	• 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. Through coordination with the Corporate Affairs function (Field Stakeholder Engagement Supervisors and CLOs will be the field-based contacts) and are best placed to advise on the community context; • 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 rivers 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ No conflict over water use with neighbouring communities ▪ No compaction of near surface aquifers ▪ No downward draining of groundwater through drill holes	▪ The seismic contractor will likely drill a 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 survey exercise ▪ No violation of buffer zone limits around groundwater sources ▪ Inventory of drill hole plugging maintained	▪ Continuous, during line survey ▪ Compliance with buffer zone requirements ▪ Continuous, during line survey ▪ Compliance with buffer zone requirements ▪ Per drill hole site	▪ 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 seismic contractor 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 hydro geologist. The hydro geological 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 Kisumu. WRMA will then approve the report and issue a drilling permit.	Low

10.9.5 **WATER QUALITY**

10.9.5.1 ONSHORE SURVEY

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**
▪ Contamination of water supply source for the camp ▪ Contamination of underlying aquifers	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ No contamination of water supply source for the camp ▪ No contamination of underlying aquifers in the project area	▪ 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	▪ 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	▪ 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 Oil Field Acquisition Supervisor and the Tullow EHS Manager on a daily and weekly basis, and will immediately report on incidents of concern.	Low

10.9.5.2 OFFSHORE SURVEY

The impact sources from the project operations will include: liquid effluent discharges from the vessels, disposal of solid wastes from the vessels, oil or chemical leaks from engines, machinery and storage areas.

Potential Impacts	**Mitigation**
• Changes in water quality • Low level contamination/toxicity of water and benthic habitats	• Engineering machinery and components (e.g. engines, pumps, etc.) will be well-maintained and checked regularly for leaks; • Use of bunded storage areas– spills and surface water will drain into a holding tank and treated according to MARPOL requirements; • Oil spill management kits will be available on board, and emergency response training including drills will be conducted; • Relevant authorities will be notified (according to the Energy Act) on detection of a spill. The location of the spill, prevailing winds, currents and sea state will be identified and recorded; • All solid and liquid wastes shall be handled appropriately.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
• Water quality remains unaltered	• No change in water quality before and after operations • No leakage recorded from	• Collect water for quality checks at baseline sampling stations after	• The Tullow EHS Representative shall be responsible for ensuring that water quality is maintained at work and living	Low

• No contamination/ toxicity of water and benthic habitats	equipment and materials storage areas on the vessel • No discharges to the lake • No throwing of solid wastes • Overboard Proper liquid and solid waste/chemicals handling apparatus and facilities installed and procedures established prior to commencement of work	end of operations • Check equipment and material stores daily for possible leakages – daily checks • Oil/chemicals storage areas are secure – daily checks • Monitor proper handling, storage and disposal of all waste on daily basis • Daily monitor to waste-handling and disposal protocols	sites, and that EHS policies regarding handling of wastes and their disposal are adhered to.	

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**
▪ Cutting of vegetation along cut lines ▪ Disturbance of wildlife (physical presence and noise) ▪ Introduced weeds and pests	• 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 water courses 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Minimal cutting of vegetation along cut line ▪ Minimal disturbance of wildlife ▪ No weeds or pests introduced into the area	▪ 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 down and biofouling removed before being taken to the project area.	▪ Continuous, during line preparation ▪ Continuous, during line preparation ▪ Daily ▪ Inspection and certification of the cleaning action	▪ 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

10.9.7 AQUATIC ENVIRONMENT (HABITATS, FLORA, AND FAUNA)

The impact sources from the project operations will include: vessels movement, vessels anchoring and grounding, accidental loss of streamers and associated equipment, liquid effluent discharges from the vessels, disposal of solid wastes from the vessels, oil or chemical leaks from engines, machinery and storage areas, use of a non-sanitised vessel that has been operating in a different marine environment.

Potential Impacts	Mitigation
• Collision with reptiles, and fish • Disturbance of aquatic animals and benthic habitats • Physical interference with crocodile and bird-breeding sites • Pollution of habitats • Introduction of exotic aquatic species	**(Collisions / Strikes):** • All seismic survey vessels will carry out visual monitoring and clearance of an exclusion zone around the array and in the immediate vicinity of the survey vessel; • Emphasis should be placed on proper disposal of food waste to avoid attracting birds to the vessels; and • Surveys will be undertaken during daylight hours only. ***(Disturbance of Benthic Habitats and Breeding / Nesting Sites)*** • Due to the fact that the breeding, spawning and migration seasons of the lake and lake-related fauna (fish, invertebrates, reptiles, water birds, hippos) are all different and are spread throughout the calendar year, avoidance of operations during such seasons is impractical, but particular care will be taken at all times to avoid disturbing the fauna; • Ocean Bottom Cable hydrophone array (OBC) shall be placed on the lake bed; • The marine source will be an air-powered array; and • The source array will be most likely towed at a depth of ca. 2m below water level, this will in turn restrict the array from being used in waters shallower than 2m. ***(Pollution):*** • Carry out vessel surface cleaning to remove biofouling prior to departure from areas with known or

	potential aquatic pests. • Immersible equipment that has been used in other aquatic settings should also be cleaned (i.e. OBCs, air powered seismic sources, and accompanying cables/ropes/chains) before use in the lake (the Fisheries (General) Regulations; • Coat vessel surfaces with an effective antifouling coating; and • Apply proper waste management on board. ***(Invasive Species):*** • Carry out vessel surface cleaning to remove biofouling prior to departure from areas with known or potential aquatic pests as required under the Fisheries (General) Regulations and • Immersible equipment that has been used in other aquatic settings should also be cleaned (i.e. OBCs, air powered seismic sources, and accompanying cables/ropes/chains) before use in the lake as stipulated the Fisheries (General) Regulations).

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management:**	**Risk with mitigation (High, Medium or Low)**
• No collision with reptiles, water turtles or fish • No disturbance of aquatic animals	• A designated expert observer is employed by the contractor • Noise and vibration levels optimised (section 8.10.4) • Equipment handled as	• Inspections during work, continuous monitoring • Monitoring to ensure that such sites are avoided • Inspection to certify that	• The Tullow EHS Rep. shall be responsible for ensuring that the aquatic environment is not or only minimally disturbed. He/she shall be responsible for ensuring that all the mitigation	Low

and benthic habitats • No interference with breeding sites • No pollution of habitats • No exotic aquatic species introduced	indicated in mitigations above • No breeding sites are interfered with • Vessels and equipment are cleaned prior to commencement of operations as indicated in mitigations above	vessels and equipment are properly cleaned	measures specified above are implemented. Any incidents will be immediately reported by the EHS Representative to the Tullow Seismic Operations Supervisor.	

10.9.8 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
▪ Cut lines affect land resources ▪ Disturbance of cultural site (meeting points and grave sites) leading to conflict with the community	▪ As for sections 9.9.1 (Physiography and Geology), 9.9.2 (Soils), 9.9.7 (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.

Desired Outcomes, Objective Indicators, Monitoring, and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Minimal disruption to farming of crop ▪ Minimal disruption to grazing of livestock ▪ Other desired outcomes relate to the following sections: Soils (10.9.2), Terrestrial Environment (10.9.6)	▪ No complaints from farmers and communities ▪ Objective indicators for Soils and Terrestrial Environment are met	▪ Information outflow to the affected communities on seismic line survey schedules and exclusion time periods ▪ Adhering to the use of existing routes and road network ▪ Enforcing policy against hunting and gathering through training and direct supervision where applicable ▪ Clearing done only on seismic survey operation area	▪ The project proponent will be in charge of this.	Low

10.9.9 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
▪ 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	• Tullow should adhere to their Cultural Heritage Management Plan where relevant; • Consultations should be undertaken with home owners, business owners and local elders to help in identifying and avoiding any residential and business properties, 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; • 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Negligible interference, if any, with the archaeological, historical and cultural sites ▪ Desired Outcomes for Soils (section 10.9.2) apply	▪ 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	▪ Buffer zones are adhered to ▪ Flagging is done and cleared once the work is completed ▪ Archaeological sites are not interfered with	▪ The Tullow CLOs 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 such sites are not disturbed, and that all the workers are aware of the locations of the site. ▪ 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.	Low

10.9.10 VISUAL AESTHETICS

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

Potential Impacts	Mitigation
▪ Cutline footprints and vegetation cover removal lower aesthetic value of landscape Poor campsite design does not blend well with the environment	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Campsite blends well with the local environment ▪ Aesthetics value assigned to the area maintained by	▪ Camp design is aesthetic and good housekeeping practices are maintained ▪ Residual impacts of cut lines	▪ Camp constructed according to the engineers' design ▪ Physiography and Geology, Soils and Vegetation sections apply	Maintenance of visual aesthetics will be the responsibility of the Seismic QC	Low

minimising cut line footprints and vegetation removal	minimized in extent (sections 10.9.1, 10.9.2 and 10.9.6 apply)	(sections 10.9.1, 10.9.2 and 10.9.6)	Representative.	

10.9.11 **NOISE AND VIBRATIONS**

10.9.11.1 ONSHORE SURVEY

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**
▪ Disturbance to humans and livestock ▪ Disturbance to workers ▪ Health risks	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Ambient noise and vibration levels maintained ▪ Workers protected in area with high noise levels	▪ 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	▪ Review of design parameters, as needed ▪ Monitor ground and noise vibration during parameter testing phase and establishment of appropriate safe offset distances ▪ Monitor installed equipment ▪ Servicing work and	▪ The seismic contactor 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

	and other machinery ▪ "Quiet" machinery e.g. generators purchased	schedules ▪ Requirement embedded in tendering of equipment documents, inspect as needed		

10.9.11.2 OFFSHORE SURVEY

Noise and vibration sources are airguns, vessel engines and other machinery.

Potential Impacts	**Mitigation**
• Disturbance to fish, reptiles, turtles and zoobenthos • Disturbance to water birds • Changes to behavioural ecology of species (feeding, breeding, migration patterns). Species would include marine flora and fauna (including water birds). • Physical damage to aquatic flora and fauna	• Avoid unnecessary acoustic energy (noise) generation through source, array, and receiver design optimization (section 4.4.7) ; • To minimize vessel noise, use modern seismic survey vessels and associated equipment, ensure that all equipment including machinery are working well and are regularly serviced and maintained, and machinery that is not in use should not be left idling; • A sequential build-up of warning pulses (soft start) should be made to deter and warn aquatic fauna immediately before commencement of seismic activity; • Due to the fact that the breeding, spawning and migration seasons of the lake and lake-related fauna (fish, invertebrates, reptiles, water birds, hippos) are all different and are spread throughout the calendar year avoidance of operations during such seasons is impractical, but particular care will be taken at all times to avoid disturbing the fauna; • EHS observers will attend on the seismic source boat to observe and report any unusual wildlife activity during acquisition; and • Vulnerable ecological communities to be identified through close liaison with KWS, and

	appropriate mitigations agreed.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
• No disturbance to fish, reptiles, turtles and zoobenthos • No changes to behavioural ecology of aquatic species • No physical damage to aquatic flora and fauna • No disturbance to water birds	• Seismic data acquisition design plans optimised for reduction of noise and vibrations from air guns • Towed equipment does not drag on the lake-bed • Regularly serviced vessels/equipment • “Quiet” machinery/ equipment, purchased	• Review of design parameters, as needed • Monitor performance of installed equipment, continuous during work • Requirement embedded in tendering of equipment documents, inspect as needed	• The EHS Representative will be responsible for ensuring the mitigation of noise and vibrations. • The EHS Representative shall also ensure that occupational health and safety protocols are strictly implemented on board the vessels. • Any incidents involving the seismic operation and the natural environment will be recorded and reported.	Low

10.9.12 SOLID AND LIQUID WASTES

10.9.12.1 ONSHORE SURVEY

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

Potential Impacts	Mitigation
▪ Pollution of surface soils, waters and groundwater ▪ Offensive odours ▪ Health risks	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ No pollution of surface soils, water and groundwater ▪ No offensive odours ▪ No health risks	▪ 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	▪ 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	▪ 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	Low

	and properly disposed of ▪ Appropriate use of personal protective equipment when and where mandatory	leaks daily ▪ Daily visual checks on sanitary systems ▪ Adherence to OHS policy and use of PPEs	to minimise or eliminate their potential environmental impacts. 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 to determine where and how the different types of wastes that will be generated during the project can be disposed of.	

10.9.12.2 OFFSHORE SURVEY

The impact sources from the project operations will include: liquid effluent discharges and disposal of solid wastes from the vessels; and oil or chemical leaks from engines, machinery and storage areas on the vessels.

Potential Impacts	**Mitigation**
• Pollution affecting aquatic flora, fauna, water and sediment quality	• No sewage discharge will be undertaken in the lake; • All wastes generated will be managed (i.e., appropriately stored, handled and disposed of; • Under no circumstances will solid and hazardous wastes be disposed of in the lake. The wastes will be returned to shore and will be stored, labelled and disposed of in accordance with local authorities legislation (no hazardous waste will be disposed of to a facility that is not fully equipped to receive, store, treat and dispose the waste, and local authorities will be notified as to the type and quantity of waste to be disposed); • The proponent must adhere to the: Water Act 2002; EMCA, 1999; Environmental Management and Coordination (Waste Management) Regulations, 2006; the Fisheries (General) Regulations and the industry best practices; • Machinery spaces will be equipped with drip trays, curbs and gutters, and other devices to prevent spilled or leaked materials from entering the water. Such wastes will be collected in a closed system designed for that purpose and transferred onshore for disposal. Waste materials and equipment lost overboard will be recorded and recovered (where possible); and • Accurate and detailed waste manifests and safe disposal records shall be maintained.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management:**	**Risk with mitigation (High, Medium or Low)**
• No pollution occurs • No leakages and discharge into the lake of oils, chemicals or sewage and any other effluents reported	• Sanitary systems are working and no breakdowns reported • Hazardous wastes (e.g. medical, oils and chemical wastes) are properly handled and disposed of • Appropriate use of personal protective equipment when handling wastes	• Equipment and facilities are checked daily • Wastes are stored properly and disposed of on land at approved facilities • Material storage containers checked for leaks daily • Daily checks on sanitary systems • Adherence to OHS policy and use of PPEs	• The EHS officer will be responsible for solid and liquid waste management. On-board systems for treating solid and liquid wastes generated in the course of rolling out the project should be properly selected, installed, and managed according to national legislation, regulations, and international best practices in order to minimise or eliminate their potential environmental impacts.	Low

10.9.13 SOCIAL CHARACTERISTICS

10.9.13.1 ONSHORE SURVEY

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

Potential Impacts	Mitigation
▪ 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	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ 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 points	▪ No violations of Tullow Social Investment Initiative 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 Groundwater Resources (10.9.4) sections	▪ Awareness of Tullow Social Investment Initiative policies by workforce ▪ Grievance mechanism in place and implemented ▪ Related monitoring aspects are being undertaken	▪ 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 with the Tullow Grievance Management Plan should be put in place.	Low

10.9.13.2 OFFSHORE SURVEY

The impact sources from the project operations will include the physical presence of vessels and the associated equipment, as well as the presence of the workforce.

Potential Impacts	**Mitigation**
• Interference with other water users in the area because of exclusion zones • Risk of accidents with other water users • Breaking or entanglement with fishing nets	• The local authorities will be advised of the planned survey including details of participating vessels, survey schedule and locations; • Tullow's CLOs will sensitise local fishing communities about the proposed activities and ensure that their concerns are addressed; • A notice will be issued through the local administration informing fishermen of the proposed seismic survey activities; • The scout and guard vessels will clear the area of fishing boats and their equipment, and prevent fishing vessels from crossing the seismic array; and • A radar reflector and flashing lights will be provided on the streamer tail buoy.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management:**	**Risk with mitigation (High, Medium or Low)**
• Minimal interference with other water users	• No accidents with other water users • No damage to properties of lake users, e.g. fishing nets • No complaints from the locals on interference with their activities • No accidents recorded	• Monitoring of the mitigations outlined above • Awareness of Tullow CSR policies by workforce • Grievance mechanism in	• The TKBV Community Liaison Officers will be responsible for handling social issues and, grievance issues	Low

	• No damage to properties recorded	place and implemented		

10.9.14 ECONOMIC CHARACTERISTICS

10.9.14.1 ONSHORE SURVEY

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

Potential Impacts	Mitigation
▪ 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	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Improved economy and living standards	▪ Number of locals recruited ▪ Number and type of Social Investment activities that Tullow undertakes and commits to ▪ Establishment of recruitment and tender committees	▪ As needed	▪ 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 property compensation (if the need arises) in consultation with relevant Government agencies (e.g. Ministry of Energy, and Provincial Administration)	Low

10.9.14.2 OFFSHORE SURVEY

The impact sources from the project operations relate to the physical presence of vessels and Tullow's operations in the area.

Potential Impacts	**Mitigation**
• Interference with shipping, boating and fishing in the area, diminishing economic returns • Employment opportunities for locals • Improvement of businesses and living standards • Social Investment Initiative project benefits	• A support vessel will conduct reconnaissance scouting ahead of the survey vessel; • Regular communication with fishing groups and provision of coordinates of survey area to fishermen will minimize potential impacts to commercial fishing activity; • Seismic operations should be scheduled during least sensitive period for instance during low fishing season ; • Liaise with local community leaders during the recruitment process; • Unskilled and semi-skilled manpower to be sourced locally; • Sustained public awareness and sensitization about the proposed project should be continued throughout the project lifespan; and • Where damage occurs, for example, to fishing nets, or when project operations may lead to exclusion of fishing in a particular area, then compensation can be made for those income losses.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management:**	**Risk with mitigation (High, Medium or Low)**
• Minimal interference with shipping, boating and fishing activities in the lake	• Improved economy and living standards due to employment opportunities and Social Investment Initiatives arising from implementation of the project	• No interference recorded • Number of locals recruited • Number and type of Social Investment Initiative projects that Tullow commits to • Establishment of recruitment and tender committees	•The project manager will be responsible for recruitment issues, taking into account the balance of geographical location (within the project area) and gender balance. Grievances can be handled by an officer to whom the task shall be assigned	Low

10.9.15 OCCUPATIONAL HEALTH AND SAFETY

10.9.15.1 ONSHORE SURVEY

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

Potential Impacts	Mitigation
▪ 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	• 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 with appropriate armed escort.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ Prevent workers and/or visitors from possible injuries/harm and health-related risks	▪ 100% use of personal protective equipment (PPE) when and where required ▪ Warning and Cautionary signage placed visibly in required places ▪ Training and drills on health and safety in the workplace, including fire-fighting	▪ Continuous monitoring and recording of incidences under each work component section	▪ The Seismic contractor EHS Representative should ensure all the 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.	Low

10.9.15.2 OFFSHORE SURVEY

Occupational health and safety issues will need to be considered in all work and living environments.

Potential Impacts	Mitigation
• Potential vessel to vessel accidents • Personal injury • Fire hazard	• Monitoring of wind speeds should be undertaken, and the marine-based seismic surveys should be called off should the winds and waves thereby generated begin to reach a pre-determined and established critical threshold that may put the life of the boat crews in danger; • Watch will be maintained on the survey vessel for other craft (sections 4.3.5, 4.3.9). • The scout and guard vessels shall be used to caution other boats, to protect deployed equipment, and to assist/support the seismic survey vessel during abnormal or emergency situations; • All deployed equipment will be made highly visible to minimise accidents and to facilitate retrieval in case of loss; • Survey operations shall be suspended in adverse weather conditions; • The survey vessel will carry operational, navigation, bathymetry tracking, and warning lights; • The OBC hydrophone cables will be tracked via GPS to monitor their location (assisting retrieval if one or more become severed); • Well-stocked first aid kits and firefighting equipment should be available to all crew, and selected crew members should be trained on first aid administration and handling of fire-fighting equipment as provided in the Occupational Health and Safety and Health Act; • Appropriate personal protective equipment (e.g. Personal Flotation Devices (PFDs)) and fire-fighting apparatus shall be maintained and be easily accessible on the vessels. The crew shall be competent in the use of firefighting equipment and well-drilled on emergency response procedures as required by the Occupational Health and Safety and Health Act;

	• Provisions of environmental health and safety plan (EHS) will be adhered to by all. • Adequate warning or caution signage, including 'no smoking' signs, will be posted as required; and • Only properly trained and authorised employees shall operate equipment or machinery.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
• No accidents, injuries, fires or other occupational and health related risks occurring	• 100% use of personal protective equipment (PPE) when and where required • Caution signage placed visibly in required places	• Training and drills on health and safety issues in the workplace, including fire-fighting • Qualified, certified and trained personnel man the vessels and equipment • Continuous monitoring and recording of incidences under each work component section	• The TKBV EHS Representative should ensure all the Tullow Oil protocols relating to environmental health and safety, and occupational health and safety policies are adhered to. • Frequent safety audits, training programs on first aid, fire-drills and other related health issues should be conducted.	Low

10.9.16 **SECURITY AND PUBLIC SAFETY**

10.9.16.1 ONSHORE SURVEY

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**
▪ Improvement in security around the camp site due to security enhancement for project activities	• 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); • The company should liaise with the Provincial Administration, the Kenya Police 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 • 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcome	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ No security-related incidents ▪ Adequate security for the workforce and communities	▪ Number of security-related incidents recorded	▪ Continuous monitoring and recording of incidences	▪ 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	Low

10.9.16.2 OFFSHORE SURVEY

The impact sources from the project operations will be related to the workforce security needs.

Potential Impacts	Mitigation
• Improvement in security due to security enhancement for project activities	• The company should liaise with the Provincial Administration, the Kenya Police, KWS, and other agencies to provide adequate security during the seismic survey operation. • Ensure that all workers have staff uniform and badges; • Adequate security measures should be provided, like perimeter fencing safe havens and security manning at the campsites and while en route to and from lake side; • The proponent should ensure that their drivers adhere to speed limits both for boats and vehicles. • Barriers and guards will be installed as necessary to protect employees and visitors from physical hazards and criminal activity. • Camp population will be forbidden from interacting with local populace. • Journey management policy and monitoring to be enforced as per Tullow's Driving Policy.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
• No security-related incidents	• Adequate security for the workforce Number of security-related incidents recorded	• Continuous monitoring and recording of incidences	•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.	Low

10.9.17 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**
• Disturbance to soils and vegetation during construction • Reduced landscape aesthetics due to stockpiling of excavated soils	• 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;

• Health and safety hazard due to poor campsite construction • Spillage of chemicals, oils and fuels from construction equipment and vehicles • Nuisance to communities • Health and safety hazard during campsite occupation	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with Mitigation (High, Medium or Low)**
▪ Minimal disturbance to environment during construction ▪ Reduced potential for environmental pollution due to oil and fuel leaks and noise and gaseous emissions ▪ Communities are not disturbed ▪ No security-related incidents ▪ No safety and health-related incidents ▪ Minimal noise and vibration pollution to the neighbouring communities	▪ 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 pollution incidents reported ▪ Incidence Occurrences records of community disturbance, number of security-related issues and safety and health-related incidents recorded and maintained	▪ Continuous monitoring and recording of incidences	▪ The construction of the campsite shall be supervised by the chosen contractor and overseen by Tullow. Camp operations shall be supervised and coordinated by the Camp Manager	Low

10.9.18 **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**
▪ Fuel spills ▪ Fire hazard ▪ Fuel contamination	• 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; • 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with mitigation (High, Medium or Low)**
▪ No fuel spills ▪ No fires ▪ No fuel contamination	▪ Number of incidents recorded	▪ Continuous monitoring and recording of incidences	▪ Proper operations in the fuel filling station shall be supervised and coordinated by the Camp Manager.	Low

10.9.19 **CAMP CLINIC**

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

Potential Impacts	**Mitigation**
▪ Pollution due to poor handling of biomedical and pharmaceutical wastes	• 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 0ºC 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with Mitigation (High, Medium or Low)**
▪ No pollution from medical and pharmaceutical wastes	▪ Number of incidents of improper disposal recorded	▪ Continuous monitoring and recording of incidences	▪ 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

10.9.20 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
▪ 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	• 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.

Desired Outcomes, Objective Indicators, Monitoring and Risk after Mitigation				
Desired Outcomes	**Objective Indicators**	**Monitoring**	**Responsibility and Management**	**Risk with Mitigation (High, Medium or Low)**
▪ 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 safely disposed of	▪ No unnecessary clearing of vegetation and soil disturbance ▪ No contamination of aquifers ▪ Aquifers, borehole and well-head are protected based on good construction practice ▪ Drill cuttings are safely disposed	• Monitoring during the drilling and well-head construction phases	▪ The Tullow 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 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.	Low

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 Hazardous Management and Monitoring Plan (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 ESMP and will be trained in the relevant categories of the ESMP 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 activities as described in chapter 3:

- 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 ESMP's developed during the ESIA for the seismic survey project;
- Preparation of a decommissioning strategy and ESMP 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 2D seismic program is initially estimated at USD. $10 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 Production Sharing Contract (PSC) with the Government of Kenya was awarded to Tullow with the aim of exploring in detail, the assigned project area of 7102.76 km^2, 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.

The Company commissioned Earthview Geoconsultants Limited to undertake an extensive Environmental and Social Impact Assessment (ESIA) study that examined the current environmental, social, cultural, and physiographical as well as geological setting on the ground. This ESIA 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 2D seismic operation that have been identified and appropriate mitigation measures suggested. The mitigation measures suggested in this report and the ESMP 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 ESIA 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 ESMP 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 rivers 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 areas 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 and other agencies to provide adequate security during the seismic survey operation.

APPENDICES

APPENDIX 1: REFERENCES

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

Environmental Impact significance Assessment

Table 1: Determination of Event Magnitude

Environmental Parameter	Impacts	Extent	Frequency	Duration	Intensity	Probability	Event Magnitude
Physiography and Geology	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*.	3	1	3	2	2	High
Climate	None						
Air quality	None						
Surface and Groundwater	None						
Soils	The potential residual impacts would be enhanced gullying and erosion due to altered runoff and drainage patterns	2	2	3	2	1	Medium
Terrestrial Environment	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	None						

Environmental Parameter	Impacts	Extent	Frequency	Duration	Intensity	Probability	Event Magnitude
Land resources and National Reserves	Cut lines affect land resources	1	2	2	1	1	Medium
Archaeological, Historical and Cultural Sites	None						
Visual aesthetics	Cutline footprints and vegetation cover removal lower aesthetic value of landscape	1	1	2	1	1	Medium
Noise and vibrations	None						
Liquid and Solid Wastes	Land degradation	2	2	3	1	2	Medium

Table 2: Determination of Receptor Sensitivity

Environmental Parameter	Impacts	Presence	Resilience	Receptor Sensitivity
Physiography and Geology	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*.	2	2	Medium
Climate	None			

Environmental Parameter	Impacts	Presence	Resilience	Receptor Sensitivity
Air quality	None			
Surface and Groundwater	None			
Soils	The potential residual impacts would be enhanced gullying and erosion due to altered runoff and drainage patterns	1	2	Medium
Terrestrial Environment	The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years.	2	1	Medium
Water Quality	None			
Land resources and National Reserves	Cut lines affect land resources	3	1	Medium
Archaeological, Historical and Cultural Sites	None			

Environmental Parameter	Impacts	Presence	Resilience	Receptor Sensitivity
Visual aesthetics	Cutline footprints and vegetation cover removal lower aesthetic value of landscape	2	2	Medium
Noise and vibrations	None			
Liquid and Solid Wastes	Land degradation	2	3	High

Table 3: Determination of Impact Significance

Environmental Parameter	Impacts	Event Magnitude	Receptor Sensitivity	Impact Significance
Physiography and Geology	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*.	High	Medium	Major
Climate	None			
Air quality	None			

Environmental Parameter	Impacts	Event Magnitude	Receptor Sensitivity	Impact Significance
Surface and Groundwater	None			
Soils	Enhanced gullying and erosion due to altered runoff and drainage patterns	Medium	Medium	Moderate
Terrestrial Environment	The residual impact will be reduced vegetation cover along cutlines; this will, however, regenerate in a few years.	Medium	Medium	Moderate
Water Quality	None			
Land resources and National Reserves	Cut lines affect land resources	Medium	Medium	Moderate
Archaeological, Historical and Cultural Sites	None			
Visual aesthetics	Cutline footprints and vegetation cover removal lower aesthetic value of landscape	Medium	Medium	Moderate

Environmental Parameter	Impacts	Event Magnitude	Receptor Sensitivity	Impact Significance
Noise and vibrations	None			
Liquid and Solid Wastes	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:

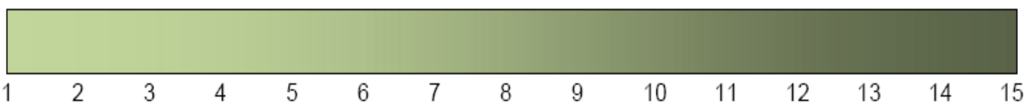
Improbable – where the possibility of the impact materialising is very low; to

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	Erosion of culture and social values as a result of intercultural association	Local	Long-term	Possible	Youth	Negative
Economic factors	Employment opportunities Infrastructure improvements.	Local	Long-term	Highly likely	Elderly, Youth, children	Major Positive
Occupational Health and Safety	None					
Security and public safety	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:

Local – effects extending to the communities in the immediate areas

Regional – effects extending to the entire county; and

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 2D 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

MINUTES OF PUBLIC CONSULTATION MEETING HELD IN MBITA DISTRICT HEAD QUARTERS, MBITA HIGH SCHOOL HALL -10/12/2012.

In Attendance:

20 male participants drawn from Mbita, Mfangano and Rusinga, including; chiefs, conservationists and community members).

The meeting began at 12:57 hours with a prayer from one of the councillors from Mbita town council. In attendance were chiefs, assistant chiefs, Mbita Council of Elder's Chairman, Mbita District Education Officers, Mbita DO 1, Mbita Town Council officers, among others.

The CLO then explained the purpose of our visit – being to explore the social-cultural and environmental aspects related to the proposed 2D seismic survey in Block 12B by Tullow and invited the consultants to introduce themselves. The stakeholders then introduced themselves as the meeting kicked off.

Arising Issues

- The stakeholders wanted to know the boundaries of block 12B.
- The members mentioned that the seismic survey would interfere with big trees that host birds and that the birds defecate and when their wastes are eroded into the lake; this helps the growth of planktons that act as fish feed- they therefore raised concern that this might indirectly interfere with the population in the lake since when the trees are cut, the birds will migrate and fish food would reduce and hence a reduction in fish population. It was therefore a concern on how the fishermen would be compensated for such indirect effects.
- Another concern was the length of time that the seismic survey would take. This was raised due to the fact that the fishermen directly rely on income from the lake on a daily basis and would be affected if the survey takes a long time.

- One of the members raised a concern about radiation from the seismic survey and asked to be assured on how safe the process would be. And they also asked how such invisible destructions such as radiation would be compensated. They also recommended that Tullow should seek permission from NEMA before the survey.
- The stakeholders also wanted to know who is behind the project logistics
- Issues were also raised about laws of compensation procedures and what is expected in case of any destruction. They asked about how people are compensated and recommended that compensation procedures should be very clear and that Tullow should not wait for law suits to be filed in courts in order to compensate.
- The stakeholders also asked what would be done in case after the survey on the Lake Victoria the fish migrates to Ugandan waters and how the community can be compensated if such a case were to occur.
- Another stakeholder talked about issues of international boundaries in Lake Victoria and asked that in case oil is found in Lake Victoria, how would the explorers demarcate the international boundaries and quell the conflict that is already between Kenya and Uganda over Migingo? The members advised that the exploration starts from land so that international conflicts are not raised from the beginning.
- One of the members representing the Mfangano Reafforestation Committee mentioned that some of the sacred sites in his area include Kwingoma in Mfangano East location, Ugimbi which lies on the eastern side and act as water catchment areas. He also added that all the rivers are sacred and that the chiefs in the area should be contacted since they have all the information regarding sacred sites in the area.
- The stakeholders advised that the County and Town Councils be contacted on issues regarding trust lands and the Lake and that a license to operate in these areas should be obtained from the County Council.
- The stakeholders appreciated the meeting and gave the go ahead that the survey be done. They however felt that meeting was brief and that there was need for another comprehensive meeting to discuss issues related to social organization, conflict resolution and decision making.

The meeting ended at 14:45 with a prayer from one of the stakeholders -Mr. Silas Ombori.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 10/ 12/2012 MBITA DISTRICT HEADQUATERS (MBITA HIGH SCHOOL)

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	DUNCAN NYONKA	M	—	16122744		0725804952
2	Lazarus Kivan	M		21995016		0721264190
3	JOHNSON OUCONKA	M		6530590		0720955382
4	CALVIN ARIKO	M		2879587		0723541046
5	ELLY OTTUDO	M	0269387	1484019		0726938769
6	JOHN OMOLO AMOS	M		6599433		0727438385
7	FRED. OWALA	M		8088043		0724451242
8	PAUL OCHIENG OUMA	M		1487280		0724306463
9	EZRA OMULO	M		1564969		0725957719
10	YUSOF B. Hulee	M		2474072		0724136892
11	KOWUOR O M	M		13277316		0728762409
12	CLLR TITUS OYUMA	M		8143057		0720672761
13	PATRICK O OMAE	M		22373279		0721620978
14	CHARLES A. JUBARE	M		1518920		0724072855
15	Cllr. Wilberforce Muoga	M		5476964		0721855166
16	KICHE OGUGA	M		1486542		0723886394
17	SILAS OMBORI	M		9306346		0725551891
18	JUSTUS OCHWEDO	M		10285776		0723794541
18	Sr. KEN OUMA	M		20409927		0710 810 967
20	RAPHAEL MATIA	M		7373576		0712631718
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- REATOR STATION CHAIRMAN
- SACRED LAND

District________________________

Division________________

Location____________________

Meeting Started__________ Meeting Ended___________

Community Representative________________

Consultant Representative_______________

Tullow CLO_________________________

MINUTES OF PUBLIC CONSULTATION MEETING HELD AT RACHUONYO NORTH DISTRICT HEADQUARTERS BOARD ROOM -13/12/2012.

In Attendance:

25 participants; 7 female, 18 male (DOI, Chiefs, elders, clergy, women leaders).

The meeting started at 10:15 hours with a prayer from one of the members. The DO 1 then addressed the people and officiated the meeting as she gave everyone a chance to introduce themselves.

The meeting started with 21 people. In attendance included the DO1, NEMA officer from Homa Bay, area Councillors, Chiefs, Women Group Leaders, BMU chairmen, BMU secretaries, Youth Representatives among others.

The first phase of the meeting involved a power point presentation by Dan Lang'o explaining to the attendants how the seismic survey will be done and what is expected from them as well as what they should expect from Tullow.

A session of questions answers then followed and some of the questions raised included:

- They wanted to know the mode of compensation that will be used to take care of people affected by the proposed project.
- The participants asked whether the seismic survey would interfere with trees and how this would be compensated (who will be compensated and how?).
- They wanted to know whether one would be compensated if the vibrations destroy a house or creates a crack in someone's house. The attendants also asked if the vibrations would be too heavy to present health hazards to those with such diseases as heart illnesses.
- The members were also concerned about the Corporate Social Responsibility of Tullow and how this will be done.

Social organization

As reported by the members, the area is divided into locations and further into sub-locations, villages and clans respectively. They share the same cultural practices and live in extended families although there are few who stay in nuclear families.

There are several registered CBOs in the area including Busy Bees, Ombujo, Okundi, Obala gulley, Kokaka, Rachuonyo North People Living with Disability, Kawere –dealing with horticulture, Chwowe, Kendu Bay Care Givers among many others. There are also several women, youth and self help groups including Nyatoto Women Group, Chamluchi Women Group, Ober Women Group, Kogembo Catering Group, Oyietich Self Help Group, Kendu Bay Environmental Group, Tilapia Women Group, Kochia Sisters, Bwaga Women Group, Gari Ocha Thim, Many Amanya Women Group, Yes We Can, Mango Tree Trust Fund Group, Aswekra Grandmothers Self Help Group, Merciful Mothers, Straight Talk

Youth Group, Koyoo Development Youth Group, Oriang Pottery Women Group, Kanyadhiang' Awach Hand Craft among others.

Main markets in the District include Kendu, Pala, Omboga, Oriang, Kandeige, Kodula, Doho, Oluch Kadel, Rakwaro, Nyangueso, Kamolo, Awach, Bala Kochoo, Obiro, Kajwang, Mainuga, Kaimbo, Lwasi, Rang'ombe, and Alum among others.

Family Structures

The elderly sons build their homes outside the fathers homestead while the young sons especially the unmarried and recently married stay with their parents in one home and are bound to eating together and sharing resources. The sons are bound to share resources with their parents even when they have moved to their own homes. The men are the household heads in cases where the spouses are alive. Female headed households are only common in cases where the male partner has passed on.

Conflict Resolution

Conflict resolution mechanisms include the involvement of village elders at the clan level however; cases beyond the clan are forwarded to the chiefs and assistants chiefs. Cases such as theft are reported directly to the police although the arrests of suspects are done with the help of the chiefs and assistant chiefs.

Asset Distribution and Decision Making

Asset distribution as reported occurs mainly through inheritance within the paternal family lineage. Major decisions are made by the household heads who are in most cases a male. Decisions on the use and sale of assets such as land are made by men in consultation with other members of the clan. The women however have little say on land and are only briefed on issues after decisions are made.

Other Issues

The area has important designated lands that they think should not be interfered with. These include:

- Areas around Lake Victoria which they use as grazing lands, especially during the dry season. The areas are reserved as trust land and should not be interfered with.
- Other trust lands that were said to be important include Kobala Community Trust Land and Apida Trust Land in Kajieyi along the beach.
- The wetlands (*Siany* in the local language) -where they graze during dry seasons and where they harvest reeds for weaving baskets. Certain wetlands are also used to provide soil for pottery and brick making.
- The area around Simbi Nyaima should not be interfered with because the water has medicinal value, it is a tourist attraction site, the people around collect salt licks which they sell to the neighbouring communities who keep cattle or exchange with maize in the neighbouring Kisii land.
- Areas around the beaches were mentioned to be important since they act as tourist attraction areas and they also attract income. They said that these beaches are managed by Beach Management Committees who collect taxes that help build the local schools.

Shadrack then thanked the members for their time and attendance. The meeting ended at 13: 22 hours with a prayer from one of the members.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 13/12/2012 Rachuonyo

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	Richard M. Mounde	M		0379957	[illegible]	0724432664
2	Samson M. Adhu	M		21254061	[illegible]	0711889449
3	Amina A. Abdul		F	3978379	Abdul	0727114093
4	Bowers Ajwang Awino	M	–	1897509	[illegible]	0726155743
5	WILLIAM O. ODIANGO	✓	–	3358883	[illegible]	0727950423.
6	RAMADHAN N. ABEID	✓		22923040	[illegible]	0716543336
7	KENNEDY O'SINDAGA	✓		9904533	[illegible]	0714606056
8	CLLR. JOHN MAJI	✓		1532372	[illegible]	0722650160
9	DAN JARVIS OJIJO	✓		1570014	[illegible]	0723639012
10	Rose Ochoo	F	F	8212642	[illegible]	0721307602
11	PETER O. Nundu	m	–	6600626	[illegible]	0725903820
12	Rose Angino	~~M~~	F	6523219	Rassi	0720222667
13	Nancy J. Kiptoo	~~F~~	F	21510520	[illegible]	0727579353.
14	Maureen A. Abuya		F	25528473	[illegible]	0726053414
15	Benard Omondo	M		22335393	[illegible]	0720 328352.
16	David A. Odera	M		11125650	[illegible]	0725 642 676
17	Leonard Owino	m		26455793	[illegible]	0712971003
18	JACK O. KA'WERE	M		0298048	[illegible]	0726662949
18	Augustus M. Mutia	M		1146104	[illegible]	0727981753
20	Tabitha A. Okoth	~~F~~	F	10559387	[illegible]	0714 058981
21	CLLR. OJUKA J. KITO	M		1532415	[illegible]	0716852234
22	H.A. DINDU JO ALA	M		3981673	[illegible]	0711793348
23	Naftali Juma	M		27186162	Jumaa	0717596926
24	JAIRUS GWINO	M		0411914	[illegible]	0726398399
25	LOVINSA ADHIAMBO	~~F~~	F	26686870	[illegible]	0711850900
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District Rachuonyo

Division________________

Location________________

Meeting Started__________ Meeting Ended__________

Community Representative________________

Consultant Representative________________

Tullow CLO________________

MINUTES OF THE PUBLIC CONSULTATION MEETING HELD AT NYAKACH DISTRICT HEADQUARTERS BOARD ROOM -14/12/2012.

The meeting started at 10: 32 hours with a prayer from Mrs. Diana A Ochola. The DO1 then took the chance to open the meeting officially by giving chances to everyone to introduce themselves after which he advised the stakeholders to handle the meeting with care, to welcome and to embrace development.

In attendance were opinion shapers from all sides of the district including, among other people, the DO1, two District Officers, Chiefs, Women Group Leaders, Youth Group Leaders, District Development Officers, CDF Chairman (representing the MP, Nyakach), Chairman- Nyakach Rescue and Safety Project and Councillors.

The DO 1 then gave the chance to the CLO to introduce the ESIA team and explain their mission. After Afterward, Mr. Dan Lang'o explained what Tullow oil plans to do in the bid to explore for oil and natural gas deposits in Block 12B. This was done through power point presentation explaining the process of land and marine seismic survey and data acquisition.

A question and answer session was then led by Shadrack Orinda.

Main Concerns

- The stakeholders wanted to know the length of time that the seismic survey would take.
- They wanted to know if the machinery used will produce emissions and the mitigation measures that Tullow would put in place to curb the effects of such emissions. They advised that the company should help/ liaise with groups that are planting trees to help replace the ones that are cut during the survey and help absorb carbon produced by automobiles and machinery.
- The members wanted to know the specific sites where the survey would pass through and they advised that people be told of such specific areas so that people can be ready for the seismic survey.
- They also asked whether the company has a social responsibility component and whether the seismic survey access routes can be left to act as community feeder roads after the project is decommissioned.

- There was a question about compensation process especially for trees bearing in mind that there is a group that has a bid to plant one million trees every year and cutting trees would act as a setback to their target.
- The stakeholders advised that people should be advised on financial management before being compensated.
- The stakeholders advised that compensation should be based on equity and not cash and carry so that long term effects can be realized.
- The stakeholders also advised that the proceeds of the oil exploration process, once that phase of the project is reached, should first develop the locals beginning from the District to the County to the Province and finally to the Country in case the oil is confirmed.
- They requested that the ESIA report should be given at the DDO's office once the document is completed.
- They requested that Tullow should consider employing youths within Nyakach area to ensure that the community owns the project.
- They mentioned that politicians should not be allowed to take control of the project since politicians come and go. They advised that the project should be handled administratively through the DC's office which is a permanent office.

Asset Ownership and Decision Making

It was reported that important assets such as land are owned by individuals, registered under individual names. However, the society especially men have more say over land than women.

Economic Activities

Major crops in Nyakach include cereals such as maize, millet, finger millet, sorghum. They also keep cattle and make bricks. Other wage earning activities include fish farming, fishing, sand harvesting, stone and ballast harvesting and pot making especially in Lower Nyakach side.

Social Organization

The people of Nyakach live in families where the man is the head of the household. Although there are houses headed by women, the general trend in the area is that men head households.

Some of the cooperatives in Nyakach include Nyakach Multipurpose Cooperative Society- that act as an umbrella for all the societies, Nyapako Farmers Cooperative Society, Nyabondo Coffee Cooperative Society, Furrow Farmers Cooperative Society Limited, Nyakach Farmers Society and Siany Multipurpose among others.

Conflict Resolution

The people reported having local conflict resolution mechanisms through the village elders and the elderly people of the villages.

Important Areas in Nyakach

The stakeholders mentioned the following areas as being important in their community:

- Riparian areas along the lake – these areas act as grazing lands and that interference with such area can make hippos intrude deeper into the land and cause disaster.
- Natural springs along the escarpment – act as places where the locals collect salt licks.
- Beacons that act as land marks.
- Forest reserves such as Koguta forest.
- Swampy areas (*Siany*) – for making bricks, pottery and grazing during dry periods.
- Grave yards – having cultural importance/ attachment to the ancestors.

The meeting ended at 13:54 hours with a vote of thanks from the DO 1 to the stakeholders and a prayer from one of the members.

MINUTES OF THE PUBLIC CONSULTATION MEETING HELD AT SIGOWET DIVISIONAL HEADQUATERS IN SIGOWET SDA CHURCH -17/12/2012.

In Attendance:

37 members; 3 females, 34 males, including: (Chiefs, Village Elders, Women Leaders and Clergy drawn from 5 locations).

The meeting started at 10:11 hours with a prayer from one of the pastors in attendance. The chief then introduced the every member in attendance after which he gave the ESIA team the opportunity to introduce themselves.

The meeting started with 30 people after which seven others joined bringing the total number to 37 people. Those in attendance included Chiefs, Village Elders, Women Group Leaders, Youth Group Leaders, Councillors, Religious Leaders, and Security Officers among many others.

Mr. Daniel Lang'o then took the opportunity to inform the meeting about the mission of the ESIA team and about the seismic survey after which he made a power point presentation explaining how the survey will be done and what should be expected during the survey.

Mr. Shadrack Orinda then took the members of the committee through a question and answer session.

Main Concerns

- Whether Tullow will employ members of the community.
- How people will be compensated for their land.
- Where they will move to when the proposed projects kicks off; oil exploration and the proposed dam project which was also to be carried out in the area.
- They also asked how the oil and gas resources in case found will be shared between the community, the County and the Country.
- There was a also a concern on how the oil in case found will benefit an individual within the society on whose land the oil has been found apart from the compensation for his/ her land.
- They also asked whether people will have shares in the oil exploring companies and if so how it would operate.
- The community members also asked why and how the exploring company chose the Block 12B/ what criteria was used.

Land ownership and decision making

Land in this area is owned individually. People own title deeds for the land they have. Land use plan and decision are made by men. Title deeds are in the name of men and can also remain to a woman in case the husband dies.

Land use

Grazing lands are individually owned and most people do tethering. They also plant Napier grass for their cattle. Idle lands are limited since most lands are in use for agriculture.

Agricultural lands are everywhere both on hills and along the valleys as well as escarpments. Main crops include tea, sugarcane, sweet potatoes, Bananas, coffee. Though maize was considered a main crop, it has since declined due to the emergence of a strange disease.

Social/ family organization

People are organized in families both nuclear and extended. The families and households are male headed except where the household head is dead then the woman remains the head. They have clans though such clans are not strongly knit and most of those clans stay far apart. This makes them have stronger family ties than clan ties.

Some of the major social organizations and cooperatives include:

- PEWA- dealing with table banking
- Faidika International – Loans
- Toretik – dealing with OVCs
- Samoei Community Development Project- OVCs and school fees
- Kipsimotwet
- Bewo
- Kipkata CBO
- Yurith CBO
- Kosiach Tany Farmers Cooperative
- Mategbei Farmers cooperative
- Chemengon Bursary fund
- Kaptebengwo Self Help Group
- Tegomen water project

Religious structures

The worship places are modern structures and are used on Fridays for Roho Israel, Saturdays for Seventh Day Adventists and Sundays for other Christians including AIC, Full gospel, Pentecost, power of Jesus around the world. The churches are reported to be important and should not be interfered with during exploration. The churches/ worship structures are spread through the community.

Water

There is tap water in the area but majority reported fetching their water from the rivers around including Cheptende, Sosiot, Taberiti, Cheptende, Tilipe and Mogoyue.

Markets

Markets and shopping centres were also reported to be important and should not be interfered with in case of exploration. Common markets named include:

- Sondu- Monday, Wednesday, Friday
- Kiptere- Saturday
- Sigowet-Sunday
- Cheptuyet
- Kebeneti

The important things that the community would not like to be interfered with during the survey include:

- Graveyards
- Permanent houses
- Shops
- Dispensaries
- Sugarcane farms
- Towns
- Rivers
- Personal forests

Water catchment areas in the area include Cherote, Chemogut, Ainamaine, Itondo, Kantet, Seanit, Kapkot and Kipkony.

The community members welcomed the oil the proposed oil prospecting project and agreed that the survey continues and that they will continue to pray for the project and welcome the surveyors.

The meeting ended at 1:13 hours with an official closing by the Chief and thereafter a prayer from one of the members. Mr. Lang'o thanked the members for attending the meeting and for their time as everyone left at their pleasure.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 7/2/2012

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	DINAH BII					0726755970
2	GEOFREY CHERUIYOT					0725089218
3	GABRIEL RONO					0707884786
4	DAVID KOSGEI					0723953379
5	JOEL ROTICH					0712912166
6	RICHARD LANGAT					0724544464
7	PAUL CHERUIYOT					0715469098
8	KIPKOECH VICTOR					0752389258
9	PATRICK LANGAT					0723696599
10	PETERO CHERUIYOT					0720693362
11	DANIEL SABULEI					0729029382
12	WILLIAM NGETICH					0715131882
13	FRANCIS CHERUIYOT					0728608987
14	CHRISTOPHER ROP					0726448564
15	KIPRUTOH MUTAI					0721-707185
16	ALEXANDER KOECH					0724038102
17	ALFRED METET					0729360865
18	ANDREW LANGAT					0720666328
19	SOLOMON TUM					0725-789416
20	ISAIAH KOECH					0715878216
21	PHILMON MARWAI					0723-121-782
22	DAVID SANG					0723226343
23	JOHANA TOROR				JOHN N	0708184229
24	KIBSANG BOSON					0726120205
25	ALFRED MOSO					0727679944
26	ELISHA CHEPKWONY					0720354984
27	ANDREW KOSKEI					0727738055
28	CHEMUTAI MARY					0727315549
29	DANIEL KIPTANUI					0722 847 364
30	KIPKEMOI RUTO					0724209227.
31	EZEKIEL MATINWONY					
32	JOHN KEMEI					0720731421
33	GEORGE AUDI					0724-594507
34	ALICE CHERONO					07
35	GLADYS CHELANGAT					-
36	PHILIP CHEPKWONY					0726577460
37	JULIUS KOECH					0710253365
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District KERICHO

Division SIGOWET

Location BELGUT

Meeting Started__________ Meeting Ended__________

Community Representative__________

Consultant Representative__________

Tullow CLO__________

MINUTES OF THE PUBLIC CONSULTATION MEETING HELD IN KISUMU DISTRICT AT THE KISUMU SOCIAL HALL -18/12/2012

In Attendance:

29 participants; 23 male, 6 female (including Chiefs, asst. chief, clergy, elders)

The meeting started at 14:30 hours with a prayer from one of the stakeholders after which the Assistant chief – Nyalenda welcomed the members to the meeting and gave them the chance to introduce themselves.

The ESIA team was then introduced by Mr. Daniel Lang'o giving each of them a chance to create rapport with the stakeholders. He then briefed the stakeholders on what the meeting is all about and what is expected from them.

Mr. Shadrack Orinda then took the stakeholders through a power point presentation explaining what the seismic survey entails and what should be expected out of the survey.

A question answer session was then led by Mr. Shadrack Orinda. Some of the questions raised included:

- There was a concern of how people would be compensated when seismic lines pass through their land, crops, or any other property
- The stakeholders raised concerns about the social impacts of the proposed programme. They asked how those living within the base camps would be prevented from promoting negative social interactions within the project region.
- The members were concerned about the survey affecting lucrative fish breeding areas, or preventing the fishermen from accessing high catch areas during the time of the survey. They asked how this will be compensated
- The meeting ended with an official closing speech from the chief Kolwa East and a prayer from one of the members.
- One of the stake holders asked whether the vibration tracks may create cracks on the buildings and how this will be compensated
- They also asked as to how the security of the geophone lines will be guaranteed especially at night; will the surveyors work for twenty four hours or they will employ watchmen?
- There was a question as to whether Tullow considers the health of its employees so that they do not bring new diseases/ infections to the local communities.

Social organization

The area is organized into nuclear families since most of the people are town dwellers. There are however, people living in clans within the periphery of the town. The families are headed by men except where the household head has passed away then the women are left as heads.

Decision making on sale of important assets such as land are left to men though the sale process has to go through the land board.

The area has several markets such as:

Kibuye – Sunday

Mamboleo - Tuesday

Kiboswa - Wednesday- Sunday

Chiga - Friday

Holo - Tuesday

Kisian - Saturday

Ahero - Tuesday

Kombewa - Friday

Katito - Thursday and Sunday

Akala - Wednesday and Thursday

Daraja mbili - Tuesday

CBOs and cooperatives

Katito CBO Pig rearing

Kazi ngumu widows and orphans

Bamato environmental organization – Environmental conservation

Plan International – children and orphans

Magnum environmental network – environment

Chiga rice scheme – rice

Chiga cooperative society – sugar

Maenya cooperative society – sugarcane

Nyalenda housing cooperative society

Nyakach development association

KADAWESE – sanitation

Kisumu waste management association

The main sources of water mentioned in this area include lake, tap, boreholes, and water pumps, streams and rivers.

The main crops include sugarcane, rice, maize, beans, sorghum and vegetables.

Local industries/ wage earning activities include:

- Weaving – using water hyacinth and papyrus
- Motorbike transport
- Sand harvesting
- Brick making

The meeting ended at 16:34 hours with an official closing speech from Kolua East location chief and a prayer from one of the stakeholders.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 18 / 12 /2012

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	PIUS OTIENO	✓		22468746		0713844482
2	ABIK SAMSON			26007397		0723228894.
3	RUTH HELIDA OTIENO		✓	13231147		0728209399
4	William.O.Alung	✓		11197685		0722429248
5	EUNICE OTIENO		✓	2636184		0721347400
6	LAWRENCE JUMA	✓		22782449		0724505306
7	Reuben Orongo	✓		4843354		0711125151
8	Nashon Omuko	✓		6611822		0710825013
9	Shem Ombok	✓		2664140		0713359975
10	Rashid Ali	✓		10923570		0727466796
11	Peter Owago	✓		20251574		0727662222
12	Rev George Ogada	✓		20623141		0717298423
13	LENA ATIENO JEBITA		✓	11091252		0718687490
14	ROSE OLUM		✓	10706922		0729525534
15	HESBON A OWITI	✓		10923795		0728428554
16	MAX MOBI	✓		1084946		0723911078
17	ALEO ALO	✓		10842944		0726792408
18	OTIENO KABISAH	✓		7655377		0720640637
18	Jemphor Kosore		✓	6056558		0724241054
20	ELIJAH O. DAWAMBO	✓		10218889		0722627847
21	JOHN A. OWINO	✓		0902197		0712376453
22	George O. Ojako	✓		1242207		0704268947
23	JOHUM O. AKEHO	✓		25872032		0710764014
24	MAURICE OJOK	✓		8096642		0720746574
25	Onyango Melk	✓		4846653		0722613765
26	ALICE ANYANGO		✓	29165528		0716569404
27	HEZEKIAH O. OKECH	✓		10702864		0724877584
28	VALENTINE ODHIAMBO	✓		5865949		0722471880
29	FANUEL O. OGUMA	✓		3081158		0726715766
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District KISUMU

Division________________

Location____________________

Meeting Started__________ Meeting Ended____________

Community Representative________________

Consultant Representative_______________

Tullow CLO__________________________

MINUTES OF THE PUBLIC CONSULTATION MEETING HELD IN BUDALANGI DISTRICT HEADQUARTERS ON 19/12/2012.

In Attendance:

15 participants (1 female; 14 male) including; CLO, Consultants, chiefs, assistant chiefs, councillors, teachers, Beach Management Authority Representatives, Village Elders and community members.

The meeting started at 14:40 with a prayer from one of the stakeholders after which the District Agricultural Officer representing the DC officiated the meeting. He took time to introduce the stakeholders who had arrived as he gave the Community Liaison officer the opportunity to introduce the ESIA team.

Those in attendance included Chiefs, Assistant Chiefs, Councillors, Teachers, Beach Management Authority Representatives, and Village Elders among other stakeholders. Mr. Daniel Lang'o then took the stakeholders through a 30 minutes PowerPoint presentation explaining what seismic survey is, how it is done and what people should expect in case it is done. He then allowed for a discussion session moderated by Mr. Shadrack Okumu Orinda.

Some of the concerns raised by the stakeholders included:

- They wanted to know how long the seismic survey would take. They were mostly concerned about the survey on the Lake and how it would impact on their livelihood.
- They wanted to know how they compensation be done for those whose properties are destroyed.
- They wanted to know how Tullow would identify the international boundaries within the Lake.
- They wanted to know if the vibrations would interfere with the fish in the Lake.
- They wanted to know if the residents of Block 12B would benefit from employment opportunities during the seismic survey.

After the question and answer session, the community members welcomed the proposed project and mentioned that Tullow should conduct the survey. They also appreciated the ESIA team for informing them about the proposed project.

Social Organization

The community is organized into clans that are further subdivided into families. The families live both as extended and nuclear families.

The lands in the area are private lands except for public schools, hospitals and playgrounds.

Land issues have to be discussed before they are sold. Minor conflicts are solved through the village elders' council where sanctions can be imposed. Most cases of crime and conflict are reported to the chief. The chief can then summon a meeting to or forward the case to the police in case the suspect needs to be arrested.

The people use water from the boreholes, taps, dams, lake as well as rivers.

They grow crops such as maize, beans, sweet potatoes, cassava, and millet and also practice fishing for subsistence. They also practice rice farming.

Some of the markets and market days include:

Budalangi	Wednesday and Saturday
Maumau	Saturday
Port Victoria	Friday
Omena beach	open market
Mulukoba	Monday/ Tuesday

Cooperative Societies

Bunyala Handicraft

Bunyala fishermen marketing society

Bunyala cereals rural Sacco – deals with cereals

Magombe multipurpose – deals with rice

Grass root Poverty Alleviation Programme – deals with agro-processing

CODMI- community disaster management initiative

BUCARUWA- deals with water resource management

The stakeholders thanked the ESIA team for visiting them. A prayer was offered and the agricultural extension officer officially closed the meeting at 16:11 hours.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 20 / 12 /2012

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	M.W. OPIYO	M		2096857	[illegible]	0725609681
2	H.S. MWANGU	✓		13015453	[illegible]	0722466443
3	JOHN ODINO	M		11031128	[illegible]	0786600504
4	JOHN KUDOMBI	M		4793249	[illegible]	0723193557
5	BENARD OUMA	M		0736960	[illegible]	0723784246
6	JUDITH NERIMA	F		27386638	[illegible]	0719380713
7	CANUTE OWAGWANDA	M		0263164	[illegible]	0726651973
8	ALFRED NAMWAKIRA	M		1171728X	[illegible]	0711313396
9	Julius Kaman	M		22548888	[illegible]	0723-067300
10	SUSAN ACHOLA	F		24500211	[illegible]	0724322494
11	ALEX D. OGEYA	M		20080753	[illegible]	0713834733
12	JOHN O. AWINO	M		0359434	[illegible]	0720399547
13	ALFRED MAYUMBA	M		20219650	[illegible]	0725378210
14	STEPHEN MBSAH	M		2706198	[illegible]	0722446666
15	BEN MULUNDA	M		11683368	[illegible]	0721356012
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District Budalangi

Division________________

Location______________________

Meeting Started__________ Meeting Ended____________

Community Representative________________

Consultant Representative_______________

Tullow CLO__________________________

MINUTES OF THE PUBLIC CONSULTATION MEETING HELD IN BONDO DISTRICT AT TINTOLER CONFERENCE HALL ON 20/12/2012.

Attendance: 24 participants (3 female, 21 female) The consultants, Chiefs from Bondo and Rarieda, Civic leaders, elders, clergy.

The meeting started at 9:12 hours with a prayer from one of the chiefs. The stakeholders in attendance were chiefs, CDF management committee chairman, councilors, and church leaders.

The chief then welcomed the stakeholders and gave them a chance to introduce themselves.

The CLO then gave the ESIA team a chance to introduce themselves after which Mr. Daniel Lang'o was given an opportunity to explain the Mission of the meeting and present a PowerPoint presentation on seismic survey. Mr. Lang'o therefore presented a power point illustrating what seismic survey is and how it will be conducted

A discussion session moderated by Mr. Shadrack Okumu Orinda was then opened and some of the concerns include:

- They wanted to know if the vibrations would make pregnant women miscarry;
- Since there is the anticipation of some people being displaced in case oil is found, the question is whether the company has acquired some designated land where those affected will be relocated.
- There were questions as whether there are measures in place to ensure that harmful gases are not emitted
- The stake holders asked what would assure them that the company will keep their promises once they gain entry since many exploring company only seek permission for entry after which they fail to keep their promises. They gave an example of a gold company that did the same.
- They also asked the measures in place to ensure that the locals don't sell their land to others who may have the prior knowledge of availability of oil in a given area. They also asked whether they will be informed when and where the oil is found so that they are aware and cautioned on cases where prospectors get to know the availability of oil and instead buy the land without telling the locals about it.
- They advised that the area is densely populated and proper strategies should be put in place to ensure minimal disruption
- They also asked whether the process of the survey could emit any chemicals that can interfere with either aquatic or terrestrial life.

<u>Other information</u>

- They mentioned that the grave yards are very important and should not be interfered with.

- The community is organized into clans which are loosely knit and families that are strongly knit.
- Grazing lands belong to individuals and not community
- Land is owned by individual (private land) except schools, playgrounds and markets.
- Decision making on important assets such as land is done by men who in most cases own the title deeds on behalf of their families.
- Water sources include tap water, lakes, rivers, boreholes and shallow wells
- Cooperative societies include Likungu Irrigation society, Rabolo irrigation scheme. NOSOMI- deals with crops, and Wich Lum cooperative society. NGOs working in the area include Care Kenya, Plan International and Centre for Disease Control.
- Main crops include maize, beans, millet cassava, sweet potatoes, groundnuts and mangoes. The main cash crops (not properly developed) are groundnuts and cotton

Some of the markets and market days named include

MARKET PLACE	MARKET DAY
Ndori	Monday and Thursday
Oyude	Tuesday and Friday
Nyilima	Open Trading
Kalanding	Open Trading
Kamito	Open Trading
Arab	Monday and Thursday
Madiany	Wednesday
Bondo	Friday and Tuesday
Ndigwa	Friday
Misori	Daily
Manywanda	Open Trading
Ragongi	Monday
Osindo	Open Trading
Usenge	Sunday
Amoyo	Open

Ajigo	Open
Wich Lum	Thursday, Monday

The stakeholders were happy to welcome the idea of seismic survey and gave their verbal assent saying that the same will be development for them. The meeting ended at 11:03 with a prayer from a stakeholder.

PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 20 / 12 /2012

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	PETER A. OBEDO	✓	600/=	8539089		0734736505
2	OBERA OMBERE	✓	600/=	5462661		0735319024
3	GORDON O. OJUNDO	✓	600/=	7869730		0720393408
4	CHR ERIC OTIENO O'GWAMBO	✓	600/=	0125093		0723327426
5	ALPHONCE O. AYOMA	✓	600/=	0250287		0716954852
6	LOICE OTIENO		✓ 600/=	21281878		0724483755
7	ALICE KABAR		✓ 600/=	24860040		0729480719
8	NELLY OKOTH		✓ 600/=	6195744		0703887493
9	ELISHA ONGONDO	✓	600/=	8340188		0727505706
10	JOHN G. OMINO	✓	600/=	1183653		0722530359
11	COSMAS O. OKWAMA	✓	600/=	8211937		073672442
12	MAURICE O. ARINGO	✓	600/=	8211939		0722656968
13	N. AKELO GWELA	✓	600/=	2867542		0710308219
14	VICKLIFE O. RAGUT		600/=	855736		0723728613
15	JAMES O. MUNDA	✓	600/=	8016990		0726501671
16	DAVID O. OKUMU	✓	600/=	9757002		0729991172
17	Oscar O. Awuolie	✓	600/=	6470615		0723760924
18	CLR. PORTAS ADONGO	✓	600/=	2851884		0710308215
18	ERICK S. OWAL	✓	600/=	13890538		0726692109
20	AGRIPA O. ABUNGU	✓	600/=	2725107		0711567015
21	MATHEWS ODUOR (PR)	✓	600/=	13602284		0722586395
22	DICKSON ORUKO	✓	600/=	9943706		0712980538
23	SAMUEL O. ONGONDO	✓	600/=	0510025		0722447527
24	TOBIAS ABONDO ODERA	✓	600/=	6472475		0720310640
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District BONDO/RARIEDA

Division________________

Location____________________

Meeting Started__________ Meeting Ended___________

Community Representative_______________

Consultant Representative_______________

Tullow CLO_________________________

MINUTES OF PUBLIC CONSULTATION MEETING HELD IN NYANDO DISTRICT HEADQUARTERS -21/12/2012

In Attendance

DO1, Key Informants, Opinion leaders and Community members.

The meeting started at 10:50 hours with a prayer from one of the members. The DO1 then welcomed the stake holders giving them the opportunity to introduce themselves. The CLO introduced Tullow team as Mr. Lang'o took the chance to introduce the ESIA team.

Mr. Shadrack Orinda then gave a power point presentation about the seismic survey to be undertaken by Tallow and what should be expected out of the same. A question answer session was then led by Mr. Shadrack Orinda.

Main concerns

- They wanted to know if houses, schools or homesteads would be avoided if the seismic lines were to pass through them.
- They wanted to know if Tullow has a corporate social responsibility plan, and if so, when they would start benefitting from it.
- They wanted to know when the seismic survey activities would commence.
- They wanted to know some of the negative impacts that they were likely to experience as a result of the seismic survey.
- They mentioned that the soils in the region were highly degraded and as a result there were huge gulleys in the area. They wanted to know if Tullow could help reclaim such gulleys.
- There was a concern that many investors had come to the community with good promises and changed as soon as they gained the permission to operate within the community. They asked whether Tullow would be any different.
- They also cautioned that Tullow should be careful with politicians who would disrupt the programme.
- They asked about the intensity of vibrations and whether that would affect buildings in terms of creating cracks.
- They also advised that the issue of land acquisition for the seismic survey and associated processes is volatile should be handled with care and that issues of compensation should be made very clear.

The meeting ended at 12:57 hours with an official speech from the DO1 and a prayer from one of the stake holders.

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PUBLIC CONSULTATION MEETING ATTENDANCE LIST FOR THE PROPOSED 2D SEISMIC SURVEY IN BLOCK 12B BY TULLOW OIL KENYA B.V.

Date 21/12/2012

No.	NAME	MALE	FEMALE	ID. No.	SIGNATURE	CONTACTS (CELL PHONE)
1	STEVEN O. GOMBE	✓		9591934	[illegible]	0728938695
2	EVANS P. OLUEYO	✓		2546503	[illegible]	0720668913
3	JOSHUA O. OPERE	✓		7494532	[illegible]	0716952455
4	ANDREW J. OYWAYA	✓		4849331	[illegible]	0722318870
5	SAMUEL O. THACHA	✓		16024510	[illegible]	0724666015
6	CHRISTOPHER NDALE	✓		0103318	[illegible]	0721568962
7	DAVID OWITI OWITI	✓		5176422	[illegible]	0724766931
8	PHILGONA OMWANA		✓	14590550	[illegible]	0713340716
9	TABITHA ANGAWA		✓	13037170	[illegible]	0724126817
10	MARTIN G. SODO NUDI	✓		0402897	[illegible]	0727142940
11	MICHAEL B. GEIL	✓		8219155	[illegible]	0735858335
12	ELIUD N. OMINO	✓		8907326	[illegible]	0735935967
13	HEZBOURNE NIALA	✓		6165517	[illegible]	0710399495
14	PETER O. OMBIE	✓		21489118	[illegible]	072033569
15	MOSSES O. ODIGA	✓		11382729	[illegible]	0723323909
16	CHARLESTONE O. FUOYEGENCE	✓		2635714	[illegible]	0721589135
17	LEONARD ALOO ABANDE	✓		3348089	[illegible]	0721869294
18	CLEOPHUS ODHIAMBO DULLO	✓		10702114	[illegible]	0714745119
18	JAMES J. AWILLY	✓		5175693	[illegible]	0726697222
20	LEONARD ABARA	✓		6057536	[illegible]	0720686994
21	GORDON ONDIEK	✓		2252354	[illegible]	0729525512
22	RAYMOND OLWCH OTERO	✓		11230504	[illegible]	0710766604
23	M.M. MAINGA		✓	22437025	[illegible]	0723995060
24	ALFET 'H' JILLO		✓	21755396	[illegible]	0715-333700
25	JANET A. OWITI		✓	25697894	[illegible]	0716464645
26	JOSEPH OUMA	✓		8607803	[illegible]	0722927907
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District NYANDO

Division

Location

Meeting Started ____ Meeting Ended

Community Representative

Consultant Representative

Tullow CLO

APPENDIX 4: KEY STAKEHOLDERS

No.	Contact Person	Stakeholder	Location	Contacts
1.	Mr. Gerson Fumbuka-Maritime Safety and Security Officer	Lake Victoria Basin Commission	Kisumu	Tel: +254 57 2023873/894 Cell: +254-736427506 Email: fumbuka@lvbcsec.org
2.	Ms. Miriam Siwa - Chief Manager Planning, Research Business Development Investment Promotion	Lake Basin Development Authority	Kisumu	Tel: +254 057 2027227 Cell: +254 722 705466 Email: siwacm@lbda.co.ke
3.	Dr. Godfrey Ogonda-Deputy Director (Programmes)	OSIENALA (Lake Victoria Centre for Research and Development)	Kisumu	Tel: +254 57 2023487 Cell: +254 728 777 863 Email: ogonda@osienala.org
4.	Johnstone Imbira-KESAP Chairman (Nyanza Chapter)	Ministry of Agriculture	Kisumu (Provincial Office)	Cell: 0711152036/ 0734166610 Email: imbirason@yahoo.com
5.	Mr. Okungu – Water Expert LVEMP II	Lake Victoria Environmental Management Programme	Kisumu	
6.	Environment Expert	Lake Victoria Environmental Management Plan	Kisumu	Tel: +254 57 2023873/894
7.	Mr. Antony Aura Saisi - County Director of Environment	NEMA	Kisumu	0721 897 557 0736 136 897
8.	Lead Scientist	Kenya Wildlife Service-(Scientist)	Kisumu	
9.	Mr. Fred Ogombe – Head of Conservancy	Kenya Forest Service	Kisumu	0721669509
10.	Mr. Kenneth Werimo - Director	KEMFRI	Kisumu	
11.	Ms. Margaret Outa - District Environment and Land Development Officer	Ministry of Environment	Kericho	0712810390

12.	Mr. Kaunda - District Agricultural Officer	Ministry of Agriculture	Kericho West (Sosiot)	0723380171
13.	Mr. Walter Adongo	ICRAF (World Agroforestry Center)	Kisumu	
14.	Mr. Opango Mr. Oleko-(Pollution Control Officers)	WRMA (Lake Victoria South Catchment) - Regional Office	Kisumu	Cell: 0721493509 Email: opango69@yahoo.com
15.	Mr. Charles Juma	Tullow Oil	Kisumu	
16.	Mr. Silas Owiti	Dunga Ecotourism and Environmental Youth Group (DECTA)	Kisumu	0710 969829
17.	Mr. Richard	Dunga Beach Management Unit	Kisumu	0723049228
18.	Mr. John Raila	Hippo Focus Group	Kisumu	0726436988
19.	Mr. Leonard Akumu	Eco-Finder Kenya	Kisumu	0726701042
20.	Ms. Regina Nyumba	Oyusi Women Group	Kisumu	0718700655
21.	Mr. Nicholas Dede	Dunga Nam Lich	Kisumu	0724662534
22.	Mr. Maurice Ongowe	Dunga Fishermen Cooperative Society	Kisumu	0723884024
23.	Mr. Arthur Wangwana	Dunga Primary School	Kisumu	0713313664
24.	Mr. Vincent Otieno	Lucky Apex	Kisumu	0713382159
25.	Mr. Godfrey Agom	One Team One Dream	Kisumu	0728348513
26.	Nelly Sang - Librarian	DIDC	Kericho	0724968531
27.	Geoffrey - Librarian	DIDC	Busia	0726346884
28.	Ochieng - Librarian	DIDC	Siaya	0722970278

APPENDIX 5: ESIA POSTER TEMPLATE

ENVIRONMENTAL AND SOCIAL IMPACT ASSESEMENT PROCESS

Public Meeting and Invitation of Interested Persons to Comment

TULLOW OIL WILL BE PERFORMING SEISMIC SURVEY IN BLOCK 12B COVERING:

BUDALANGI, BONDO, RARIEDA, KISUMU WEST, EAST & CENTRAL, NYANDO, NYAKACH, BELGUT, AINAMOI, KARACHUONYO, HOMA BAY, MBITA, SUBA AND NYATIKE

THE PUBLIC MEETING IS MEANT TO PROVIDE BACKGROUND INFORMATION OF THE PROPOSED PROJECT, AND TO OBTAIN COMMENTS AND CONTRIBUTIONS FROM VARIOUS INTERESTED AND AFFECTED PARTY WITH REGARD TO THE ASSESSMENT BEING UNDERTAKEN. COMMENTS MAY ALSO BE RECEIVED THROUGH; LETTER, EMAIL, TELEPHONE CALL OR SMS TO THE ADDRESS GIVEN BELOW OR DIRECT INPUT AT THE PUBLIC MEETING SCHEDULED.

IF YOU INTEND TO REGISTER AS AN INTERESTED AND AFFECTED PARTY KINDLY FORWARD YOUR COMMENTS REGARDING THE PROPOSED DEVELOPMENT TO THE CONTACTS BELOW OR FILL THE PUBLIC CONSULTATION FORM AVAILABLE AT THE DC'S OR CHIEF'S OFFICE OR PURPOSE TO ATTEND THE PUBLIC MEETING.COLLECTIVE PARTICIPATION IS IMPORTANT IN FORECASTING ANTICIPATED POTENTIAL BENEFICIAL IMPACTS AND DEVISING HOW THEY CAN BE ENHANCED WHILE AVOIDING AND/OR MITIGATING THE NEGATIVE IMPACTS TO ACCEPTABLE STANDARDS.

All your comments should reach us on or before: **7th December, 2012.**

Public Meeting Date and Venue

Date	Time	Venue

Return Address for Comments:

Earthview GeoConsultants Ltd,

P.O. Box, 10366-00100 Nairobi, Kenya.

Tel: 0723-324758; 0722-768535; 0722-768536;

Email: earthview@geologist.com

APPENDIX 6: SUPPORTING STUDIES

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-trichloethane (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 compounds and NO 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^{o}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
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 Ethylparantrophenyl 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
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	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																				
Biochemical Oxygen	x	x	x	x	x	x	x		x		x	x	x	x	x	x				
Total Suspended	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/Pigme	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Elemental																			x	
Total Phosphorus						x				x					x				x	x
Ammonia (as N)												x			x	x	x	x		
Organic Nitrogen						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								
Cyanide A										x		x								
Fluorine										x		x	x					x	x	
Free Available																				
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												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	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: • Overall plant layout • Feed chamber/ charging • Primary Combustion Chamber • Secondary Combustion Chamber • Particulate Scrubbers • Acid Gas Scrubbers • The stack/ chimney.
2	Feeding and Charging	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. No waste is to be fed into the incinerator: 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	The primary combustion chamber must: 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	The secondary combustion chamber must: 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.

		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	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: • Cyclone separator • Electrostatic precipitators • Fabric filters
6	Chimney/Stack	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	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. • 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	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 neighbourhood. 2. Must be housed in a suitably ventilated room.
9	Emission Limits	1. Combustion efficiency: Combustion efficiency (CE) shall be at least 99.00% The Combustion efficiency is computed as follows:

$$C.E = \frac{\% CO_2}{\% CO + CO} \times 100$$

2. The temperature of the primary chamber shall be 800 ± 50 C

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.

4. Opacity of the smoke must not exceed 20% Viewed from 50 Meters with naked eyes.

5. All the emission to the air other than steam or water vapour must be odourless and free from mist, fume and droplets.

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.

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
Manganese	Mn

		Tin Sn Vanadium V Nickel Ni Hydrochloric HCL Hydrofluoric acid HF Sulphur dioxide S02 7. A 99.99% destruction and removal efficiency (DRE) for each principal organic hazardous constituent (POHC) in the waste feed where: DRE = [(Win - Wout)/Win]*100 Where: Win = mass feed rate of the POHC in the waste stream fed to incinerator, and Wout = mass emission rate of POHC in the stack prior to the release to the atmosphere. 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. Note: ▪ *All pollutant concentrations must be expressed at 0^0 C and 1.013 x 10^5 N/m^2, dry gas and 11% oxygen correction.* • Oxygen correction is computed as: $E_s = \frac{21 - O_s}{21 - O_M} \times E_M$ Where: E_s = Calculated emission concentration at the standard percentage oxygen concentration E_M = Measured emission concentration O_s = Standard oxygen concentration O_M = measured oxygen concentration
10	Operation	1. Materials destined for incineration should be of known origin and composition and must be only incinerated in a furnace that is registered for the particular type of waste. 2. A record must be kept of the quantity, type and origin of the waste to be incinerated.

		3. The incinerator must be preheated to working temperature before charging any waste. 4. The incinerator must not be overcharged. 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. 6. The incinerator operator and all relevant staff must be trained to the satisfaction of the relevant control authority.
11	Housekeeping	The site where the incinerator is built must: 1. Have running water. 2. Have a solid floor. 3. Have lighting if 24hrs operation 4. Have fly ash containerization and storage before disposal.
12	Health and Safety (Protective Gear)	1. Staff handling waste must be well trained on safe handling of hazardous wastes. 2. Staff must be provided with appropriate protective gear such as, gas mask, aprons, gumboots, helmets, gloves, goggles. 3. Caution and Warning signs must be provided. 4. Firefighting equipment must be provided 5. There should be no smoking or eating on the site.

DETAILED SOIL ANALYSIS FOR BLOCK 12B

Topographical features in Block 12B include the scattered highlands such as Got Ramogi, Usenge, Sirafungo, Got Abiero and lowlands including Yala Swamp and Uyoma Plains (BONDO DEAP, 2009-2013). Other features include Kano Plains and Nyabondo Plateau.

The topography of these districts is varying, ranging from uplands of various levels to plains and alluvial valleys in the central and western part. Steep topography was found along the shores of Lake Victoria, at the Gwasi and Gembe Hills and various other Hills (*viz* Homa Hills). The majority of the district is underlain by relatively “acid” parent rock, causing soils of low fertility, and only small areas with basaltic rock types with better soils occur. Mountain soils (M) have little profile development, and vary greatly in texture. They often occur together with rock outcrops and stones (units MBC, MPC). These are mainly soils for forests. Hill soils of unit HB1 are similar, but topography is more subdued. On some of the hills, soils of varying depth and stoniness are found. Therefore, the fertility is variable. On the associated foot slopes most soils (F) have moderate fertility. The sloping piedmont plains (Y) carry soils partly similar to those of units F, associated with vertisols where the topography becomes flat. They are fertile for suitable crops which are able to stand on its heavy texture and tendency for water logging.

Soils of Sindo, Lambwe, and Kanyamwa

Most of the soils are derived from a range of parent materials and developed on uplands with steep slopes ranging from 4 to 16%. They are shallow to deep, well drained to excessively drained, very dark greyish brown to black, sandy clay to clay, in places, gravelly, stony and rocky. The cropland and Shrubland on the upper segments of landscape (uplands) consists mainly of well drained to excessively drained, shallow to moderately deep clay on relatively steep slopes (Table 1). A combination of steep slopes and shallow soils (Plate 1(a)) implies not only limited water holding capacity, but also relatively little opportunity time for storm water to penetrate into the soil profiles. This demonstrates high erosion potential due to increased run-off, particularly if the current land cover is cleared. The soil in the project area has shallow depth and the gravel bedrock reduces the volume of water and the degree of wetness of the soil that would impede the seismic survey activities. On the lower segment of the landscapes, the well drained, moderately deep, sandy clay soils exhibit rill/sheet erosion (Plate 2(b)) due to increased overland flow from the upper segment. These areas are highly vulnerable to erosion.

For the most parts of the uplands, the organic matter content (stabilizes the soil aggregates) is high (critical limit=2.0) (Table 2). High flocculation index (a measure of soil aggregate stability) indicates very stable soil structure conditions, which are explained by low sodium concentration (ESP). When sodium level is above 6, it destroys soil structure through dispersive effects. The levels of soil water and pH are optimum for soil to perform its functions including controlled erosion and sustaining environmental quality and stability. A combination of these dsirable physical and chemical characteristics of soils, including relatively high aggregate stability and stable soil structural conditions, explains the occurrence of little soil erosion, hence relatively low vulnerability to to increased land degradation.

Plate 1: (a) Shallow soils on the uplands of Kanyamwa in Rachuonyo district and (b) rill erosion on steep slopes in the project area.

Table 1: Description of the specific locations of the sampling points

Observation No.	Mapping Unit	Physiography	Geology	Slope (%)	Land use	Drainage	Depth (cm)	Texture	Types of erosion
TU018	UIB5/BD	Uplands	Intermediate rocks	2-4	Shrubland	Well drained	65	Clay	Sheet
TU019	UIB5/BD	Uplands	Basic igneous rocks	4-6	Shrubland	Well drained	55	Clay	Rill
TU022	PIA7/A	Plains	Basic Igneous rocks	4-6	Forest	Well drained	80	Clay	Rill
TU0 23	FB6/BC	Footslopes	Basic igneous rocks	6-8	Cropland	Well drained	100	Clay	Nil
TU024	YXC/AB	Piedmont Plains	Basic igneous rocks	4-6	Cropland	Well drained	80	Sandy clay	Nil
TU026	PIA5/A	Plains	Basic igneous rocks	0-2	Shrubland	Well drained	90	Clay	Nil

Table 2: The dynamic soil quality attributes of Sindo, Lambwe and Kanyamwa

Observation No	Mapping Unit	Flocculation index	Water holding capacity	Soil organic matter content %	Soil pH	ESP	Type of erosion
TU0 18	UIB5/BD	75	81	2.5	7.1	1.0	Nil
TU0 19	UIB5/BD	77	64	2.1	6.3	1.2	Nil
TU0 22	PIA7/A	76	108	1.8	6.4	1.4	Nil
TU0 23	FB6/BC	74	143	2.3	6.7	0.9	Nil
TU0 24	YXC/AB	74	110	1.4	7.1	1.0	Nil
TU0 26	PIA5/A	59	112	2.4	6.4	6.2	Nil

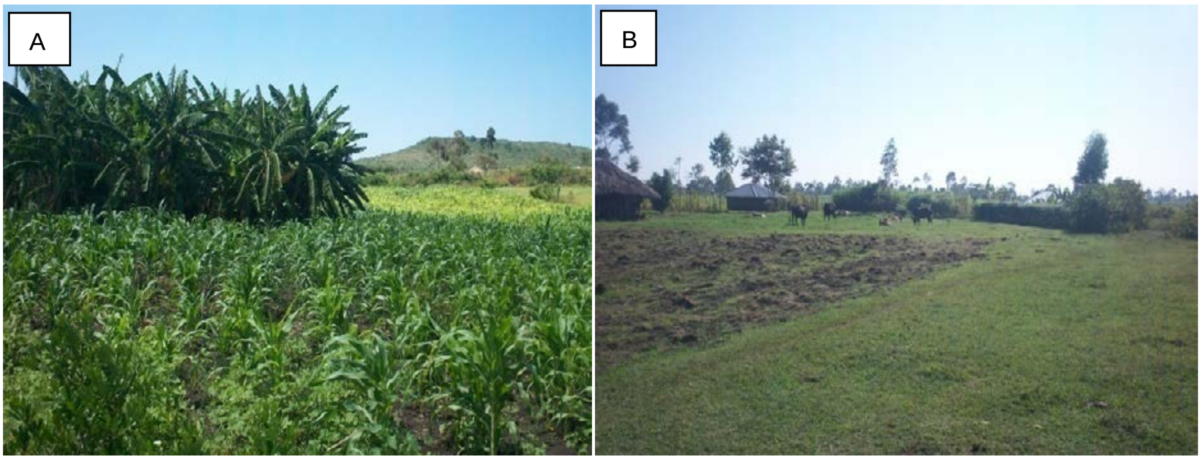

Plate 2: (a) Rich and stable soils in the project area and (b) shallow and stable soils.

Soils of Homa Bay, West Karachuonyo and Kendu Bay

The project sites have soils occurring on various physiographic positions on undulating landscape consisting of hills, uplands, footslopes and plains with a range of soil characteristics (Table 3). These soils are developed on various parent materials. Acid igneous rocks are mainly Pre-Cambrian rhyolitic lavas and Pre-Cambrian granites-granodiorites. Igneous rocks include Tertiary intermediate and basic lavas, Pre-Cambrian andesitic/basaltic lavas and Pre-Cambrian diorites-granodiorite. In the plains, loose materials originating from denuded existing rocks have been deposited as sediments. These are mostly alluvial/colluvial deposits. Figure 1 gives the summary of the geology of the area (Waruru et al., 2003).

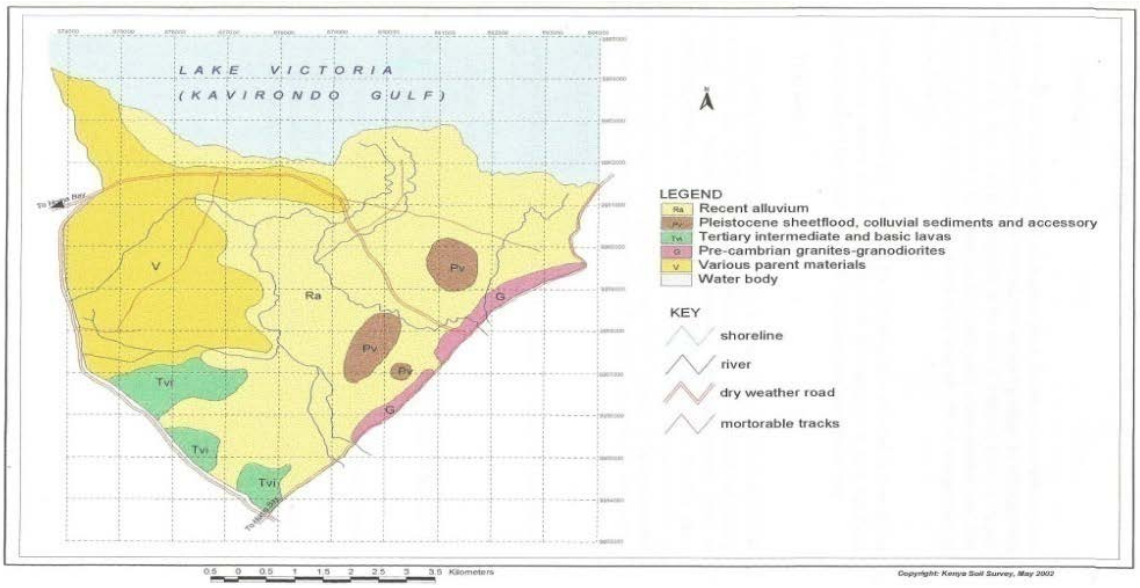

Figure 1: Geology of some parts of Rachuonyo District (Source: Kenya Soil Survey, 2002)

The soils of the area have been zoned into clusters each cluster having specific structural problems and the potential effects of the 2D seismic survey on these soils (see Table 3).

Table 3: Soil observation areas in Block 12B

<table>
<tr><th colspan="2">Clusters of soils</th></tr>
<tr><td>Observation point No. TU028

Mapping Unit FX3/BC

The soils are well drained, moderately deep, dark greyish brown clay on slope of 2-4%, with sheet erosion being dominant land degradation process. In absence of conservation structures on gently sloping areas, sheet erosion is the dominant processes being attributed to overland flows, resulting into accumulated fingers of brown sheet wash on dark greyish brown soil.

Where there are no local tracks or access roads, the areas with pronounced sheet wash due to increased sheet erosion, would be an advantage for the establishment of seismic survey lines because the sand materials contained in the sheet wash reduces the ground wetness, thereby permitting easy movement, especially in the rainy season.</td><td></td></tr>
<tr><td>Observation point No. TU029, Mapping Unit BX5A and

Observation point No.TU034, Mapping Unit UIXI/B

The soils in this cluster are developed on flat to very gently undulating (0-2%) land. They are well drained to imperfectly drained, moderately deep, and friable to firm, cracking clay. The cracking, swelling and shrinking type of clay present a challenge to operation of seismic equipment/machines. In addition the poorly formed massive clay structure would be vulnerable to increased compaction and depression when subjected to pressure from heavy machinery and Vibroseis trucks used during seismic survey. The increased compaction would result into further reduction of aeration of the imperfectly drained soils. This would reduce the capacity of the soil to filter, buffer and detoxify the organic and inorganic waste materials derived from the proposed project activities.</td><td></td></tr>
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Cluster 3: Observation point No. TU030, Mapping Unit BXC3/AB and
Observation point No. TU037, Mapping Unit YUC/AB
Well drained, shallow to moderately deep, pale brown to reddish dark brown, sandy clay to clay, on rolling uplands with slopes 6-8%. Land use types are mainly maize, sorghum and beans. The area is relatively stable environment, where there is a positive interaction between land use, land cover and soils such that no severe land degradation processes (e.g. sheet and gully erosion) take place. However, there may be erosion hazard, depending on the on the area of land requiring clearing to create cut lines.
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Cluster 4: Observation point No. TU035 Mapping Unit UIX1/B and Observation point No. TU036 Mapping Unit UIX1/B
The soils of this cluster are well drained to excessively drained, shallow to moderately deep, dark reddish brown, sandy clay to clay with limited water holding capacity. Relatively high volume of run-off, contributed by the roof-catchments from the settled areas, causes increased rate of sheet erosion that develops into gullies, making this site vulnerable to increased land degradation depending on the location of seismic cut lines and extent of land clearing involved.
Lack of conservation structures such as cut-off drains, trashline or terraces accelerate gully erosion. In areas with high sodium concentrations, the increased compaction through soil structural degradation impedes the storm water uptake thereby increasing the vulnerability of the area to environmental degradation.
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In evaluating land for the assessment of the degree of land degradation, and the potential influence on the proposed seismic survey activity in Homa Bay, West Karachuonyo and Kendu Bay region, the selected land quality indicators are those derived from the previous works done in Kimira, Oluch, Kendu Bay area, Rachuonyo District (Muya *et al.*, Waruru et al. and Wanjogu *et al.*, 2002 and 2003). Table 4 shows the land quality indicators examined for assessing the degree of land degradation and the effects of the proposed seismic survey operations on such soils.

The physical and chemical characteristics indicated in Table 5 indicate reasonably stable soil structural conditions for most observation points. Although sodium concentrations are higher than the critical limit (ESP=6), its dispersive effects are not pronounced since they counterbalanced by relatively high level of sand as opposed to clay, which is vulnerable to dispersion by sodium. Since organic matter content, bulk density and silt/clay ratio for all the observation points are within the acceptable range, soil erodibility is not a problem.

Table 4: Land quality values for all the observation points

Observation No.	**Mapping unit**	**Attributes for estimating soil moisture holding capacity**			**Soil erodibility**			**Salinity**	**Sodicity**
		Soil Depth (cm)	**Slope %**	**Texture**	**Soil organic carbon**	**Bulk density (g/cc0**	**Silt/clay ratio**	**EC mmhos/cm**	**ESP**
TU028	FX3/BC	70	6-8	Clay	1.91	1.1	0.66	0.36	2.2
TU029	BX5/A	65	0-2	Clay	1.22	1.2	0.29	0.4	2.4
TU030	BXC3/AB	80	6-8	Sandy clay	0.52	1.3	0.59	0.30	12.8
TU034	UIX1/B	60	0-2	Sandy clay loam	0.96	1.3	0.10	0.60	9.5
TU035	UIX1/B	75	4-6	Sandy clay	0.86	1.2	0.25	0.8	2.2

EC-Electrical conductivity (the concentration of salt in the soil)

ESP – Exchangeable sodium percentage (concentration of sodium in the soil)

Table 5: Final rating of land quality and degree of land degradation in different sites

Observation point	Summations of the sub-ratings of the following land quality indicators:					Degree of land degradation
	Water holding capacity	Soil erodibility	Salinity	Sodicity	Final ratings	
28	6	7	1	1	3	High
29	4	4	1	1	2	Moderate
30	5	6	1	1	3	Moderate to high
34	5	7	1	3	3	High
35	6	6	1	1	3	High

Soils of Kisumu County

The areas examined under Kisumu County are Kajulu, Kibos, Miwani, Kibigori, Songo, Chemelil, Muhoroni and Nyakach.

Major soil types and their degree of degradation

The soils of highlands above 1400m a.s.l are excessively drained to well drained, shallow to moderately deep, dark reddish brown to dark greyish brown, clay loam to clay, in places rocky, stony and gravelly loamy sand. They occur on slopes ranging from 7 to 20%. Areas with very severe erosion hazard occur on hills, footridges and footslopes. In this area, relatively steep slopes and limited water soils' capacity to absorb storm water generates a concentrated massive overland flows and sheet wash, causing the removal of fine soil particles, mainly clay and silt, leaving behind the stone pavement The erosion pavement would be appropriate for the creation of access roads for the movement of seismic trucks, especially if they occur along the motorable footpaths/tracks (Plate 3). Moderate erosion hazard occurs mainly on the lower part of the footslopes, uplands and plains. On the footslopes, the upper level uplands or footridges act as roof catchments that produce high volume of water flows onto the footslopes resulting into concentrated flows, taking their courses through footpaths, rills and gullies into the lowlands. These flows, and hence, soil erosion would be accelerated by the proposed seismic survey activities if the seismic tracks/cut lines are designed to follow directly across the slope gradients.

On the plains, severe gully erosion is taking place, having its water catchment from the upper ridges (Plate 4). The gullies are developed from minor drainage channels and cut their way upslope by slope retreat. In most cases the gullies are very deep, suggesting the occurrence of other processes including undercutting and surface cracking that enhances erosion in the subsoil (Waruru, 1992). The micro mass movement through soil creeping, crumbling and slumping are enhanced by the occurrence of relatively high sodium concentrations with increased dispersive effects on clay particles. In such areas, dynamite rather than Vibroseis energy sources would be recommended, and cut lines may be established based on the results of a more systematic soil survey and mapping during or prior to execution of the proposed 2D seismic survey project.

Plate 3: Severe land degradation in the project area

Plate 4: Severe land degradation on Kano plains

Plate 5: Severe land degradation on plains

The quality of soils with respect to 2D seismic Survey activities

The quality of the soils and their suitability for 2D seismic survey activities is assessed with respect to the specific observation points, which have inherent and dynamic properties indicated in Table 6 and 7 respectively.

Table 6: Inherent soil quality attributes of Kisumu County

Observation No	Physiography	Geology/parent material	Slope %	Soil depth (cm)	Drainage	Texture
TU0 65	Plateau	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	65	Well drained	Clay
TU0 66	Plateau	Intermediate igneous rocks (andesites, Phonolites, syenites)	10-12	25	Excessively drained to well drained	Clay loam
TU0 67	Alluvial plains	Alluvial sediments from various sources	4-6	63	Well drained	Sandy clay
TU0 72	Piedmont plains	Undifferentiated basement system rocks, predominantly gneisses)	2-4	60	Well drained	Clay
TU0 74	Piedmont plains	Undifferentiated basement system rocks, predominantly gneisses)	2-4	55	Well drained	Clay

Observation No	Physiography	Geology / parent material	Slope %	Soil depth (cm)	Drainage	Texture
TU0 75	Piedmont plains	Undifferentiated basement system rocks, predominantly gneisses)	0-2	80	Moderately drained	Clay
TU0 77	Plains	Undifferentiated basement system rocks, predominantly gneisses)	0-2	58	Moderately drained	Clay

The inherent soil quality attributes are subject to change due to natural phenomena, human influence and land degradation processes. Soil texture, slope and depth are inherent soil properties that not only influence the water uptake and retention capacities of the soil, but also the stability of a given site with respect to dynamic forces resulting from the interactions between soil properties (aggregate stability and erodibility) and seismic energy sources. Therefore, both dynamic and inherent properties of soils were considered in assessing the degree of potential land degradation with respect to the proposed 2D seismic survey activities. Table 7 shows the dynamic soil properties applied in land evaluation for seismic survey purposes. It was observed that soil erosion is taking place in most of the sites, and this is attributed to unfavourable interaction between inherent and dynamic soil quality attributes whose values fall out of the environmental thresholds. For instance, flocculation index is less than 75 for all the points indicating the presence of unstable soil aggregates, which are subject to dispersive effects of sodium that may be enhanced by disturbance arising from seismic survey operations. Low organic matter content, means low ability of soil to stabilize the aggregates, hence increased erosion. Shallow soils and low available water holding capacity enhances increased run-off due to limited capacity to absorb the rainwater. However, shallow soils to the bedrock or weathering parent material are favourable.

Table 7: The dynamic soil quality attributes of Kisumu County

Observation No	Flocculation index	Water holding capacity	Soil organic matter content %	Soil pH	ESP	Type of erosion
TU0 65	15	60	2.2	5.9	1.7	Nil
TU0 66	44	20	1.3	5.2	1.9	Sheet
TU0 67	25	58	1.1	6.4	5.0	Sheet, rill and gully
TU0 72	23	55	2.6	5.8	1.7	Nil
TU0 74	41	52	1.4	5.2	1.8	Sheet
TU0 75	48	90	2.4	6.4	6.2	Sheet
TU0 77	17	51	1.8	5.5	3.7	Nil

Soils of Kericho County

The areas examined under Kericho County included: Belgut, Fort Ternan, Kipkelion and Cheptiret.

Physiography and geology

The major Physiography of the area comprises lower middle-level uplands, plateau, footslopes, piedmont plains and minor valleys. The geology consists of intermediate igneous rocks such as Phonolites, andesites and syenites and undifferentiated basement systems.

Major soil types and their degree of degradation

The soils of the uplands and footslopes are excessively drained to well drained, shallow to moderately deep, clay loam to clay. They occur mainly on slopes ranging from 6-8%. Areas with very severe erosion hazard occur on uplands and footslopes, where relatively steep slopes and limited soils' capacity to absorb storm water generates high sheet and rill erosion.

The quality of soils with respect to 2D seismic survey

The quality of the soils and their suitability for 2D seismic activities with respect to the specific observation points, which have inherent and dynamic properties indicated in Table 8 and 9 respectively.

Table 8: Characteristics of the specific observation points of Kericho County

Observation No / Mapping Unit	Physiography	Geology / parent material	Slope %	Soil depth (cm)	Drainage	Texture
TU0 83 (LI7/AB)	Plateau	Intermediate igneous rocks (andesites, Phonolites, syenites)	2-4	60	Well drained	Clay
TU0 84 (AA1/A)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	65	Well drained	Clay
TU0 85 (FU2/BC)	Piedmont plains	Undifferentiated (various) rocks	0-2	45	Well drained	Clay loam
TU0 86 (FI2/CE)	Footslopes	Intermediate igneous rocks (andesites, Phonolites, syenites)	6-8	65	Excessively drained	Clay loam
TU0 89 (UI13/C)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	4-6	40	Well drained	Clay
TU0 90 (VXC3/AC)	Minor valley	Undifferentiated (various) rocks	6-8	70	Moderately drained	Clay

All the soil quality attributes of observation points numbers TUO 83 and 84 falls within the allowable thresholds (Table 9). The positive interactions between these attributes account for the observed soil aggregate stability for observation points number TU083 and TU084 (flocculation index (FI)>75). High soil aggregate stability means stable soil structural conditions which are favourable for installation and operations of seismic survey machinery such as Vibroseis trucks. The relatively low flocculation index for the rest observation points (FI<75) and low available water holding capacity (<100 mm) explains the occurrence of sheet erosion. The sheet erosion is severe where exchangeable sodium percentage (ESP) is more than the threshold value of 6. Therefore, these points (TU085, 86 and 90) may be used for the proposed project with caution.

Table 9: Inherent soil quality attributes of Kericho County

Observation No./Mapping Unit	Flocculation index	Water holding capacity	Soil organic matter content %	Soil pH	ESP	Type of erosion
TU0 83 /LI7/AB	75	90	2.2	6.1	1.6	Nil
TU0 84 /AA1/A	77	66	2.7	5.9	1.1	Nil
TU0 85 /FU2/BC	7	46	2.9	6.4	7.0	Severe
TU0 86 /FI2/CE	25	70	1.0	6.0	2.1	Sheet
TU0 90 /VXC3/AC	31	80	1.8	6.1	2.4	Sheet

Soils of Bondo County

The areas examined under Bondo County included: Usenge, Uyoma, Asembo and Seme.

Physiography and geology of the area

The major physiography of the area comprises hills, uplands, plateau, minor valleys and bottomlands. The geology intermediate igneous rocks such as phonolites, andesites and syenites occur mainly on the hills, uplands and plateaus, while the minor valleys and bottomlands are underlain by various rocks.

Major soil types and their degree of degradation

The soils are generally well drained to excessively drained, clay loam to clay, majority being shallow to moderately deep, with relatively low to moderately high available water holding capacity. Rill erosion is the most dominant land degradation process, however, not a serious limitation to the proposed project. Majority of soils have shallow soil depth to weathering or bedrock (Refer to Plate 5), and are well drained to excessively drained with no cracking and shrinking clays, thus offering a stable soil physical environment for establishment of seismic survey cut lines and installation and operation of seismic survey equipment and machinery.

The quality of soils with respect to 2D seismic survey

The quality of the soils of the hills for the proposed project is very high because of the presence of gravelly layer of 30 cm over firm rock (Table 10). In addition to this, excessively drained conditions reduce the chances of water stagnation on the surface that would impede the operations of seismic survey machinery such as the Vibroseis trucks. However, the combination of the steep slopes and shallow soil depth generates heavy overland flow that concentrates into run-off down the slopes, causing severe land degradation in the lower-lying areas, and measures should be undertaken to mitigate this. Plateaus and uplands consist of well drained and moderately deep sandy clay loam to clay soils on flat to gently undulating slopes. These soils are generally suitable for the proposed project activities.

Table 10: Characteristics of the specific observation points of Bondo County

Observation No. / Mapping Unit	Physiography	Geology / parent material	Slope %	Soil depth (cm)	Drainage	Texture
TU0 45 (HI1)	Hills	Intermediate igneous rocks (andesites, Phonolites, syenites)	8-10	30	Excessively drained	Gravelly sandy clay loam
TU0 47(HI1)	Hills	Intermediate igneous rocks (andesites, Phonolites, syenites)	4-6	55	Well drained	Clay
TU0 48 (UIIC/B)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	55	Well drained	Gravelly clay
TU0 49 (BX2/AB)	Bottomlands	Various rocks	0-2	60	Well drained	Clay
TU0 51(UIB7/B)	Minor valleys	Various rocks	2-4	50	Well drained	Clay
TU0 52 (PIA8/A)	Minor valley	Undifferentiated (various) rocks	2-4	50	Well drained	Gravelly clay

Observation No./Mapping Unit	Physiography	Geology/parent material	Slope %	Soil depth (cm)	Drainage	Texture
TUO 54 (UII1/B)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	55	Well drained	Clay
TUO 57(VXC8/AB)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	60	Well drained	Sandy clay
TUO 60 (UIG3)	Uplands	Intermediate igneous rocks (andesites, Phonolites, syenites)	4-5	47	Well drained	Sandy clay loam
TUO 63 (LI7/BC)	Plateaus	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	30	Well drained	Clay
TUO 65 (LI7/BC)	Plateaus	Intermediate igneous rocks (andesites, Phonolites, syenites)	0-2	65	Well drained	Clay

As shown in Table 11 below, Flocculation index for all the observations, being lower than 75, is indicative of the existence of undesirable processes including deflocculating, especially where exchangeable sodium percentage (ESP) is more than 6, being 14 in the bottomlands. This means that the bottomlands are susceptible to compressions and depressions when subjected to stress by movement of equipment. In addition, formation of strong surface crust and severe erosion (both rill and sheet) taking place on the bottomlands explains the occurrence of these negative processes. In such cases, low impact tyres can be used on the vibroseis equipment. In some sites, particularly on the hills, effects of relatively high sodium concentrations and low flocculation index are counterbalanced by high organic matter content (3.0%) which enhances aggregate stability against the undesirable impacts of high sodium level and low water holding capacity. This explains their suitability for the proposed project.

Table 11: Inherent soil quality attributes of Bondo County

Observation No./Mapping Unit	Flocculation index	Water holding capacity	Soil organic matter content %	Soil pH	ESP	Type of erosion
TU0 45/(HI1)	28	25	3.0	6.2	6.0	Sheet
TU0 47/(HI1)	49	70	1.9	6.7	3.5	Sheet
TU0 48/(UIIC/B)	55	69	1.6	6.4	2.8	Crust formation
TU0 49/(BX2/AB)	16	90	1.5	6.1	14	Sheet and rill
TU0 51/(UIB7/B)	26	88	1.9	5.2	6.5	Sheet
TUO 52/ PIA8/A)	24	86	1.9	5.0	4.2	Sheet
TUO 54/(UII1B)	20	66	1.6	6.0	6.3	Sheet
TUO 57/(VXC8/AB)	68	56	1.0	6.1	0.1	Sheet
TUO 60/(UIG3)	70	45	1.0	5.7	0.1	Nil
TUO 63/(LI7/BC)	40	25	2.9	5.2	2.6	Nil
TUO 65/(LI7/BC)	34	55	1.7	5.7	4.1	Nil

Soils of Rusinga and Mfangano islands

Physiography and geology

The major physiography of the area comprises hills, uplands and footslopes. The geology consists of basic and ultra-basic igneous rocks and various rocks.

Major soil types and their degree of degradation

The soils of Rusinga and Mfangano islands are broadly clustered into three major physiographic units, namely hills, uplands and footslopes (Sombroek *et. al*., 1982). The soils of the hills are a complex of excessively drained to well drained, shallow to moderately deep, firm, stony, gravelly clay loam to clay, in places with humic topsoil with vertic and argic properties. The soils of the uplands are well drained, moderately deep, friable clay. The soils of the footslopes are a complex of well drained to moderately drained, shallow to deep, gravelly, sandy clay.

The quality of soils with respect to 2D seismic survey

The gently sloping uplands (slopes 0-2%) with reasonably high available water holding capacity of well drained clay (Table 12), offers an opportunity for positive interactions between the inherent and dynamic soil quality attributes. These interactions are facilitated by the existing vegetation and reasonably good ground cover (Plate 6). The influence of the vegetation on soil structural formation and stabilization is a function of rooting activity and surface cover that maintain or enhance biological activities for sustained ecosystem functions and stable biophysical conditions of environment. This has created moderately suitable soil and environmental conditions for the proposed project. On the other hand, excessively drained, shallow, gravelly clay on steep slopes (8-30%) creates an unstable environment for the interactions between water and ecosystem functions required for formation and stabilization of soil aggregates, hence limited capacity of the soils to sustain the proposed project. The combination of the steep slopes and shallow soil depth results into inappropriate partitioning of the rain water into soil water storage and surface run-off, thereby causing unfavourable water balance within the ecosystems, which leads to increased susceptibility to erosion in most areas. Currently, the soil quality, water quality in the streams and ecosystem in this area are sustained by the current land use, vegetation and cover. Therefore for the area to be used for the proposed project the seismic survey cut lines should be carefully planned, taking into consideration the unstable interactions between soil quality, vegetation cover, steep slopes and shallow depth. During seismic survey on this site, these soil and environmental characteristics should form important parameters for evaluating the expected impacts of the proposed development on environment, based on a more systematic soil survey and mapping.

Table 12: Characteristics of the specific observation points of Rusinga and Mfangano islands

Observation No./Mapping Unit	Physiography	Geology/parent material	Slope %	Soil depth (cm)	Drainage	Texture
TU001	Uplands	Basic and ultra-basic igneous rocks	0-2	80	Well drained	Clay
TU002/(ZAC/AB)	Hills	Various rocks	4-8	20	Excessively drained	Gravelly clay
TU003/(FX5/BD)	Footslopes	Various rocks	6-10	15	Excessively drained	Gravelly clay
TU004/(FX5/BD)	Hills	Various rocks	16-25	25	Excessively drained	Gravelly clay
TU009/(YB1/BC)	Hills/piedmont plains	Basic and ultra-basic igneous rocks	4-6	46	Well drained	Clay
TU010/(YBC/AC)	Hills	Basic and ultra-basic igneous rocks	25-30	20	Excessively drained	Clay loam

Plate 6: Gently sloping and stable environments in Rachuonyo district

Plate 7: Relatively unstable environments in Lambwe Valley area

Two extreme conditions with respect to soil quality for the proposed project were found in the area (Tables 12 above). On the observation point number TU001; the soils have the highest flocculation index with firm humic clay, and having no severe land degradation, hence no erosion. These offered relatively stable soil structural and environmental conditions, which are moderately favourable for the 2D seismic survey. The lowest flocculation index was found on the observation point number TU004, with the lowest water holding capacity. Low flocculation index and low water holding capacity means low soil aggregate stability, which, being on a steep slope causes the potential occurrence of landslide, thereby creating an unstable physical environment for the movement, installation and operation of seismic machinery. The generally low organic matter content and high sodium concentration, particularly for observation numbers TU003 and TU010 (ESP>6.0), explains the increased land degradation processes through sheet, rill and gully erosion (Table 13).

Table 13: Inherent soil quality attributes of Rusinga and Mfangano islands

Observation No	Flocculation index	Water holding capacity	Soil organic matter content %	Soil pH	ESP	Type of erosion
TU002(ZAC/AB)	39	22	1.7	5.7	1.2	Sheet
TU003 (FX5/BD)	16	18	1.2	5.6	6.1	Gully
TU004 (FX5/BD)	11	10	1.5	5.9	1.8	Landslides
TU009 (YB1/BC)	34	49	2.3	6.2	3.6	Sheet
TU010 (YBC/AC)	28	18	1.3	5.5	6.3	Sheet and rill

Application Reference No. PR/10,747

Registration No: 0016716

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NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT LICENSE

This is to certify that the Project Report/Environmental Impact Assessment Study Report received from TULLOW KENYA B.V. (Name of of individual/firm) of P.O. BOX 63298-00619, NAIROBI (Address submitted to the National Management Environment Authority (NEMA) in accordance with the Environmental Impact Assessment and Audit Regulations regarding the proposed 2D Seismic Survey in Block 12B (title of project) whose objective is to carry on 2D Seismic Survey on an approximately 500 kilometer line to determine the potential for hydrocarbon deposits (briefly describe purpose) located at Parts of Kisumu, Kericho, Homa Bay, Migori, Siaya, Nandi, Vihiga and Busia Counties (locality and district) has been reviewed and a licence is hereby issued for implementation of the project, subject to attached conditions.

Dated this 24TH Day of MAY, 2013

Signature

(SEAL)

Director General
The National Environment Management Authority

CONDITIONS OF LICENSE

1. This licence is valid tor a period of 24 months (time within which the project should commence) from the date hereof.
2. The Director-General shall be notified of any transfer/variation/surrender of this license.

P.T.O.

1.0 General Conditions

1.1 This approval is for the onshore and offshore seismic survey on Block 12B which covers parts of Kisumu, Kericho, Homa Bay, Migori, Siaya, Nandi, Vihiga and Busia Counties in the Western and Eastern part of Lake Victoria at a cost of KShs.850 million (USD 10 million).

1.2 Without prejudice to the other conditions of this license, the proponent shall implement and maintain an environmental management system, organizational structure and allocate resources that are sufficient to achieve compliance with the requirements and conditions of this license.

1.3 The Authority shall take appropriate action against the proponent in the event of breach of any of the conditions stated herein or any contravention to the Environmental Management and Coordination Act, 1999 and regulations therein.

1.4 This license shall not be taken as statutory defence against charges of environmental degradation or pollution in respect of any manner of degradation/pollution not specified herein.

1.5 The proponent shall ensure that records on conditions of licenses/approval and project monitoring and evaluation shall be kept on the project site for inspection by NEMA's Environmental Inspectors.

1.6 The proponent shall submit an Environmental Audit report in the first year of occupation/operations/commissioning to confirm the efficacy and adequacy of the Environmental Management Plan.

1.7 The proponent shall comply with NEMA's improvement orders throughout the project cycle.

1.9 The proponent shall provide the final project accounts (final project costs) on completion of construction phase. This should be done prior to project commissioning/operation/occupation.

2.0 Exploration Conditions

2.1 In the event that the project site borders a river to a stream, the proponent, pursuant to Regulation 6 (c) of the Water Quality Regulations of 2006, shall protect the riparian reserve by ensuring that **NO** development activity is undertaken within the full width of the river or stream to a minimum of six (6) meters and a maximum of 30 meters on either side, based on the highest recorded flood level.

2.2 The proponent shall prepare an Emergency Response Plan (ERP) prior to commencement of works.

2.3 The proponent shall ensure that material safety data sheet of all potentially hazardous materials are well maintained.

2.4 The proponent shall ensure that adequate and appropriate sanitary facilities are provided for the workers during exploration phase.

2.5 The proponent shall work closely with the local leaders and the fisherman to avoid conflicts.

2.6 The proponent shall ensure adequate awareness of the public before mapping the oil or gas deposits in the area.

2.7 The proponent shall ensure that a rapid risk assessment is done before commencing the project.

2.8 The proponent shall ensure that exploration works are supervised and undertaken by qualified personnel.

2.9 The proponent shall ensure that all excavated material and debris is collected, re-used and where need be, disposed off as per the Environmental Management and Coordination (Waste Management) Regulations of 2006.

2.10 The proponent shall ensure strict adherence to the provisions of Environmental Management and Coordination (Noise and Excessive Vibrations Pollution Control) Regulations of 2009.

2.11 The proponent shall ensure strict adherence to the Occupational Safety and Health Act (OSHA), 2007.

2.12 The proponent shall ensure that exploration workers are provided with adequate personal protection equipment (PPE) as well as adequate training.

2.13 The proponent shall ensure strict adherence to the Environmental Management Plan developed throughout the project cycle.

2.14 The proponent shall ensure that the development adheres to any specifications issued for development of such a project within the jurisdiction of the Municipal Councisl of Kisumu, Busia, Bondo, Nyando, Belgut, Homa Bay, with emphasis on approved land use for the area.

3.0 Operational Conditions

3.1 The proponent shall ensure that in the event that the exploration is successful, the licensing and commissioning of the area shall require fresh application to NEMA and other relevant authorities.

3.2 The proponent shall ensure corporate social responsibility by hiring and utilizing local resources as much as possible.

3.3 The proponent shall ensure that adequate and appropriate Emergency Response Plans are designed and implemented during the survey.

3.4 The proponent shall ensure that all waste water is disposed as per the standards set out in the Environmental Management and Coordination (Water Quality) Regulations of 2006.

3.5 The proponent shall ensure that all equipment used are well maintained in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations of 2009.

3.6 The proponent shall ensure that all solid waste is handled in accordance with the Environmental Management and Coordination (Waste Management) Regulations of 2006.

3.7 The proponent shall comply with the relevant principal laws, by-laws and guidelines issued for development of such a project within the jurisdiction of the Municipal Councils of Kisumu, Homa Bay, Migori, National Oil Corporation of Kenya, Kenya Forest Service, Ministry of Public Health and Sanitation, Directorate of Occupational Health and Safety Services, Lake Basin

Development Authority, Mines and Geology, Kenya Wildlife Service, Ministry of Agriculture, Ministry of Energy, National Museums of Kenya, Water Resources Management Authority and other relevant Authorities.

3.8 The proponent shall ensure that environmental protection facilities or measures to prevent pollution and ecological deterioration such as buffer zones for the excessive vibrations, restoration of camp and exploratory sites, waste management, occupational health and safety mechanisms are designed, constructed and employed simultaneously with the proposed project.

4.0 Notification Conditions

4.1 The proponent shall notify the Ministry of Energy of any accidents or incidents during the project phases within 24 hours.

4.2 The proponent shall seek written approval from the Authority for any operational changes under this license.

4.3 The proponent shall ensure that the Authority is notified of any malfunction of any system within 12 hours on the NEMA hotline No. **020 6006041** and mitigation measures put in place.

4.4 The proponent shall keep records of all pollution incidences and notify the Authority within 24 hours.

4.5 The proponent shall notify the Authority in writing of its intent to decommission the facility **one (1) month** in advance.

5.0 Decommissioning Conditions

5.1 The proponent shall ensure that a decommissioning plan is submitted to the Authority for approval at least one (1) month prior to decommissioning.

5.2 The proponent shall ensure that all pollutants and polluted material is contained and adequate mitigation measures provided during the phase.