



# **Extended Well Testing – Amosing 1 Environment Project Report Study**

Report Prepared for

**Tullow Kenya B.V.**

Report No. KT/4081/EPR/01

October 2014



# **Extended Well Testing Environment Project Report Study**

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**October 2014**

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# 1 Non-technical Summary

## 1.1 Overview and purpose of the project

As part of the proposed development of Blocks 10BB and 13T, Tullow Kenya B.V. (hereafter referred to as 'Tullow') wishes to complete an extended well test (EWT) at the existing Amosing-1 well-site ('Project'), located to the south of the town of Lokichar, Kenya. The well pad coordinates are 2° 9' 38.05" N; 35° 48' 15.569" E.

Following discussion with NEMA (August 12<sup>th</sup> 2014), it was agreed that due to the limited scope and localised scale of the EWT activities, an Environmental Project Report (EPR) could be prepared, in accordance with Part II, Section 7 of the Environmental (Impact Assessment and Audit) Regulations, 2003.

The purpose of the project is to appraise the hydrocarbon reservoir using the existing Amosing-1 well to obtain more information on reservoir characteristics, and assist in identifying the optimum method that can be used to recover the oil. Up to 1,500 bbls of reservoir fluids will be flowed per day from Amosing-1 to allow observations to be made of reservoir characteristics during testing. In addition, EWT activities will also involve the completion of an injectivity test where water is re-injected back into the hydrocarbon reservoir. EWT activities are expected to start during Q1 2015 and be completed within a period of up to 12 months including the post crude oil reinjection.

## 1.2 Summary of the project

No additional land is required and all activities will take place within the existing site boundary, other than the use of the public road network to transport workers and equipment. A summary of project activities is provided below:

- **Site modification** - minor site modifications are required within the existing boundary of the well pad, including civil works to accommodate the crude oil storage tanks;
- **Installation and operation of EWT equipment** – this includes the following:
  - Installation of a single separator to separate reservoir fluids into gas, crude oil, and produced water;
  - The flaring of associated gas to the atmosphere (no crude oil will be flared);

- The storage of crude oil and produced water in aboveground steel tanks;
- Reinjection of produced water, potentially mixed with freshwater to provide additional volume, on completion of EWT activities to test the injectivity of the reservoir; and
- Either reinjection of crude oil back into the reservoir, or the storage of crude until it can be exported in the future.
- **Supporting facilities** – the use of existing worker accommodation camps, use of existing groundwater boreholes and use of existing waste management facilities.
- **Use of the public road network** – to transport workers, equipment and other materials required for the project.
- **Site closure** – after the EWT is complete the equipment used for the test will be removed. The steel tanks used for the storage of crude oil (if this option is selected) will be positioned within the existing boundary and no additional land is required.

The construction of the Amosing-1 well pads, drilling of the wells, associated access roads, the accommodation camp and waste management facilities at Ngamia-1 and (future) site decommissioning and reinstatement following well closure have already been permitted in the Environmental Impact Assessment (EIA) of the proposed exploratory Well Drilling in Block 10BB, Turkana South and Turkana Central Counties by Africa Oil Kenya BV, October 2010 (License no. PR 7764 / 0001253 expiring 11 May 2015). All waste generated by the EWT project will be transported to Tullow's existing facilities at Ngamia-1 and managed in accordance with the Waste Management Regulations in Kenya and Tullow's existing EHS procedures.

The abstraction of groundwater from existing boreholes for Tullow's activities (including the EWT) has already been approved by the Water Resource Management Authority (WRMA) under an existing permit.

The EPR defined an environmental Area of Influence (Aoi) of 2km based upon the results of air and noise modelling carried out for the project. A wider socio-economic Aoi was defined as 10km, based on the proximity of nearby communities and use of the area surrounding the existing well pad for animal grazing land.

### 1.3 Stakeholder engagement

EWT project stakeholders were identified and consultations activities were completed during two separate fieldtrips that were undertaken during July and September 2014. Stakeholders for the EWT EPR included government officials at a County and sub-County level, community groups and representatives, and Non-Governmental Organisations (NGOs). The key findings of stakeholder consultations activities are summarised below:

- Stakeholders expressed concern associated with the potential for environmental pollution (water, air emissions, generation of dust, generation of noise), the project's contribution to global climate change which is perceived to be changing rainfall distribution patterns across the region, and the generation of waste; and
- Concerns were also raised associated with the use of additional land (it was confirmed that no additional land was required for the EWT project), potential employment opportunities (it was confirmed that due to the limited scope of the works, no local employment was required), and the potential for Tullow to share the benefits associated with the future production of oil (it was confirmed that the export of oil to market was outside the scope of the project).

Overall, the outcome of stakeholder consultations indicated that there was support for Tullow's activities in the area and stakeholders were pleased to be involved in preparation of the EPR and wished to see community-level engagement continue during the implementation of the EWT project.

### 1.4 Impact assessments

An impact assessment was undertaken, using a risk-based approach, to identify the environmental and social risks and impacts associated with the EWT project. The outcome of the assessment process identified the following Minor residual impacts:

#### Routine events

Deterioration to local air quality, creation of nuisance to local communities and reduction in availability of vegetation used for animal grazing due to the generation of dust from the use of vehicles.

Reduction in the availability of local groundwater supplies and groundwater over abstraction resulting in deeper saline water mixing of with upper freshwater horizons due to the abstraction of groundwater from boreholes.

Introduction of alien and invasive species affecting existing plant species, biodiversity and pastoralist livelihoods due to the use of road vehicles to transport equipment, materials and workers.

Soil and groundwater contamination due to the generation of hazardous and non-hazardous waste.

#### Non-routine events

Deterioration to local air quality (non-GHG emissions) and contribution to global climate change (GHG emissions) due to the potential for a release of gas to occur owing to a surge in gas volume during well testing.

Soil and groundwater contamination, deterioration to local air quality (non-GHG emissions) and global climate change (GHG emissions) and impact on community health and safety due to the potential for fire/explosion to occur during well testing.

The assessment process identified the following Moderate residual impact:

#### Routine events

Increased risk to community health and safety resulting in an injury/fatality, or damage to private property and loss of livestock due to the use of road vehicles on the public road network and a road traffic incident.

## **1.5 Environmental and Social Management Plan and future inspections and audits**

All of the mitigation and control measures identified were incorporated into an Environmental and Social Management Plan (ESMP) that will be discussed with Tullow's contractor(s) before they mobilise to the field. The purpose of this discussion will be to indicate Tullow's expectations from an environmental and social perspective and discuss and agree roles and responsibilities associated with the ESMP. During the completion of the EWT project, Tullow will also undertake a series of audits and inspections. Any corrective actions identified will be immediately recorded and written notices will be issued to the relevant contractors, supplemented by additional checks.

## Acronyms

Terminology	Description
<b>AoI</b>	Area of influence
<b>bbls/d</b>	Barrels per day
<b>BOPD</b>	Barrels of oil per day
<b>CR</b>	Critically endangered
<b>EN</b>	Endangered
<b>EPR</b>	Environmental Project Report
<b>EPR</b>	Environmental Project Report
<b>ESIA</b>	Environmental and Social Impact Assessment
<b>ESMP</b>	Environmental and Social Management Plan
<b>ESMS</b>	Environmental and Social Management System
<b>EWT</b>	Extended Well Test
<b>EWT</b>	Extended Well Test
<b>FSEO</b>	Field Stakeholder Engagement Officers
<b>GIIP</b>	Good International Industry Practice
<b>GO</b>	Governmental Organisation
<b>GoK</b>	Government of Kenya
<b>GOR</b>	Gas-oil ratio
<b>KTL</b>	Kurrent Technologies Ltd.
<b>Lokichar Basin Development</b>	Wider appraisal and development activities planned by Tullow in the South Lokichar Basin, Block 10BB and 13T
<b>Lokichar Cluster</b>	Oil and gas development fields
<b>mmscfd</b>	Million standard cubic feet per day
<b>Mol%</b>	Molar percentage
<b>NEMA</b>	National Environmental Management Authority
<b>NGO</b>	Non-Governmental Organisation
<b>scf/stb</b>	Standard cubic feet per standard barrel
<b>sq km</b>	Square kilometre
<b>WRMA</b>	Water Resource Management Authority

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## **3 Introduction**

### **3.1 Overview**

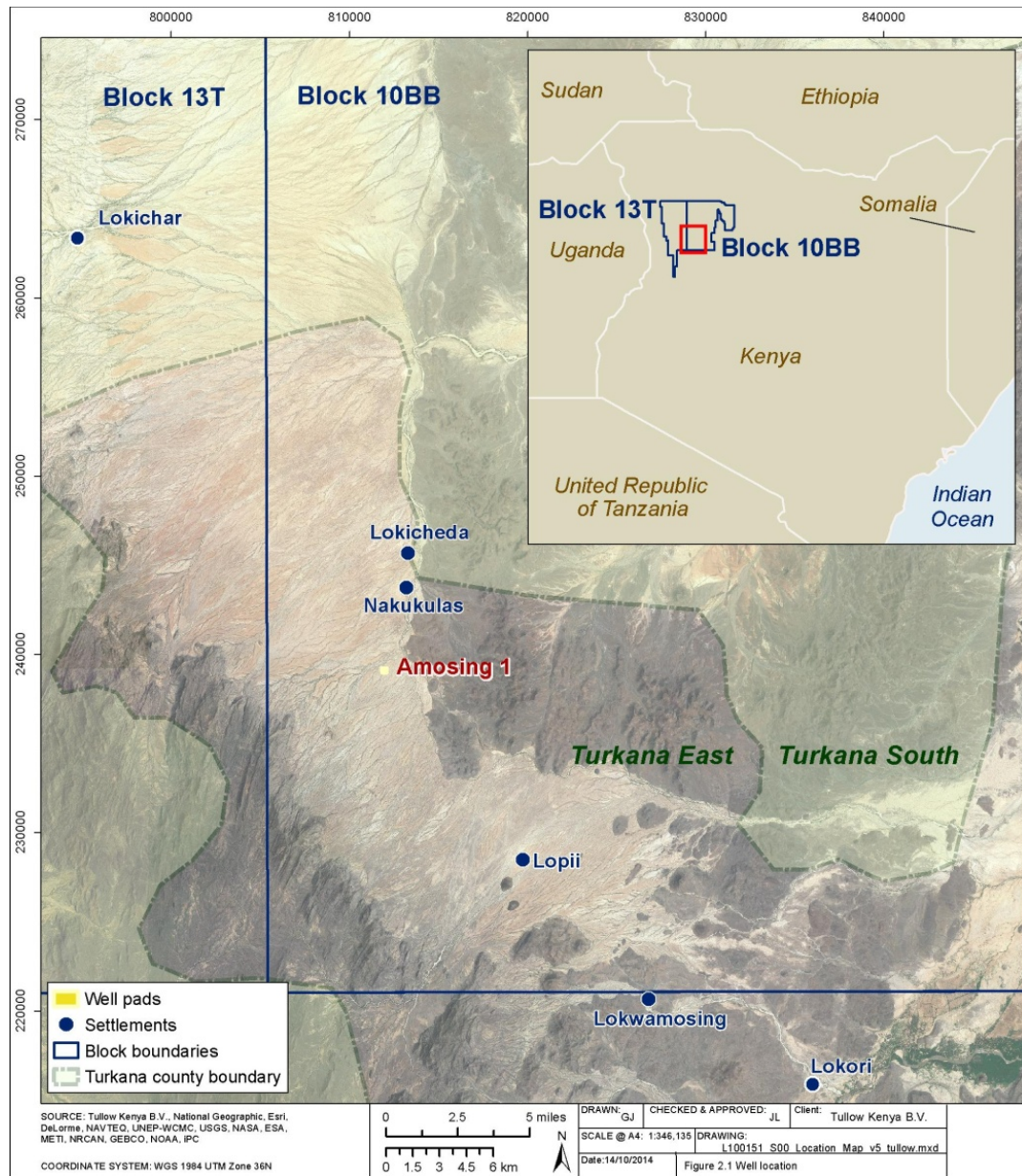
Tullow Kenya B.V. (hereafter referred to as 'Tullow') has interests in five onshore exploration block licence areas in the East African Rift Basin of Kenya, covering c.67000 km<sup>2</sup>. As part of the proposed development of Block 10BB, Tullow wishes to complete an Extended Well Test (EWT) at the Amosing-1 well-site, located to the south of the town of Lokichar (see Figure 1 below). The coordinates for the existing Amosing-1 well pad are 2° 9' 38.05" N; 35° 48' 15.569" E and this is the first well that Tullow wishes to progress from exploration to appraisal within the South Lokichar Basin.

Following discussion with NEMA (August 12th 2014), it was agreed that due to the limited scope and localised scale of the EWT activities an Environmental Project Report (EPR) could be prepared, in accordance with Part II, Section 7 of the Environmental (Impact Assessment and Audit) Regulations, 2003. On this basis, Tullow have prepared an EPR as a single submission to NEMA in support of the change of land use. In accordance with the Environmental Management and Coordination Act 1999, Tullow has commissioned local environmental consultants, Kurrent Technologies Ltd. (KTL) (NEMA Reg. No. 0191 as a 'Lead Firm'), to prepare the EPR.

### **3.2 Project Purpose**

The purpose of the project is to appraise the hydrocarbon reservoir using the existing Amosing-1 petroleum well to obtain more information on reservoir characteristics, and assist in identifying the optimum method that can be used to recover the oil. Up to 1,500 bbls of reservoir fluids will be flowed per day, from Amosing-1 to allow observations to be made of reservoir characteristics during testing. In addition, EWT activities will also involve the completion of an injectivity test where water is reinjected back into the hydrocarbon reservoir.

Figure 1: Location of the Project site



### 3.3 Project Summary and Scope of the EPR

The activities assessed in this EPR are specifically associated with the change of use for the existing well pad at Amosing-1 from exploration to appraisal. EWT activities are expected to start during Q1 2015. A summary of project activities is provided below:

**Site modification** - minor site modifications are required within the existing boundary of the well pad, including early civil works and construction of crude oil storage tanks;

**Installation and operation of EWT equipment** – this includes the following:

- Installation of a single separator to separate reservoir fluids into gas, crude oil, and produced water;
- The flaring of associated gas to the atmosphere (no crude oil will be flared); and
- The storage of crude oil and produced water using steel tanks;
- Reinjection of produced water, potentially mixed with freshwater, on completion of EWT activities to test injectivity of the reservoir; and
- Either reinjection of crude oil back into the reservoir, or the storage of crude until it can be exported in the future.

**Supporting facilities** – the use of existing worker accommodation camps, use of existing groundwater boreholes and use of existing waste management facilities.

**Use of the public road network** – to transport workers, equipment and other materials required for the project.

**Site closure** – after the EWT is complete the equipment used for the test will be removed. The steel tanks used for the storage of crude oil (if this option is selected) will be positioned within the existing boundary and no additional land is required.

The construction of the Amosing-1 well pad, drilling of the wells, associated access roads, the camp facilities at Ngamia-1 and (future) site decommissioning and reinstatement following well closure have already been permitted in the Environmental Impact Assessment (EIA) of the proposed exploratory Well Drilling in Block 10BB, Turkana South and Turkana Central Counties by Africa Oil Kenya BV, October 2010 (License no. PR 7764 / 0001253 expiring 11 May 2015).

The abstraction of groundwater from existing boreholes for Tullow's activities (including the EWT) has already been approved by the Water Resource Management Authority (WRMA) under an existing permit to abstract / use WRMA Form 010 as per Environmental Management and Coordination (Water Quality) Regulations (2006).

## **3.4 EPR Process**

### **3.4.1 Aims and objectives**

The aim of the EPR is to identify the areas of the project where significant environmental and social affects may occur, and to identify mitigation measures that reduce the probability and/or severity of these affects.

The objectives of the EPR process are to:

Identify potential environmental and social risks and impacts associated with the EWT;

Integrate environmental and social considerations into project planning and design activities, in order to achieve a high standard of environmental and social performance during project implementation; and

Consult with stakeholders at an early stage of preparing the EPR.

### **3.4.2 Environmental and social data sources**

As part of Tullow's ongoing exploration activities, a significant amount of environmental and social data has been collected from various field studies and publicly held sources and this information was used during preparation of the EPR. Two field visits were also undertaken (14 to 21 July 2014 and 02 to 03 September 2014) to check the reliability of existing data and gather additional information in the field.

### **3.4.3 EPR study team**

Table 1-1 identifies the core EPR team. Curricula vitae for these staff are attached in Appendix A. The NEMA registration certificates and practicing licenses for the EPR team are presented in Appendix B.

**Table 1: EPR key team members**

Name	Company	Role	Qualifications	Years of Experience
<b>Sanjay Gandhi</b> (registered with NEMA to submit EPRs and EIAs).	KTL	EPR Team Lead	Bsc Hons Civil Engineering	25
<b>Gideon Owaga</b>	KTL	Sociologist	BA. Sociology and Public Administration, MA Rural Sociology and Community Development,	4

### 3.5 Report Structure

The structure of the EPR is summarised below:

- Section 1: Introduction
- Section 2: Legislation and Policy Framework
- Section 3: The Project
- Section 4: EPR Process (& Methodology)
- Section 5: Analysis of Alternatives
- Section 6: Environmental and Social Baseline
- Section 7: Stakeholder Engagement
- Section 8: Impact Assessment
- Section 9: Environmental & Social Management Plan
- Section 10: Conclusions
- References

Appendices:

- Appendix A: Environmental Project Report team CVs
- Appendix B: NEMA certificates

## 4 Legislation and Policy Framework

### 4.1 Introduction

The purpose of this section is to present the applicable regulatory and legislative framework that is relevant to the project.

### 4.2 National

#### 4.2.1 National regulatory authorities

The key national regulatory authorities involved in permitting and environmental management of the oil and gas in Kenya are outlined below:

- **Ministry of Energy and Petroleum (MoEP):** is the government ministry responsible for facilitating the provision of clean, secure, sustainable and affordable energy services for social-economic development while protecting the environment. The technical department relevant to the Project is the Petroleum Energy Department (PED). The PED is mandated to carry out exploration for oil and gas within Kenya.
- **Ministry of Environment, Water and Natural Resources (MEWNR):** is the government ministry responsible for the governance for sustainable use of natural resources in order to secure livelihoods and economic prosperity. The Ministry is composed of four technical departments (Mines and Geology, Resource Survey and Remote Sensing, Meteorology, and Environment) as well as one major parastatal – the National Environment Management Authority (NEMA). The Directorate of Environment is responsible for the overall coordination of environment and is involved in policy formulation, development and advice on environmental matters in the Ministry.
- **National Environmental Management Authority (NEMA):** is the government lead agency focused on implementing the Environmental Management and Coordination Act (EMCA) enacted in 1999.
- **WRMA:** is a state corporation charged with being the lead agency in water resources management in Kenya. In order for WRMA to undertake its stipulated responsibilities, the Water Act (2002) provides for decentralised and stakeholder involvement; implemented through regional offices of the Authority based on drainage basins (catchment areas) assisted by Catchment Area Advisory Committees (CAACs).

#### 4.2.2 Constitution, national policies, strategies and action plans

The Kenyan legal hierarchy comprises the Constitution, National Policies, international treaties and agreements, primary legislation (laws and acts / bills) and subsidiary legislation (such as notices, rules and orders).

The **2010 Constitution** enhanced protection and enforcement of fundamental rights and established a two-tier structure of government through the National and County Governments. The re-distribution of the functions and powers between the two levels has resulted in differences in approaches between the Constitution and national legislation that has necessitated the review and update of national policies for the oil and gas and energy sector, and additional environmental legislation.

The relevant key national policies, strategies and action plans that are relevant to this project include the following:

- **Kenya Vision 2030:** the current national development blueprint for the period 2008 to 2030. The objective of Vision 2030 is to transform Kenya into a middle income country with a consistent annual growth of “10 % by the year 2030”. One of the aims of the vision is to make Kenya a nation that has a clean, secure and sustainable environment by 2030. This will be achieved through promoting environmental conservation to better support the economic pillar. Improving pollution and waste management through the application of the right economic incentives in development initiatives has also been raised as being critical to Vision 2030.
- **Sessional Paper No. 6 of 1999 on Environment and Sustainable Development:** established to aid in ensuring that development policies, programmes and projects take environmental considerations into account; that an independent EIA Report is prepared for any development before implementation; and that effluent treatment standards conform to acceptable health standards (this is replaced by the National Environmental Policy 2013).
- **National Environmental Policy 2013:** aims to achieve a better quality of life for present and future generations through sustainable management and the use of the environment and natural resources. The policy focuses on providing a framework for an integrated approach to planning and sustainable management whilst promoting research and capacity development through the use of innovative environmental management tools. In particular, it sets out important provisions relating to the management of ecosystems and the sustainable use of natural resources, recognising that natural systems are under intense pressure from human activities particularly for critical ecosystems including forests, grasslands and arid and semi-arid lands;

the Lokichar Basin falls into the arid and semi-arid lands (ASAL) category.

- **National Policy on Water Resources Management and Development (Sessional Paper No.1 of 1999):** established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way.
- **National Water Policy, 2012:** developed in line with the mandate, vision and mission of the ministry responsible for water affairs in Kenya. In essence the Policy is built on the achievements of the sector reform commenced with the Water Act 2002 and based on the sector principles outlined in the National Water Policy 1999. In order to address the goals of Vision 2030 and take account of the effects of climate change and other factors, a National Water Master Plan 2030 is being developed.
- **National Environment Action Plan (NEAP) 2007:** provides a framework for the implementation of the Environment Policy and realisation of the National Millennium Development Goals and Vision 2030. It outlines methods to combat climate change including mitigation and adaptation, improving inter-sectoral coordination, mainstreaming sustainable land management into national planning, policy and legal frameworks and undertaking research on the impact of climate change on environmental, social and economic sectors.
- **Draft National Energy Policy (February 2014):** sets out the national policies and strategies for the energy sector that are aligned to the new Constitution and in tandem with Vision 2030.

#### 4.2.3 National legislative framework

A summary of Kenya's environmental and social legislation and guidelines, as of June 2014, that are relevant to the Project is presented in Table 2.

**Table 2: Summary of relevant legislation and guidelines**

Legislation	Summary
<b><i>Oil &amp; Gas / Energy</i></b>	
<b>Petroleum (Exploration and Production) Act, 1986</b>	Provides regulations on petroleum agreements relating to the exploration for, development, production and transportation of, petroleum and for connected purposes.
<b>Petroleum Development</b>	Established a Petroleum Development Fund and the

Legislation	Summary
<b>Fund Act, 1991</b>	imposition of a petroleum development levy and for connected purposes.
<b><i>Environment</i></b>	
<b>Environmental Management and Coordination Act (EMCA), 1999</b>	Provides an appropriate legal and institutional framework for the management of the environment and for the matters connected directly or indirectly. EMCA makes it a mandatory requirement for an EIA study for certain activities (defined in list in the Second Schedule) to be carried out by proponents and for NEMA licensing of the EIA – see below. Operators of projects are then to carry out Environmental Audits in order to determine the level of conformance with commitments in the EIA study and license conditions. EMCA provides for the use of international standards where no national equivalents exist.
<b>Environmental (Impact Assessment and Audit) Regulations, 2003</b>	Includes the procedure for conducting EIA/ESIA studies by detailing the parameters to be evaluated during the study. It also provides guidelines on the payment of the EIA license fees, procedures for environmental audits and development of environmental monitoring plans.
<b>Environmental Management and Coordination (Water Quality) Regulations, 2006</b>	Includes permitting schemes for ‘domestic use’ and effluent disposal in relation to the following: Protection of sources of water for domestic use; Water for industrial use and effluent discharge; and Water for agricultural use. Water abstraction and use involves a 2-stage process, comprising a permit to construct works followed by a permit to abstract / use subject to all construction permit conditions being fulfilled.
<b>Environmental Management and Coordination (Noise and Excessive Vibrations)(Control) Regulations, 2009</b>	Applies to the operation of equipment or machinery and engagement in commercial or industrial activity that is likely to emit noise or excessive vibrations. The regulations set out requirements in regards to the following: Prohibition of excessive noise and vibration; Provisions relating to noise from certain sources; Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations; and Noise and excessive vibrations mapping.
<b>Environmental Management and Coordination (Waste Management)</b>	Includes regulations on the permitting of waste transport and waste management activities in regards to: Domestic wastes; Industrial wastes; Hazardous and

Legislation	Summary
<b>Regulations, 2006</b>	toxic wastes; Pesticides and toxic substances; Biomedical wastes; and Radio-active substances. The Third Schedule sets out standards, guidelines and procedures for incinerators.
<b>Wildlife Conservation and Management Act, 2013</b>	Includes the Red List of protected and endangered species within Kenya.
<b>Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006</b>	Includes regulations on: engagement in activities with an adverse impact on any ecosystem; introduction of any exotic species; and unsustainable use of natural resources.
<b>Land Act, 2012</b>	Consolidates and rationalises land laws to provide for the sustainable administration and management of land and land based resources. (NB: a draft Community Lands Bill is being formulated currently).
<b>Water</b>	
<b>Water Act, 2002</b>	Provides for the conservation and controlled use of water resources in Kenya.
<b>Water Resources Management Rules, 2007</b>	These Rules implement provisions of the Water Act, 2002, and apply to all policies, plans, programmes and activities to which the Act applies. They stipulate requirements for amongst others: water course designation, public notification and consultation; release and use of stored water; groundwater development authorisation; and regulation of groundwater development.
<b>Social</b>	
<b>Occupational Safety and Health Act, 2007 (OSHA)</b>	Makes provisions for the health, safety and welfare to be observed by employers and persons employed in places of work. Its scope has been expanded through amendments to cover all workplaces including offices, schools, academic institutions, factories, and plantations. It also establishes codes of practices approved and issued by Directorate of Occupational Safety and Health Services (DOSHS) which regulates OHS performance.
<b>Work Injury Benefit Act, 2007 (WIBA)</b>	Provides for compensation for employees on work related injuries and diseases contacted in the course

Legislation	Summary
	of employment and for connected purposes. The act includes compulsory insurance for employees.
<b>Public Health Act (Cap 242)</b>	States that no person shall cause nuisance or condition liable to be injurious or dangerous to human health.
<b>Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005</b>	Provides statutory guidelines for the enforcement for occupational noise within workplaces.
<b>Employment Act, 2007</b>	Defines the fundamental rights of employees, to provide basic conditions of employment of employees, and to regulate compliance.

#### 4.2.4 International protocols, agreements and treaties

Table 2 identifies relevant international environmental and social development agreements to which Kenya is a party. Kenya is also a signatory to a range of International Labour Organisation Fundamental (and other) Conventions which are summarised in Table 3 and 4.

**Table 3: International environmental agreements relevant to Kenya**

Issue	Convention and Objective	Summary	Kenyan Status
Biodiversity	<u>International Plant Protection Convention - new revised text approved by Resolution 12/97 of the 29th Session of the FAO Conference in November 1997 – Declaration</u>	To prevent the spread and introduction of pests of plants and plant products and to promote measures for their control.	Multilateral
	<u>Convention on Biological Diversity</u>	To ensure the conservation of biological diversity; the sustainable use of its components and the fair and equitable sharing of the benefits.	Multilateral
	<u>Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)</u>	To protect migratory species of wild animals and their habitat.	Multilateral
	Convention on	To ensure that	Multilateral

Issue	Convention and Objective	Summary	Kenyan Status
	International Trade in Endangered Species of Wild Flora and Fauna	international trade in specimens of wild animals and plants does not threaten their survival.	
Climate Change	<u>Kyoto Protocol to the UN Framework Convention on Climate Change</u>	To reduce or limit the emission of gases contributing to the "greenhouse effect" and causing climate change in the industrialised countries	Multilateral
	<u>United Nations Framework Convention on Climate Change</u>	To achieve stabilisation of greenhouse gas concentrations.	Multilateral
Cultural	UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage	To ensure that effective and active measures are taken for the protection, conservation and presentation of the "cultural and natural heritage" on its territories.	Multilateral
	UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage	To safeguard and ensure respect for the world's Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.	Multilateral
Democracy	<u>Partnership agreement between the members of the African, Caribbean and Pacific (ACP) Group of States of the one part, and the European Community and its Member States, of the other part, signed in</u>	To promote and expedite economic growth with a view to contributing to peace and security and to promoting a stable and democratic political environment.	Multilateral

Issue	Convention and Objective	Summary	Kenyan Status
	<u>Cotonou on 23 June 2000 - Protocols - Final Act - Declarations</u>		
Desertification	<u>United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa</u>	To combat desertification and mitigate the effects of drought with a view to achieving sustainable development.	Multilateral
Ozone	<u>Amendment to the Montreal Protocol on substances that deplete the ozone layer, adopted at the ninth meeting of the Parties</u>	To ensure effective protection of the ozone layer by regulating trade in substances that depletes it.	Multilateral
Waste	<u>Basel Convention on the control of transboundary movements of hazardous wastes and their disposal</u>	To lay down obligations with regard to ensuring that the transboundary movement of wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes.	Multilateral

**Table 4: International Labour Organisation (ILO) Fundamental and other conventions**

Issue	Convention	Summary	How applied in Kenya
Women's Rights	International Labour Organisation (ILO) Convention No. 89 on Women's Rights and Working Conditions	These conventions set out basic principles and rights at work in regard to gender equality	The principles and rights set out in these Conventions are generally adopted in the 2010 Constitution and in Kenya's Employment Law, 2007, plus the Industrial Relations Act, 2007, the Workers' Injury Benefit Act, 2007; and the Occupational Safety and Health Act, 2007.
	ILO Discrimination (Employment and Occupation) Convention 1958 (No. 111)		
	United Nations Convention on the Elimination of all Forms of Discrimination Against Women		
	ILO Worst Forms of Child Labour Convention, 1999 (No. 182)		
	ILO Child Rights and Working Conditions Convention No. 90		
	ILO Forced Labour Convention, 1930 (no. 29)		
	ILO Abolition of Forced Labour Convention, 1957 (No. 105)		
Labour Rights	ILO Right to Organize and Collective Bargaining Convention, 1949 (No. 98)	These conventions set out basic principles and rights at work in regard to representation	
	ILO Freedom of Association and Protection of the Right to Organize Convention, 1948 (no. 87)* <sup>1</sup>		
Occupational Health and Safety	ILO Occupational Safety and Health Convention, 1981 (No. 155)	These conventions set out basic principles and rights at work in regard to workplace health and safety management	

### 4.3 Tullow Oil Policies and Standards

Tullow is committed to completing the project in accordance with applicable company policies, national legislation, international treaties and protocols.

<sup>1</sup> Kenya has not ratified the Freedom of Association and Protection of the Right to Organize Convention, 1948 (no.87).

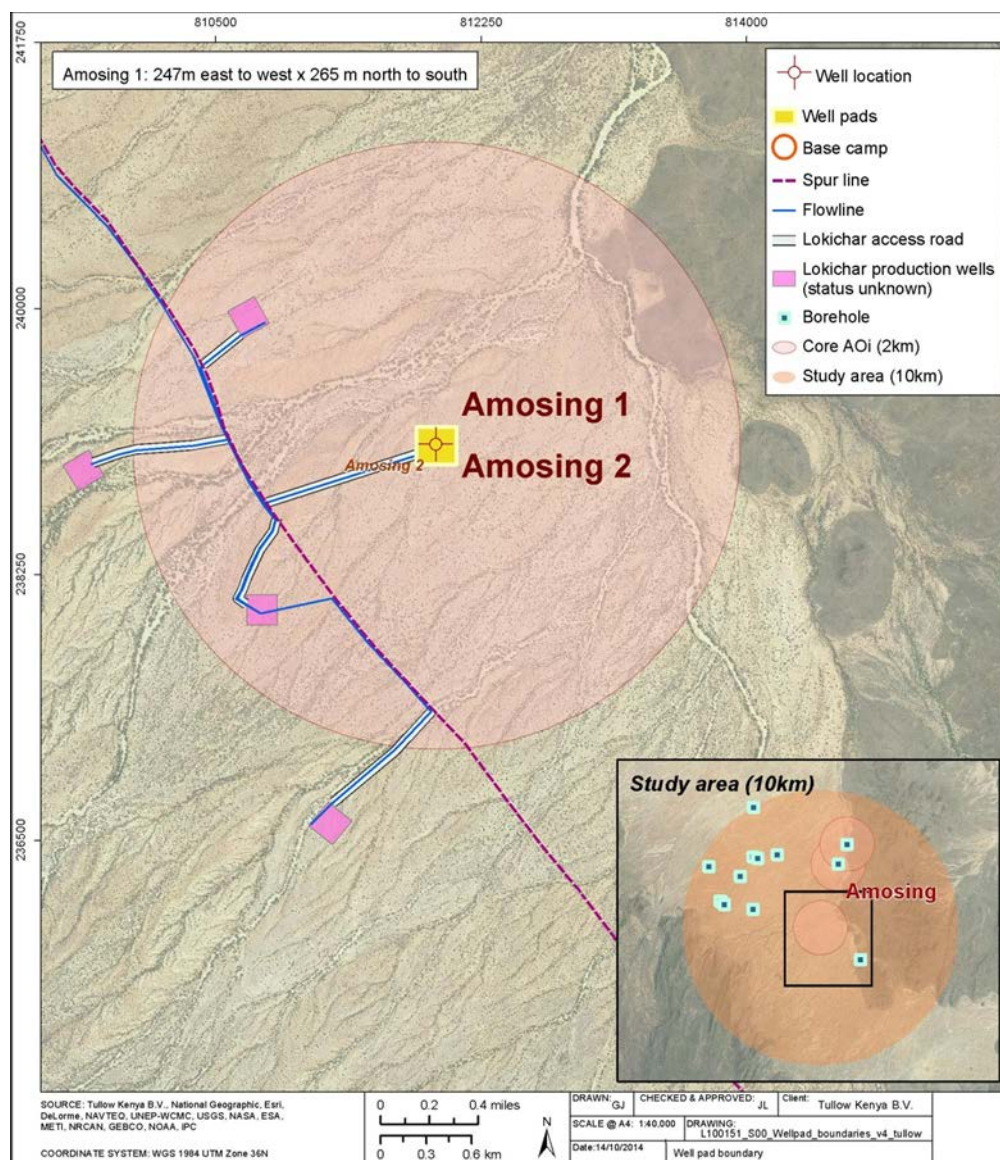


## 5 The Project

### 5.1 Project Location

The Amosing-1 well site, located within Block 10BB in the Turkana South County of Northwest Kenya, is 30 km south- southeast of Lokichar (see Figure 1-1). The coordinates for Amosing-1 well pad are 2° 9' 38.05" N; 35° 48' 15.569" E. A location map of the EWT well site is shown in Figure 2.

**Figure 2: EWT site and surrounding boreholes**

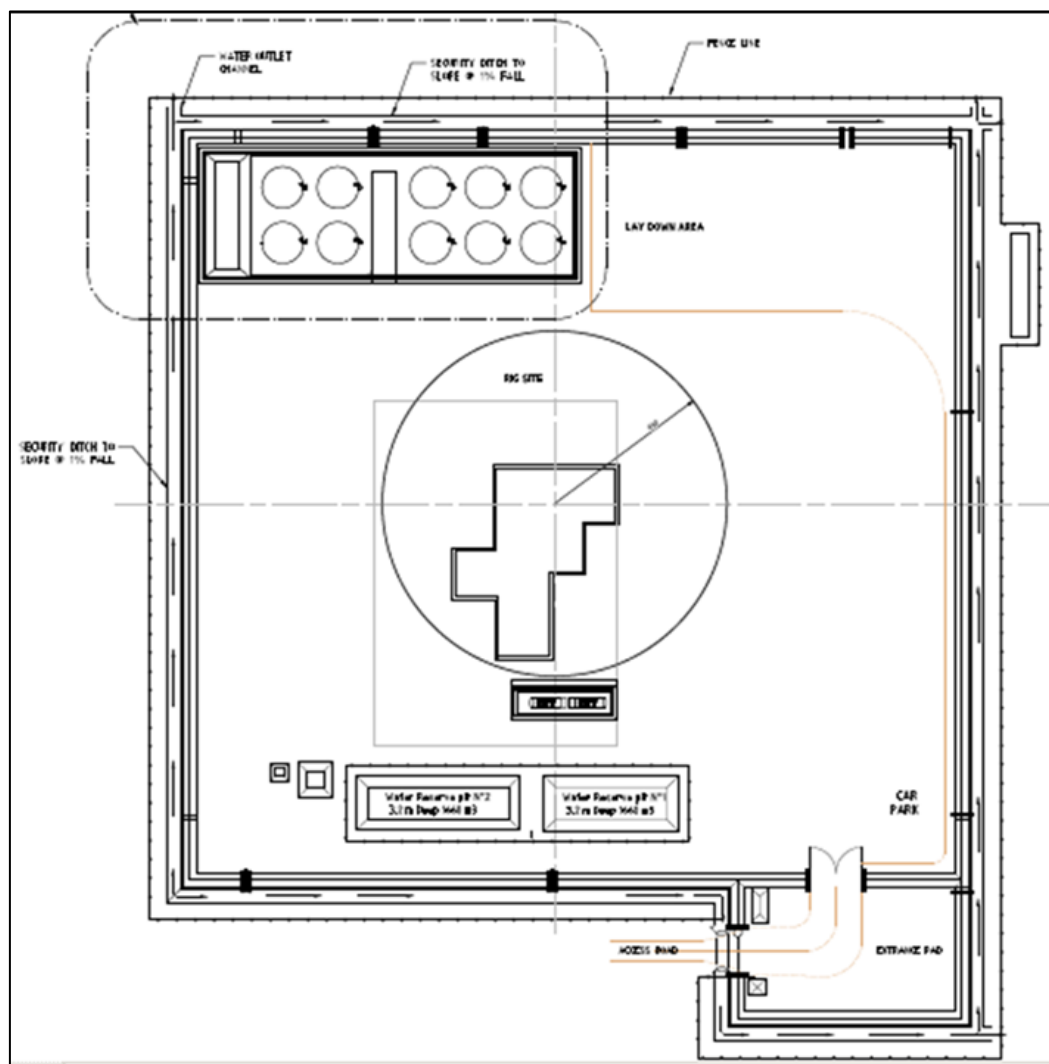


## 5.2 Site Overview

### 5.2.1 Site layout

The proposed revised layout of the Amosing-1 well pad is illustrated in Figure 3. The existing well pad footprint (the site boundary) is 247m x 265m which will not be altered.

**Figure 3 : Amosing-1 well site revised layout**



### 5.2.2 Site preparation and EWT installation

Minor civil construction works will be required within the existing well site for the construction of a lined, dyke earthen bund to contain the oil storage tanks. The existing drilling water pit at Amosing-1 is adequate to accommodate the anticipated 2,385 cubic metres of produced water that is expected to be generated.

### 5.2.3 Crude tank farm installation

Within the existing well pad, a crude tank farm consisting of 10 to 12 vertical cylindrical low pressure storage tanks will be installed. The volume of each individual tank is 5,000 bbls (11.80 x 7.36 metres). The maximum vertical height of the each tank assuming a roof slope of 1:12 plus PVV valve vent pipe, is 9.1 m above grade. Each tank will be constructed in compliance with the appropriate international standards for vertical cylindrical low pressure storage tanks (API 12 Series Tank - Specification API Spec 12B). A lined earthen bund will be constructed to contain the crude storage tanks. The bunds will be designed to accommodate the 10 to 12 tanks, totalling c. 4,000 sq metres (80 x 50 metres) within the existing site perimeter. Bunding will be undertaken in accordance with API RP 12R2 Practise for Setting, Maintenance, Inspection, Operation and Repair of Tanks in Production Service. This includes a requirement for the bund to:

Contain, at a minimum, the volume of the largest tank enclosed plus an allowance for rainwater (nominally 10 % additional tank volume, i.e. 5,000 bbl x 1.1 = 5,500 bbls = 870 m<sup>3</sup>);

Be impervious to effectively contain any spilled oil;

Have a sloped base to drain rainwater water away the tanks;

Have a tank foundation or grade band (steel band to contain a suitable backfill material like sand or pea gravel for an unanchored tank) that will be slightly elevated, level, and larger in diameter than the tank itself, with the surrounding area graded to provide good drainage away from the tanks;

The grade band foundation will be one to one-and-one-half feet larger in radius than the diameter of the tank and may be embedded in the soil. The grade band and fill shall be level within  $\pm\frac{1}{4}$  inch. The grade band will be anchored in place with stakes and backfilled, but the tank is unanchored and will have a grade band type foundation (a steel band used to contain a suitable backfill material like sand or pea gravel for an unanchored tank);

Have a pipe drain, if required, at the lowest point to permit draining any accumulations of storm water and a locked-closed valve outside the drainage area to ensure proper containment and control of fluids other than storm water;

Be designed to drain the oil away from the tanks to a perimeter ditch or sump in the event of a tank failure. In the event of a tank fire and subsequent tank rupture, the oil will be drained away from the adjacent tanks, reducing the risk of a cascade of tank failures; and

Storm water will be able to be collected in bunds and allowed to evaporate - any residual water will be analysed and treated to national environmental standards prior to release.

#### **5.2.4 Tank venting**

Pressure Vacuum Vent (PVV) valves (Motherwell Tank Protection Fig 383 PVV valve (8" Inlet)) will be fitted to the roof of each tank (approximately 7.6 m above grade). The valve will have a short (c. 1.5 m) vertical discharge from the valve, giving a total elevation of 9.1 m above grade. The valve will not be a continuous vent.

#### **5.2.5 EWT equipment**

All of the EWT equipment will be transported to the site using road vehicles and will include steel tank components for on-site construction, separators, heaters, pumps and eight climate-controlled containers for office space, material storage, laboratory equipment, generators and air compressors. All air compressors will be stored within acoustically enclosed containers. Once the EWT is complete, the equipment will be removed. The containers are used (expected to comprise 10 to 12) to transport equipment to the site will be positioned within the existing site boundary. No additional land will be required.

Up to eight diesel-powered generators will be used to provide electricity to the EWT equipment.

The following equipment will be installed above ground:

Crude oil storage tanks: the max height to top of the PVV line will extend 30 ft or 9.1 metres above grade;

Separator/stabilisation tank: a nominal 65,000 LTR tank will have the dimensions of 40ft x 8ft x 9ft 6" or 12.2 x 2.4 x 2.7 metres; and

Hydraulic rod pump: a vertical hydraulic ram mounted on the wellhead and a hydraulic power pack. The top of the ram is circa 10.67 – 12.2 metres from grade.

### 5.3 Completion of EWT activities

The testing of the well will last approximately 60 days. The predicted gas-oil ratio (GOR) is between 300 and 70 scf/stb, and the predicted produced water cut is 0 to 30%, resulting in the following generated at the surface each day:

Crude oil: 500 to 1,500 bopd; and

Associated gas: up to 0.5 to 1mmscfd; and

Produced water: Up to 400bbls/d.

During testing, crude oil will be pumped using a downhole pump through a flowline into a heat exchanger, connected to a separator/stabilisation tank where the oil is stabilised, degassed and free water separated, and then transferred (by flowline) into a nearby storage tank.

#### 5.3.1 Flaring

Crude oil will not be flared. Associated gas will be separated from reservoir fluids and flared. Gas volumes are expected to be minimal and due to the low volume of gas expected, it is not possible to use the gas for another use such as power generation.

Associated gas will primarily be Methane (approx. 70-80 mol%) with the remainder being mainly ethane and a smaller percentage of propane. The gas has no H<sub>2</sub>S or CO<sub>2</sub> present. The temperature of the gas at the flare tip is anticipated to be between 50°C and 75°C, depending on the depth of the hydrocarbon reservoir zone being tested.

The flare will comprise a horizontal pipe that leads to a ground flare pit. The flare line will be placed above the ground and the pit will have sloping earthen sides. The maximum and minimum gas flare volumes are 0.36 MMscf/d to 0.01 MMscf/d.

#### 5.3.2 Produced water storage, reinjection and the use of chemicals

Produced water from the separator will be transferred into existing, lined pits located within the existing well pad. The produced water pits will be dosed with a biocide to prevent bacterial growth.

Produced water will be re-injected back into the reservoir either using the Amosing-1 well, or another existing well within the Lokichar field. The purpose of the reinjection is to check the overall injectivity of geological formations. Prior to reinjection, produced water will be treated with demulsifier, scale inhibitor, an oxygen scavenge. Depending upon the total volume of produced water generated, additional water may be required for the injectivity test and this additional will be abstracted from nearby existing boreholes.

### 5.3.3 Crude storage, reinjection and disposal

#### *Storage volumes*

The maximum oil storage on Amosing-1 will be 50,000 bbls.

#### *Reinjection of crude*

After the EWT is complete crude oil will either be reinjected back into the hydrocarbon reservoir using the Amosing-1 well, or temporarily stored until the oil can be exported as part of the wider Phase 1 South Lokichar Basin Development Project. The preferred option is to reinject the crude oil. Due to the waxy characteristics of the crude, the oil will need to be heated above ambient temperature to reduce the viscosity enough to be transferrable. The oil will be transferred in batches of approximately 350 bbls to smaller “re-heat” tanks to raise oil temperature above 85°C until all the wax is back in solution, before being pumped.

The alternative is to continue to store crude oil temporarily in the steel tanks until oil can be exported as part of the future Phase 1 South Lokichar Basin Development Project. The export of crude oil generated from the EWT will be covered in a separate EPR, or Environmental and Social Impact Assessment (ESIA).

## 5.4 Decommissioning

Tullow will, in the future, develop a full decommissioning plan in compliance with NEMA requirements. Under the relevant primary legislation, Tullow must submit the decommissioning plan for approval to NEMA in respect of the EWT works within 14 days of commencing the decommissioning of the EWT and appraisal activities.

## 5.5 EWT Personnel

Due to the short-term duration of the project and nature of EWT activities which requires skilled personnel, no additional recruitment by Tullow’s contractors will be required. The estimated personnel numbers are presented in Table 5.

**Table 5: Etsniated EWT personnel**

Phase	Details	Additional number of people on site
<b>Civil Works during site preparation</b>	The existing civil contractors in the field will carry out the minor earth work modification within the site which will be completed before tank construction crews arrive on site.	None – as the 15 unskilled workers needed for civil works will already be on site as part of the existing Civil contractors in the field.
<b>Tank Erecting/ Manifolds (Essentially Construction)</b>	This is a sequential task and overlaps with EWT flow / Injection activities.	2 crews of 8 skilled persons
<b>Operations</b>	Well testing activities	Approximately 10 day shift / 6 night shift skilled personnel (plus additional personnel for monitoring).

## 5.6 Camp Facilities

A series of mobile containers will be located within the well pad to provide office, workshop, laboratory and storage facilities. Additional personnel will be accommodated at the existing accommodation facilities at the Ngamia-1 well-site. No additional camp facilities are required for the EWT.

## 5.7 Waste Management

### 5.7.1 Waste streams

Tullow's existing facilities at Ngamia-1 will be used to support the EWT and camp waste management. Waste will be managed in accordance with Tullow's existing procedures. The EWT project is estimated to generate the following types of waste streams:

- **Produced water** – All produced water will be reinjected.
- **Construction debris** – Minor volumes of packaging materials will be generated and transported by road to Tullow's existing facilities.
- **Wastewater** – All wastewater from washing/toilets will be transferred to existing cesspits/septic tanks.
- **Hazardous waste** – Hazardous waste generated will be transported by road to Tullow's existing facilities.

- **Municipal waste from use of camps** – Municipal waste generated will be transported by road to Tullow's existing facilities.

## 5.8 Water Requirements

A summary of the maximum amount of freshwater required is provided below:

A maximum quantity of 2,385 m<sup>3</sup> of water is required for the injectivity test. The amount of freshwater used will be reduced by mixing produced water generated by the EWT with the freshwater, so that the minimum volume of freshwater is used.

An estimated volume of 100litres/day/person is assumed for the 16 personnel on site which will generate a total demand of 1,600 litres/day.

Boreholes that have been identified as potential water sources include the Nakukulas-9 and Nakukulas-10 (sometimes referred to as Ngamia-9 and Ngamia-10) and existing buried pipelines will be used to transport water to Amosing-1.

## 5.9 Natural materials

No additional access roads or aggregate materials are required.

## 5.10 Transport

Tullow has already completed an assessment of road routes that are being used for ongoing exploration activities. The assessment identified a preferred route for EWT which passes from Mombasa through Nakuru, Eldoret, Kitale, and Lokichar en route to Lokori. This is the preferred road route, primarily because it requires no upgrades to existing road infrastructure.

EWT equipment comprises a series of modular components that are transported on haulage trucks. Approximately 65 heavy haulage trucks will be required to transport the EWT equipment between Mombasa and the well site. The laydown and final assembly of heavy EWT components will be carried out within the existing well pad perimeter. No off-road transport will be required. No additional land is required for the laydown area.

## 5.11 Non-routine scenarios

Design features that have been accommodated into the Project to reduce environmental risk associated with non-routine scenarios include the following:

**EWT equipment** - the wells to be tested are low pressure wells that require artificial lift to extract the oil from the hydrocarbon reservoir. An emergency well shutdown valve downstream of the well head will be linked to a shutdown system in the event of an emergency event.

**Storage of crude oil using tanks** – all tanks will be positioned inside a secondary bund to prevent soil and groundwater contamination arising from a failure of primary containment.

**Gas release from the flare** – A series of audible alarms will be installed to check for the presence of unignited gas. In addition, a site-specific Emergency Response Plan will be prepared which will describe actions to be taken in the event of a sudden surge in gas volume.

## 5.12 Security

The well pad perimeter features an existing security fence which will not need to be extended as part of the EWT. There is 24 hour security cover currently in place and this will continue for the duration of the EWT and thereafter, until the site is fully decommissioned.

## 6 Methodology

### 6.1 Baseline characterization

Existing environmental and social data was gathered from previous ESIA's and fieldwork to inform the baseline chapter of this report.

### 6.2 (Mini) ENVID

ENVID is a tool to identify potentially significant environmental impacts at an early stage in a project. The small scale of the EWT activities did not require an ENVID, and KTL completed an initial review of EWT activities to identify potential environmental and social risks and impacts associated with the project.

#### 6.2.1 Area of Influence

The project Aol is illustrated in Figure 4 and was informed by the following factors:

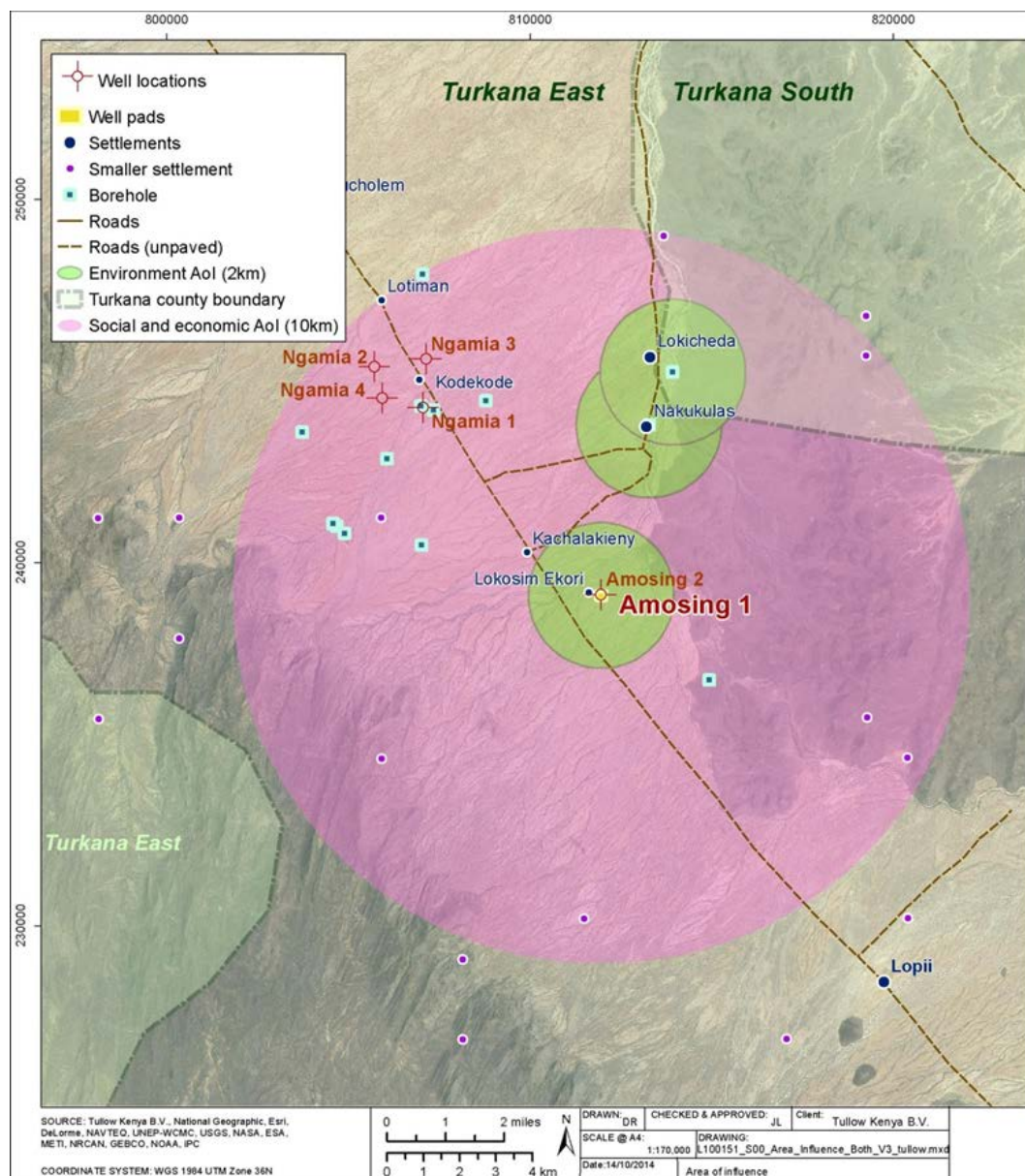
- **Environmental characteristics:** 2 km radial distance from the central point of the well pad:
  - **Air Quality:** the results of air dispersion modeling concluded that ambient air quality would return to background conditions within 300 m from the central area of the well pad.
  - **Noise:** the results of noise modeling calculated that noise levels would return to ambient conditions within 1.7 km from the central point of the well pad during night time periods, and 1.1km during day time periods.
  - **Water Quality:** the risk from seasonal flooding and potential contamination of seasonal water courses was mitigated during the construction of the original well pad by locating the well to avoid major luggas and minor surface drainage features.
  - **Location of freshwater boreholes:** a radial distance of 2km from the central point of the well pad that includes the location of two boreholes that may be used to obtain additional water for the injectivity test, namely N-9 and N-10. There are no community water points within 1 km of the well site.

Biodiversity features are not relevant to defining the Aol as the EWT project does not involve any additional land take and no impacts to biodiversity are therefore anticipated.

- **Social and Economic:** 10 km from the central point of the well pad. The rationale being as follows:
  - **Location of freshwater boreholes:** a radial distance of 6 km from the central point of the well pad that includes the location of two boreholes that may be used to obtain additional water for the injectivity test and are used by the local communities, namely N-9 and N-10. There are no community water points within 1 km of the well site.
  - Presence of nearby communities and pastoralist groups: as of September 2014 there are no permanently occupied settlements within 2 km of the Amosing-1 well site, the nearest village being Nakuklas which lies 7 km to the NE. The presence of uninhabited small seasonal manyatta and animal shelters within 2 km suggests that members of the wider community use surrounding land for pastoralist livelihoods.
  - Cultural: there are no known cultural sites within 2 km of the well pad.

Employment issues are not relevant as due to the very short timeframe and technical nature of the EWT there will be no temporary positions available to nearby communities. Land-related issues are also not important, as there will no additional land used by the Project.

**Figure 4: Boundaries of the environmental Aol (2km) and socio-economic Aol (10km)**



### 6.3 Impact Assessment Methodology

The impact assessment method adopted for the EWT Project uses a risk-based approach that considers the likelihood and consequence of environmental and social risks from occurring during the EWT Project. The likelihood of a risk occurring was assigned a factor which ranges from 1 to 5 using the descriptions given in Table 6.

**Table 6: Definition of Likelihood used in the EIA matrix**

Description	Projects	General	Factor
<b>Very unlikely</b>	Has not occurred in similar studies or projects, but could. Conceivable in extreme circumstances.	Freak combination of factors would be required for incident to occur.	<b>1</b>
<b>Unlikely</b>	Known to happen, but only rarely.	Rare combination of factors would be required for the incident to occur.	<b>2</b>
<b>Possible</b>	Incurred in a minority of similar studies or projects.	Incident could occur if a number of additional factors are present.	<b>3</b>
<b>Likely</b>	Could easily be incurred and has generally occurred in similar studies or projects.	Not certain but incident could occur with one normally occurring additional factor.	<b>4</b>
<b>Very likely</b>	Could be expected to occur more than once during the study or project delivery.	Almost inevitable that incident could occur.	<b>5</b>

The severity factor for each risk was subsequently considered using the descriptions described in Table 7. The severity reflects the expected degree of harm, injury or loss, assuming the effectiveness of existing mitigation measures in place. Where more than one affect was possible, the highest severity factor was used for the assessment.

Table 7: Severity factor used in the EPR Study

Impact Types					
Injury and disease	Environmental effects	Social / cultural heritage	Community / Government / Media / Reputation	Financial Impact	Severity Factor
<b>Low level short term subjective inconvenience or symptoms. No measureable physical effects. No medical treatment. No absence from work. May require first aid.</b>	No lasting effect. Low-level impacts on biological or physical environment. Limited damage to minimal area of low significance.	Low level social or cultural impacts. Low-level repairable damage to commonplace.	Public concern restricted to local complaints. Ongoing scrutiny/attention from regulator.	< £10k	<b>1</b>
<b>Objective but reversible disability/impairment and/or medical treatment injuries requiring hospitalisation.</b>	Minor effects on biological or physical environment. Minor short-medium term damage to small area of limited significance.	Minor medium term social impacts on local population. Minor damage to structures/items of some significance. Minor infringement of cultural heritage. Mostly repairable.	Minor, adverse local public or media attention and complaints. Significant hardship from regulator. Reputation is adversely affected with a small number of site focused people.	£10k - £100k	<b>2</b>
<b>Moderate reversible disability or impairment (&lt;30%) to one or more persons (LTIs).</b>	Moderate effects on biological or physical environment but not effecting ecosystem function. Moderate short-medium term widespread impacts (e.g. oil spill causing impacts on shoreline)	Ongoing social issues. Permanent damage to structures/items of cultural significance, or significant infringement of cultural heritage / sacred locations.	Attention from media and/or heightened concern by local community. Criticism by NGOs. Significant difficulties in gaining approvals. Environment credentials moderately affected.	£100k - £1m	<b>3</b>

Impact Types					
Injury and disease	Environmental effects	Social / cultural heritage	Community / Government / Media / Reputation	Financial Impact	Severity Factor
<b>Single fatality and/or severe irreversible disability or impairment (&gt;30%) to one or more persons.</b>	Serious environmental effects with some impairment of ecosystem function (e.g. displacement of species). Relatively widespread medium-long term impacts.	On-going serious social issues. Significant damage to structures/items of cultural significance, or significant infringement and disregard of cultural heritage.	Significant adverse national media/public/NGO attention. May lose licence to operate or not gain approval. Environment/management credentials are significantly tarnished.	£1m - £10m	<b>4</b>
<b>Short or long term health effects leading to multiple fatalities, or significant irreversible human health effects to &gt;50 persons.</b>	Very serious environmental effects with impairment of ecosystem function. Long term, widespread effects on significant environment (e.g. unique habitat, National Park)	Very serious widespread social impacts. Irreparable damage to highly valued structures/items/locations of cultural significance. Highly offensive infringements of cultural heritage.	Serious public or media outcry (international coverage). Damaging NGO campaign. Licence to operate threatened. Reputation severely tarnished. Share price may be affected.	> £10m	<b>5</b>

After the likelihood and severity factor had been identified, these were combined (refer to Figure 4-3) to identify overall impact significance. The categories of impact significance used were the following: Severe, Major, Moderate, Minor or Negligible, where: risk = likelihood factor x severity factor.

Likelihood factor	Severity factor				
	5	4	3	2	1
5	Severe (25)	Severe (20)	Major (15)	Moderate (10)	Minor (5)
4	Severe (20)	Major (16)	Major (12)	Moderate (8)	Minor (4)
3	Major (15)	Major (12)	Moderate (9)	Minor (6)	Negligible (3)
2	Moderate (10)	Moderate (8)	Minor (6)	Minor (4)	Negligible (2)
1	Minor (5)	Minor (4)	Negligible (3)	Negligible (2)	Negligible (1)

Impact significance was evaluated to determine if additional mitigation measures were required. Where additional mitigation measures were required, these were added to the impact assessment table and the significance of the residual impact was subsequently determined.

## 7 Analysis of Alternatives

This section of the EPR considers feasible alternatives including the “no development” option. As the EWT project is to be undertaken on an existing well site, there are no alternatives associated with the project’s location. The relevant alternatives to the project are as follows:

- Appraisal well selection or ‘no development’; and
- Disposal options for the crude.

### 7.1 Appraisal well selection or no development

As with the exploration phase, well site selection is based on many complex factors (e.g. surface and subsurface geology, oil chemistry, oil reserve potential, topography, communications, technical and economic cost benefit analysis, and environmental and social sensitivities). These factors were taken into consideration by Tullow when identifying which exploration well to appraise. Based upon the information available to date, Tullow identified that Amosing-1 was the most viable well site to progress to appraisal based upon results from the existing exploration campaign of Block 10BB and 13T.

The EWT is required to clarify the economic viability of oil reserves within the South Lokichar Basin and is essential to the success of the wider development project. Consequently, the ‘no development’ option is not feasible as the Government of Kenya wish to continue the development of an oil industry.

### 7.2 Disposal of Crude

A total of four different options associated with the disposal of crude were evaluated, namely:

**Option 1: Flaring of the crude** – eliminated on environmental and social grounds as flaring of the crude would generate potentially significant quantities of air emissions that are harmful to human health and the surrounding quality of the environment;

**Option 2: Immediate sale to market: either through at-gate sales or at point-of-use sales dependent on customer and destination** – eliminated as there is currently no infrastructure present, such as a crude oil pipeline for example, that will allow the crude oil to reach markets;

**Option 3: Temporary storage of crude until a market has been identified** - crude will be stored in large tanks within the existing well site and then transferred into a future oil export pipeline. This option may be used and has been included in this EPR; and

**Option 4: Reinjection on completion of the EWT** – this is Tullow's preferred option to reinject the crude using the Amosing-1 well.

In summary, options 3 and 4 will be taken forward for future discussions with the Ministry of Energy and Petroleum.

## 8 Environmental and Social Baseline

### 8.1 Physical Environment

#### 8.1.1 Seasonality and Climate Change

##### *Seasonality and rainfall*

The region is characterised by harsh climatic conditions and a bi-modal climate with two dry season (June-September, December-March) and two rain-seasons (March - May, October – November). Rainfall can be sporadic and unpredictable, occurring outside the rain-seasons (Republic of Kenya, 2002).

Official meteorological data is lacking for much of the region; long-term rain records however exist for Lodwar (which is some 100 km to the north of the project area) and Turkwel Gorge (which is 60 km southwest at a much higher altitude). Data collected at Lodwar between 1999 and 2013 indicates that rainfall is extremely variable; for example, in that period annual rainfall ranged from 75.9 mm to 417.3 mm (Kenya Meteorological Department, 2013).

Sporadic rainfall also leads to the potential for high rainfall intensities (>30 mm/hr) to fall in brief violent storms (15 to 20 minutes) resulting in flash floods, particularly in the northern sector (Republic of Kenya, 2002). The wettest 24-hour period recorded at Lodwar occurred on 2nd September 2011, when 166.6 mm of rain fell; this supports the risk of flash-flooding / flooding associated with extreme rainfall events (Kenya Meteorological Department, 2013).

Monthly rainfall also varies considerably with every month of the year experiencing zero rainfall on at least one occasion, with exception of April which had a minimum rainfall of 1.4 mm in 2009. On average, April is the wettest month and February and June, the driest (Kenya Meteorological Department, 2013). Table 8 shows the monthly totals recorded at the Lodwar meteorological station between January 2011 and June 2012.

**Table 8: Monthly rainfall totals recorded in Lodwar in 2011 and 2012**

Mon.	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
2011	0.0	0.0	58.3	16.5	0.3	3.5	19.3	0.0	134.9	50.5	96.8	1.5
2012	0.0	0.0	0.5	79.9	81.6	0.0	-	-	-	-	-	-

Source: IGAD Climate Prediction and Application Centre (2012)

### ***Temperature***

The Study Area has an average temperature range of 24 – 38 °C. During the dry seasons, temperatures vary between 26 – 40°C, and during the rainy season the range is 20 – 25 °C. The lowest temperatures are generally experienced in the months of November and December, and the highest in the months of January, March and August, and may exceed 37 °C (Republic of Kenya, 2002).

Data collected at Lodwar station between 2008 and 2013 showed that daily maximum temperatures ranged from 21.2 °C (recorded in November) to 39.9 °C (in February). Minimum daily temperature ranged from 16.5 °C (also in February) to 31.3 °C (in May) (Republic of Kenya, 2002).

### ***Sunshine hours***

Daily sunshine hours are high at 9.8 hours/day and solar radiation averages 500 cal / cm<sup>2</sup> per day (RSK, 2014).

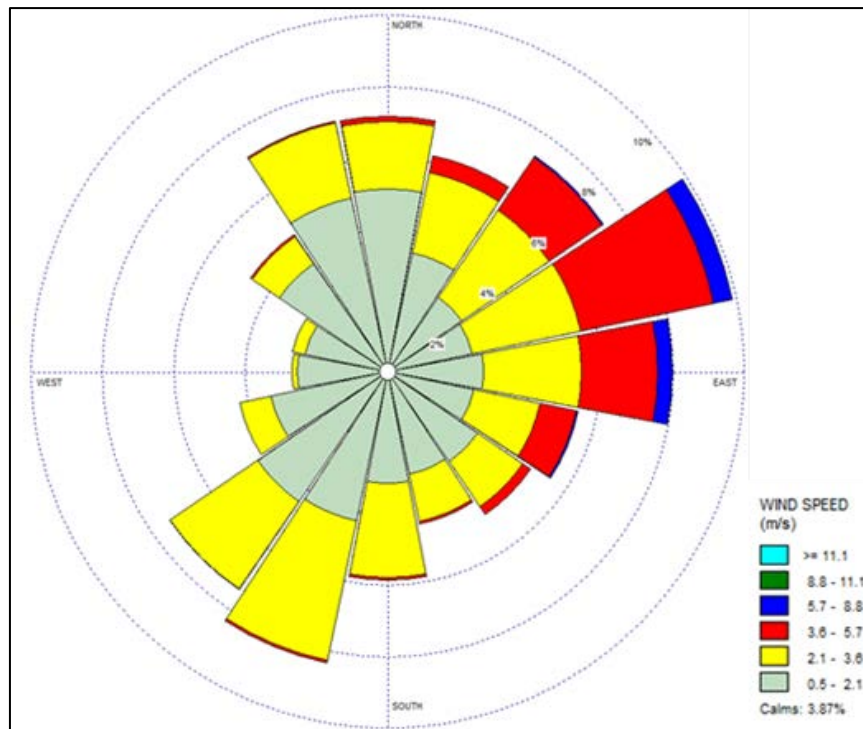
### ***Evaporation***

Strong winds and high temperatures lead to high levels of evaporation. Annual evaporation at Turkwel Gorge ranges from 2,700mm - 3,100mm, but is slightly lower at Amolem ranging from 2,100 - 2,800 mm per annum. Maximum monthly evaporation at Turkwel Gorge is 246 mm and at Amolem 236 mm (Kenya Meteorological Department, 2013).

### ***Wind***

In the Study Area, wind predominantly blows in an east to south-easterly direction (UK Met Office, 2014)(See Figure 5). From 2008-2013, the Kenya Meteorological Department at Lodwar measured maximum wind speed of 7.7 m/s and mean wind speed of 3 m/s.

Figure 5 : Wind rose for the Lokichar area



*Extreme and localised high winds are also known to occur within the region, often generating dust storms (Republic of Kenya, 2002).*

#### 8.1.1.1 Agro-ecological zoning

Kenya is divided into seven agro-ecological climatic zones using a moisture index based on annual rainfall expressed as a percentage of potential evapotranspiration (FAO, 2002). Turkana County falls into Kenya's Agro-Ecological Zones V, VI, and VII. The Lokichar-Lokori area straddles the boundary between Zone VI and VII<sup>2</sup>, with an agro-ecological index of 25%, which defines it as 'arid'. It is characterized by low rainfall, high temperatures and high rates of evaporation (FAO, 2002).

#### 8.1.2 Geomorphology and Landscape

The Aol is typical of the wider South Turkana context and Turkana ASAL; which does not lie within an area of protected landscape or landscape designated in relation to landscape value/quality (RSK, 2014).

<sup>2</sup> Areas with an index greater than 50% have high potential for cropping, and are designated zones I, II, and III; semi-humid to arid regions (zones IV, V, VI, and VII) have indexes of less than 50% and a mean annual rainfall of less than 1100 mm.

The landscape within the region is predominantly flat and low lying but with isolated steep-sided hills and ridges associated with Rift Valley geomorphology, and Rift faulting and volcanism (RSK, 2014). The altitude is about 900 m above sea level (asl) at the foot of the escarpment marking the Uganda border to the west, and then falls to 370 m asl at Lake Turkana in the east. The altitude of the mountains varies between 1,500 - 1800 m asl in the east, reaching a peak at Loima where they form undulating hills. The mountains are mainly located in central Turkana with plains around Lodwar and more specifically the Lotikipi plains in the north. In the south-east, the Suguta valley follows a tectonic trough bordering the Samburu uplands (Wood and Guth, 2014; cited RSK, 2014).

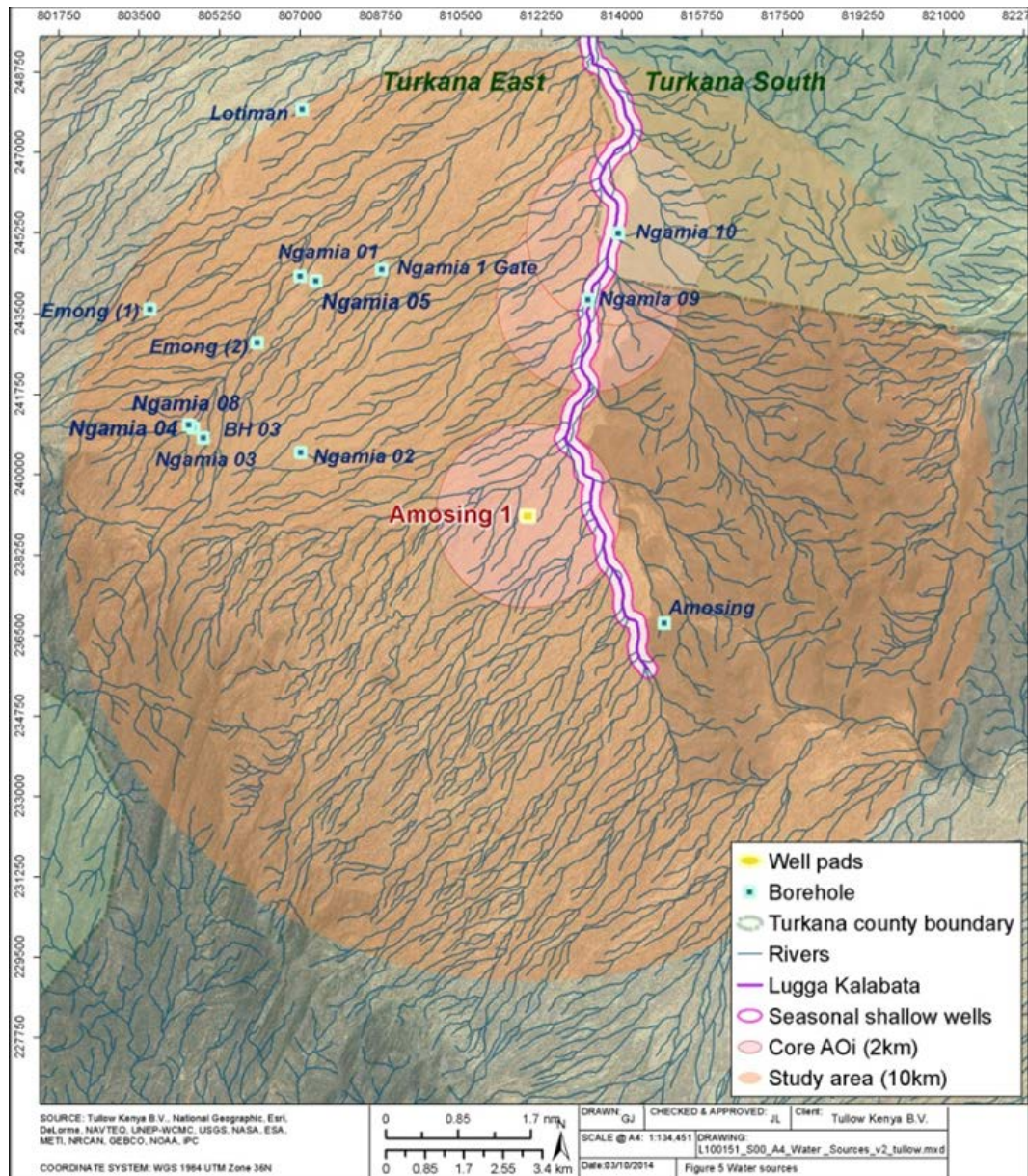
There is a large number of luggas (ephemeral riverbeds) which are prone to flash floods/ heavy water flow rates for only a few hours or days following heavy rains, and are dry the rest of the time. Often these include gullies with high banks when they flow through land that is slightly more elevated than the surrounding area. Amosing-1 is upstream within the catchment area of a large lugga, Lugga Kalabata, which flows north towards Lake Turkana (see Figure 6 below).

There is limited land use and vegetation cover, sufficient in some areas to support nomadic grazing.

Habitation is largely confined to scattered settlements (some only used intermittently) and the accommodation camp for oil exploration workers. Oil exploration activities might be described as a locally significant element of the landscape but are of a scale which is dwarfed by the overall landscape. Much of the landscape in the Aol is essentially natural; characterised by pristine, rugged scenery with extensive plains, shrub-lands, luggas and hills. Small dunes (<1m) are stabilised by *Indigofera spinosa* dwarf shrubs and grass species.

The Aol around the Amosing-1 well site consists of a plain forming part of the wider Lokichar Basin. The local topography is almost level, with slight undulation. The project site is estimated to be 720 – 740 m asl (Google Earth, 2014). The Amosing-1 well pad is located on generally flat land of sandy soils and no surface rock with some gently sloping areas of sandy scrubland. The site is in close proximity to several ephemeral water courses which channel surface water run-off from seasonal rainfall to the Nakukulas lugga (Tullow, 2012 – Scouting Report). The existing well site at Amosing-1 is flat and has been sited to avoid luggas (Tullow, 2014).

Figure 6: Hydrological map of project area



### 8.1.3 Geology

Geologically, Turkana is characterised by elongated mountain/ hill ranges with a general north-south alignment, and intervening areas covered by superficial deposits, which obscure the underlying formations. The regional geological succession, from most recent to oldest, is as follows:

- **Recent superficial deposits** such as limestone, occurring at various localities as a heavy admixture of soils and sand but more often as almost pure limestone, and lacustrine deposit platforms along the present day Lake Turkana shoreline.

- **Tertiary volcanics** make up most of the mountain ranges which are composed of a series of erupted lavas and intercalated pyroclastics.
- **Turkana grits** are a sedimentary series in NW Kenya deposited on basement rocks and lacustrine basin. Exposures of Turkana Grits are confined to eastern Turkana as conglomerates, quartzites, sandstone, minor shales and limestone.
- **Basement system rocks** are metamorphosed rocks, mainly sediments of Precambrian age, which outcrop along much of the Uganda escarpment, the eastern part of Lapur Hills, and in scattered outcrops in the southern part of Turkana County.

The Aol is underlain by Tertiary volcanic rocks, Turkana grits and sandy deposits. The Tertiary volcanic rocks are exposed on the ranges trending in a south-north orientation (RSK, 2014).

#### 8.1.4 Soils

Soils within the region either originate from the geology of the tectonically active Rift Valley environment or the alluvial flood plains of the major rivers and stream systems and in proximity to lakes (RSK, 2014). The general lack of vegetation cover and the hot, arid climate has led to the development of soils typically associated with desert-like environments, which are: moderately well drained, generally nutrient-poor, high pH, low in organic matter and clay content (except for the alluvial soils), saline and strongly sodic<sup>3</sup>. The region is prone to rapid soil erosion by wind and water resulting in dust storms, especially just prior to the seasonal rains (RSK, 2014).

In the Lokichar Basin soils are characterised as Agro-Ecological Zones Lower Midlands 5 (LM5), which is 'suitable for pastoral activities/ livestock and millet agriculture' (FAO, 1981; Maingi, 2008).

The soil within the Aol is poor in organic matter and shallow, stony and rocky; as such most of the area is not well suited for arable agriculture. The surface consists of sealed and crusted sandy clay loam to sandy clay textured soils with low soil organic matter content, overlain by surface pebbles. Trampling by grazing animals contributes to degradation of the soils, and the condition of the soil is considered fragile (Earthview Geoconsultants, 2012).

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<sup>3</sup> Definition of sodic: 'disproportionately high concentration of sodium (Na) – often characterised by poor structure and drainage'.

Soil erosion continues to be a major pressure on soil resources in the Aol and site observation confirm that this is being exacerbated by localised increases in off-track motoring, which compact the soil and exposes it to erosion by wind and runoff when it rains. Visual inspections of soil during site visits confirmed that the soil resource within the Aol is sandy, dry, weakly cemented, generally degraded, unproductive and easily eroded with low agricultural potential. It was also evident at both well sites that the area has been extensively overgrazed. No soil sampling or analysis was undertaken as the EWT activities will involve no additional land take.

## 8.1.5 Water Resources (surface water and groundwater)

### 8.1.5.1 Surface water

Turkana County has two major rivers: the Turkwel and the Kerio. The water in both rivers originates outside the County in the southern hills that receive more rainfall. Amosing-1 location is located in the plains between rivers Turkwel and Kerio and are within the catchment area of the River Kerio, which flows in a general south-north direction (RSK, 2014).

Local surface waters within the Aol mostly consist of ephemeral streams that flow only during and shortly after the rains and in an easterly direction. The plains within the Study Area are intersected by numerous dry riverbeds, including inter alia the Nakukulas, Kakachot, Naparipari, Kaipeton, Lokichar and Nattohe Luggas that feed into the River Kerio (see Figure 7-3 below). Storms are however known to produce ephemeral floods in luggas and across open ground; during which time water flows commonly overtop lugga channels (Cardno, 2012).

The Amosing EWT location is close to a small lugga that flows eastwards towards the Nakuklas Lugga, which flows north to the Kalapata Lugga. However, there is no consistently available surface water supply near the proposed EWT site.

#### **Groundwater**

Groundwater is the most available source of water in the Aol. There are three groundwater categories:

**Shallow alluvial aquifers** - Located at a depth range of surface to 80 m have a high-potential of aquifer occurrence (95% potential). With a conservative assumption of an average thickness of 5 m cumulated aquifer and a minimum porosity of 10%, this category of aquifer has a total storage capacity of 1,620 million cubic meters (MCM), which represents an average of 0.5 MCM per 1 km<sup>2</sup> (Radar Technologies International (RTI), 2013). Drilling boreholes in/ adjacent to luggas has the potential to yield high quality water; various organisations have drilled community boreholes that supply potable water (e.g. at Kangirisae, Nakaalei, Loperot, Nakuklas, Lokichar, Kimabur and Lochwa) and/or provided hand pumps for use in shallow wells (e.g. at Lopii).

**Deep-seated aquifers** – Located within specialised rock formations between 80 m to 600 m. This aquifer type represents a total groundwater potential of 50 MCM per km<sup>2</sup>, 100 times more than the shallow alluvial aquifers (RTI, 2013). Deep groundwater aquifers are often a function of long transport and slow movement. Intense chemical weathering exacerbated by temperatures creates soluble salts and minerals that can percolate into groundwater aquifers affecting water quality; hence deep aquifers can be very old and may often be brackish (Earthview Geoconsultants, 2010).

**Conductive fractures** - Fissures and fractures in the rock formations can store and convey significant volumes of water. The fractures in this part of Turkana convey significant groundwater quantities both horizontally and vertically underground, and discharge from deep aquifers towards the surface (RTI, 2013). Yields in excess of 5 m<sup>3</sup>/ hr can be achieved from boreholes located in "open" faults and fissure zones. Evidence from borehole logs confirm that most groundwater resource in the Study Area is tapped from fractured aquifers developed within the basalts (Earthview Geoconsultants., 2010).

### **Aquifer recharge**

The most important sources of groundwater recharge for shallow aquifers are associated with the seasonal luggas. Water percolates into the sandy beds where thin horizontally layers significantly reduce the percolation rate. Some of the catchments areas extend widely, receiving substantially more water over a longer period than surface waters; flood flows are also important for the recharging shallow aquifers (RSK, 2010).

The deep aquifers were found by RTI (2013) to have an annual recharge capacity of 1.35 BMC/ year. Taking into consideration the total potential recharge rates of both high-potential shallow aquifers and the five deep aquifer structures, RTI estimates the total renewable groundwater resources of northern-central Turkana to be 3.447 BCM per year, which represents only 1.38% of the total storage volume (250 BCM)(RTI, 2013).

Drainage patterns give an indication of the permeability of the ground and likelihood of infiltration of rainfall. The permeability is likely to be lower where there are more drainage routes. Due to the geology and climate the majority of seasonal rainfall runs off and evaporates. There is little evidence of infiltration at the EWT sites outside of the luggas which retain water in their sands and sediments.

### Water Resource Extraction

Shallow aquifer groundwater is extracted from shallow hand-dug wells in the luggas for domestic and pastoral use by the local population. Shallow wells in the channels and banks represent one of the primary sources of water for people and livestock, often influencing the siting of communities and *manyattas*. A number of techniques are used to enhance water retention and availability, including subsurface dams (artificial subsurface barriers to trap water) and sand dams (barriers to hold sand and sediments and water in larger storage areas). The water stored in the riverbed sediments also sustains small trees and riparian vegetation, otherwise absent in the desert areas.

Tullow has drilled a number of boreholes into deep aquifer resources to serve the needs of both communities and its own on-going activities. The boreholes that will be used as water sources for the EWT are N-9 and N-10. N-10 is approximately 6 km from Amosing-1 and N-9 is approximately 5 km. The nominal yields of the boreholes are approximately 15 m<sup>3</sup> / hour each.

#### 8.1.6 Natural hazards

The principal natural hazards are:

##### **Seismic hazards**

In terms of overall seismic risk, the presence of part of the East African Rift, which runs through the west of Kenya and the Davie fracture just south of the Mombasa, means that Kenya is vulnerable to seismic activity and related natural disasters including earthquakes, volcanic eruption and tsunamis (Rao, 2013).

Evidence suggests that there was a 5.2 earthquake in the middle of the Lake Turkana in 2012 (USGS National Earthquake Information Center, 2012). Prior to that the 'Turkana region' experienced an earthquake in 1913 with an estimated surface wave magnitude of 6.0. Despite considerable 'low level' seismic activity, the Lokichar basin is identified as being a Medium risk area with a Peak Ground Acceleration of 0.8 – 2.4 m/s (WHO, 2010).

The most recent volcanic eruption was associated with the Central Island volcano of Lake Turkana in Kenya, in 1975. Although classed as 'dormant', there remains inherent risk from this hazard for any infrastructure placed in close proximity to the Amosing-1 site.

##### **Climate hazards**

Flooding and flash flooding are potentially significant hazards. Most of the watercourses throughout the area are dry until after the seasonal rains, at which point flooding onto the associated flood plains or luggas is a common occurrence

across the region with often significant ponding remaining following recession of the main floodwaters (RSK, 2014).

The generally sandy and weakly consolidated nature of the area's soils together with the lack of ground covering vegetation and a predominantly arid climate, make the soils prone to wind blow and wind erosion.

Since the 1970s, the severity, frequency and impacts of drought, have increased and the areas affected by drought and desertification are expanding (Shitarek, 2012). The failure of three successive rain seasons in 2010 and 2011 was exacerbated by high fuel and food prices on the international market, poor governance, conflict and lack of political commitment leading to under- in the ASALs, among other factors" (IGAD report for OXFAM, 2012). This subject is an important consideration in terms of the ecosystem services associated with access to water (see Section 6.4.1 below).

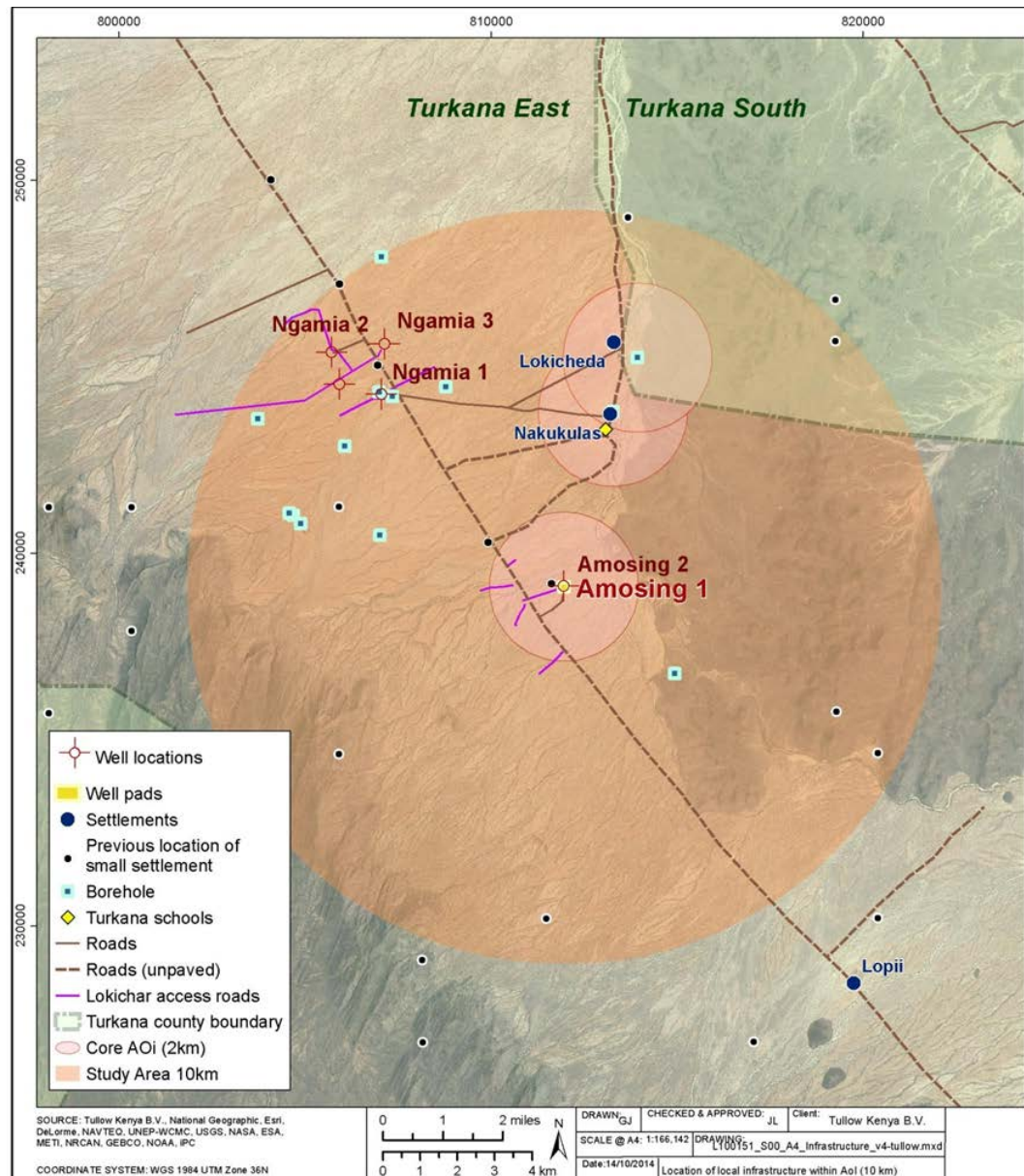
## **8.2 Environmental Quality**

### **8.2.1 Air quality**

The ambient air quality is low in anthropogenic pollutants as the area is rural, sparsely populated, generally undeveloped and far removed from major towns, cities, agricultural and industrial centres that are major contributors to air pollution. There is some natural pollution related to windblown dust as the sometimes strong easterly winds blow across the sparsely vegetated surface. Sources of existing anthropogenic air pollution include exhaust fumes and dust released by the vehicles traversing the survey area, and dust raised by herds of grazing animals (see Figure 7 which shows the road network and existing infrastructure within the provisional AoI).

The site visit confirmed that air quality levels are good and anthropogenic pollutant sources are negligible.

Figure 7: Road infrastructure



## 8.2.2 Noise and vibration

Baseline ambient daytime time noise levels across the AOI will generally be low due to the largely rural setting where there is neither industrial development nor significant traffic (Earthview Geo-consultants, 2010). Ambient noise levels during the night will be characterised by insect noise.

The site visit confirmed that daytime noise levels are negligible.

### 8.2.3 Water Quality (surface water and groundwater)

#### Surface water

Water sampling was carried out from selected locations in the study area for the purpose of water quality analysis for the Exploration ESIA for Block 10BB. The quality analysis results showed that the surface water within the Study Area is slightly acidic to slightly alkaline (6.75-9.02) and turbidity of the water is highly variable ranging from low to high turbidity (15 – 307 N.T.U). The water is often coloured (40-255 mgPt/l) and has high content of iron (2.23-5.7 mg/l) and magnesium (6.8-37.9 mg/l), and low to high fluoride content (0.68-3.5 mg/l). Such water may require treatment before it can be used for domestic purposes. The other chemical characteristics are, however, satisfactory (Cardno, 2012).

#### Groundwater

The physical and chemical properties of groundwater from the operational boreholes in Turkana South County can be summarised as shown in Table 9 below.

**Table 9: Operational borehole data – Turkana South County**

Parameter Attributes	Parameter Attributes
<b>Colour (mgPt/ l)</b>	Colour clear (<5 mgPt /l); however, groundwater from Lugga shallow well is coloured (75 mgPt/ l)
<b>Total Dissolved Solids (TDS)</b>	Total Dissolved Solids (TDS) ranges from 305.7 to 4787 mg/ l
<b>Taste</b>	Taste Good
<b>Turbidity</b>	Turbidity ranges from 0 to 865 N.T.U
<b>Odour</b>	Odour None
<b>Hardness</b>	Hardness moderate to very low but highly variable depending on aquifer formation
<b>Iron</b>	Iron ranges from 0.017 to 2.62 mg/ l
<b>Magnesium</b>	Magnesium ranges from 6.82 to 51.99 mg/ l
<b>Fluoride</b>	Ranges from 0.19 to 7.6 mg/ l
<b>Manganese</b>	Ranges from < 0.01 to 16 mg/ l
<b>pH</b>	Slightly acidic to slightly alkaline (6.68 to 8.67)

*Sourced from ESIA for 10BB (Cardno, 2012).*

A water chemical analysis carried out by Tullow on the N-10 borehole, which is one of the two boreholes expected to provide water for the proposed project activities, concluded that the water quality is good and fit for human consumption (see Table 10: Groundwater quality for details).

**Table 10: Water chemical analysis of Tullow borehole N-10**

Parameter	Results mg/l (ppm)	Max Guideline Value mg/ l (ppm)
Total Alkalinity as (CaCO <sub>3</sub> )	305	500
Chloride (Cl)	39	250
Sulphate (SO <sub>4</sub> )	57	250
Nitrite (NO <sub>2</sub> )	0.1	3.0
Fluoride (F)	0.8	1.5
Sodium (Na)	115	200
Iron (Total)(Fe)	0.28	0.3
Manganese (Mn)	0.4	0.5
Total Hardness as (CaCO <sub>3</sub> )	190	500
Oxygen absorbed. 4 hr. at 27 °C (P.V)	0.4	1.0
Total Dissolved Solids, residue dried at 180°C	344	1000
Total Alkalinity as CaCO <sub>3</sub>	305	500

In summary, N-10 has been characterised as being alkaline, hard; fairly well mineralised water; and chemically fit for human consumption.

## 8.3 Biodiversity and Protected Areas

### 8.3.1 Habitats

The Aol lies in an area characterised by the Deserts and Xeric Shrublands Ecoregion. This ecoregion is characterised by deciduous trees and shrubs (commonly *Acacia spp.* and *Commiphora spp.*), with closed woodland around the margins of watercourses; concentrations of arid-adapted large grazing and browsing mammals, known for their regular migrations in response to rainfall patterns. The ecoregion also supports a variety of endemic and restricted range species of various taxa including less well-studied groups such as invertebrates and herpetofauna (RSK, 2014).

Lack of water and pasture is a serious deterrent to the presence of mammals, whilst loss and degradation of habitat is also a major factor in the distribution of birds, reptiles, invertebrates and other animals in the County.

There are several heterogeneous and highly variable habitats within the Aol:

**Near barren**, where there is a significant amount of bare ground with little or no herbaceous cover and woody vegetation contributes less than 2 % of ground cover, being mostly concentrated in the interfluves;

**Grassed shrubland**, where grasses provide the dominant vegetation cover interspersed with herbaceous and woody plants;

**Dwarf shrubland**, which occurs on shallow soils and dominated by woody plants less than 1 m in height;

**Shrubland**, which consists of woody plants that are less than 8 m in height and usually with multiple many stems emanating at or near the base; and

**Riverine / lugga courses**, where the presence of water and silt, supports more pronounced vegetation with some trees extending above 8 m in height.

All habitats in the Aol have been subject to varying degrees of disturbance by human activities including over-grazing, deforestation, hunting and harvesting which have resulted in changes to primary ecological functions and/or species composition (e.g. the disappearance of mega fauna).

There is no habitat of significant importance to IUCN Critically Endangered and/or Endangered species. For example, species like the black rhinoceros range widely across disjointed areas of Kenya but are not confirmed as present within the Project area. Consequently, the habitat in the Aol cannot be considered as a “discrete management unit” for that species. Any loss of habitat would be marginal to the extent of available land and therefore unlikely to potentially impact the species’ long-term survivability. Some habitats, such as luggas and river courses, are considered to be locally sensitive due to their functions in regards to water resources, diversity of tree and other plants.

### 8.3.2 Vegetation

Turkana County has a wide variety of vegetation types ranging from annual grassland to upland forests. Rainfall and elevation determines variations of vegetation. Most parts of the County have dwarf shrubs, annual grassland, bushed and wooded grassland with annual and perennial grasses. The western boundary of the County has abundant bushland and shrubland. Woodland is widespread occurring in small patches while forest in small patches is limited to major drainage and mountain tops. Dwarf shrub and grasslands are found in the eastern part of the County and they provide nutrition forage for livestock during and shortly after the rainfall periods. Southern parts of the County have considerable greater vegetation production potential with perennial plants which

are generally capable of maintaining photosynthetic activity into the dry season. The cover is dense in the low lying areas and along the river basins (RSK, 2014).

The vegetation is mainly sparse and characterised with dwarf shrub-land to shrub-land types of vegetation. Acacia thorn scrub with large acacia trees are found everywhere in the investigated area, especially along the luggas, accompanied by xerophytes succulent on the lava outcrops. Thick bushes and scrubs with little undergrowth are found scattered in the plains, scattered bushes are found in some areas.

As identified during the field reconnaissance site visit, dominant trees within the Study Area are Acacia and Commiphora shrubs with scattered taller trees of *Delonix elata*, *Acacia tortilis* and *Adansonia digitata*. Others include *Juniperus procera*, *Euphorbia Nyikaye*, *Indigofera spinosa*, *Heliotropium steudleri*, *Commiphora africana*, *Seddera hirsuta* and *Balanites aegyptia*. Important grasses include *Aristida adoensis* and *Stipagrostis hirtigluma*. These occur as annual or perennial grass types (mainly *Solanum coagulans*). Other grasses include *Aristida mutabilis*, *Chrysopogon aucheri*, *Tetrapogon spp*, *Enneapogon cenchroides*, and *Chloris roxburghiana*.

The land surrounding the Amosing-1 well pad is characterised by sparse *Acacia reficiens* and *Indigofera* dwarf shrubs. Some succulents were also in evidence and annual *Aristida* grasses (at the start of the rainy season). The entire area is typically overgrazed (Tullow, 2012a - Amosing-1 Scouting report). To date, no examples of invasive alien plant species (e.g. *Prosopis juliflora*) have been detected within the Aol and none were identified during the field reconnaissance visit.

### 8.3.3 Animals

Mammal species identified within the Study Area include the: ground squirrel (*Xerus erythropus*), dwarf mongoose (*Mungos mungo*), black-backed jackal (*Canis mesomelas*), cape hare (*Lepus capensis*) and dik-dik (*Madoqua guentheri*). Mammal sightings are scarce.

Reptiles such as snakes (e.g. green mamba (*Dendroaspis angusticeps*) and puff adder (*Bitis arietans*)), skinks and other lizards are also present. Little information is available on the importance of the invertebrate fauna of the region.

During site scouting visits, no large terrestrial fauna was observed, and locally obtained information confirms that these have been largely eradicated by subsistence hunting and/or displaced by livestock pressure on available grazing.

### 8.3.4 Birds

The Rift Valley is an important region for migratory birds, and the Lake Turkana region is crossed by the East Africa/East Asia flyway. Large numbers of birds use this route between their Palaearctic breeding grounds in Eurasia and their wintering sites in Africa, typically arriving in late August and September and returning north again in spring. Parts of the region are designated at various levels in recognition of their importance for biodiversity conservation. There are no such designations within 10 km of the core Aol of either site.

Birds that are typically found within the Study Area include: chestnut-bellied sand grouse (*Pterocles exustus*), red billed hornbill (*Tockus* spp.), white browed sparrow weaver (*Plocepasser mahali*), black-headed plover (*Vanellus tectus*), white bellied go-away bird (*Corythaixoides leucogaster*), hoopoe (*Upupa epops*), eastern chanting goshawk (*Melierax poliopterus*), white headed buffalo weaver (*Dinemellia dinemelli*), superb starling (*Lamprotornis superbus*), fork-tailed drongo (*Dicrurus adsimilis*), brown-necked raven (*Corvus ruficollis*), red and yellow barbet (*Trachyphonus erythrocephalus*), Abyssinian roller (*Coracias abyssinicus*), white-throated bee-eater (*Merops albicollis*), white-headed mousebird (*Colius leucocephalus*) and sparrow-lark (*Eremopterix* spp.) (Earthview Geoconsultants, 2012).

### 8.3.5 High conservation value species

In order to improve the information on species of conservation interest, a list of national and global species was collated from the Kenyan Red List (as published in the Wildlife and Conservation Management Bill, 2013) and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (published and updated on-line at: <http://www.iucnredlist.org/>). There is no indication that any red listed species inhabit the study area.

### 8.3.6 Protected areas / Areas of International Conservation Interest

No protected areas are located within the EWT Study Area or core Aol.

## 8.4 Ecosystem services

### 8.4.1 Overview

Ecosystem Services can be simply defined as “*the benefits people derive from ecosystems*” (Millennium Ecosystem Assessment, 2014). Water, soils, habitats and biodiversity provide a broad array of provisioning services within the region. Of particular importance are water resources, livestock grazing, arable crop growing and fishing, whilst trees provide wood for construction timber and

charcoal making. There are a number of key cultural services related to socio-economic benefits, such as tourism at Lake Turkana and its National Parks.

The association between ecosystem resources and social conflict is widely recognised and is embodied in the Kenya Vision 2030 (Government of Kenya's development aspirations for the country). This conflict is evident in violent disputes involving pastoralists in the north eastern regions of Kenya, which are caused, in part, by resource competition, in particular for land and water, and livestock raiding.

Furthermore, physical boundaries cutting across traditional migratory routes increase problems in accessing traditional grazing resources. Where there is disruption of normal migratory patterns, this can lead to unsustainable utilisation of natural resources, as livestock tend to be concentrated in secure areas resulting in environmental degradation. It is generally recognised that the following services are of local importance within the Aol:

**Access to water:** The availability of water is arguably the most important ecosystem service (a provisioning service) within the Study Area (RSK, 2014). Local people within the Study Area access water either through water infrastructure within the larger settlements of Nakukulas and Lopii (on the periphery of the Study Area), at water points connected to water boreholes and/or mobile bowzers replenished at the new water points. Outside of villages access water is predominantly through shallow hand-dug wells located in luggas. This water is used for both domestic and livestock use.

Indicative information suggests that water accessibility has increased as all permanent sources (traditional wells, boreholes, springs, and shallow wells) are sufficiently utilised within the region; with distances to water points reducing from normal (6 to 8 km) during the dry season to 3km for livestock use; and to 1 to 2 km for water for human consumption (Ministry of Planning and National Development, 2012; cited in Cardno., 2012).

**Pastoralism:** Pastoralism is the main land use and source of livelihoods in the Aol; therefore pasture is a key ecosystem service. Animal shelters and herd animals present at the Amosing-1 site during site specific assessments clearly indicate grazing areas for pastoralists' livestock.

**Wild foods / plants:** Vegetation in Turkana County has different primary production potentials and capacities to support both livestock and people. Indigenous fruits/foods can be important sources of food especially during prolonged dry periods, with most Turkana 'pastoralists' depending significantly on wild foods as a food source including a variety of roots, fruits, seeds and leaves (. It was estimated that up to 60% of the population received around a third of their calories from wild foods (Levine & Crosskey, 2006; cited in Cardno, 2012). The thorns are used for making compound fences and livestock fences while some tree roots are used as traditional medicines. The inhabitants also use trees for building manyattas and as firewood for heating and cooking.

**Cultural significance:** Certain natural features such as trees (Ekwar) may have strong cultural significance to local individuals and communities; this significance may be considered an ecosystem service. The significance of these features is discussed further in Section 6.6 below.

## 8.5 Communities and Demographics

### 8.5.1 Demographics

The Rift Valley is a sparsely populated area. According to the projected National Population Census of 2009, the population of Turkana County for 2012 was estimated as being 939,080 with 488,609 males (52 %) and 450,471 females (48 %); while Turkana South County had a population of 226,379, 28,437 households and a population density of 12 persons / km<sup>2</sup> (Kenya National Bureau of Statistics' (KNBS), 2009). The average household size in Turkana is 6.9, 1.6 higher than the national household size of 4.4 (CRA, 2011).

The well site is located in Lochodin, in the Kochodin Division of Turkana East County. Lochodin covers 771 km<sup>2</sup> and has a population of 2,039 living within 246 households, giving a population density of 3 per km<sup>2</sup>. This demographic is fairly dispersed with village clusters sparsely scattered within the county (KNBS, 2009). Table 11 shows the 2009 details for the South Turkana Constituency and its wards.

**Table 11: Turkana south constituency demographics**

Constituency / ward	Population			Age Groups						Households (%)			
	Total	Male	Female	0-5	0-14	10-18	15-34	15-64	65+	Total	<3	4-6	7+
Turkana South Constituency	133,972	71,299	62,673	21,118	62,158	39,492	47,359	68,777	3,037	16872	5.3	27.1	67.5
Kaputir	15,068	8,191	6,877	2,503	6,949	4,246	5,383	7,785	334	2199	8.7	39.0	52.3
Katilu	41,528	22,054	19,474	6,980	20,075	12,009	13,848	20,516	937	5322	3.2	27.6	69.2
Lobokat	9,839	5,413	4,426	1,439	4,242	2,951	3,811	5,348	249	1405	5.3	41.7	53.0
Kalapata	23,509	12,379	11,130	3,231	10,875	7,522	8,369	12,139	495	2424	1.2	11.6	87.2
Lokichar	44,028	23,262	20,766	6,965	20,107	12,764	15,948	22,989	1,022	5522	7.9	25.0	67.0

Despite the harsh climatic realities and poor access to health facilities, population growth is on an upward trend just like most parts of the country; cited as 3.3 % for Turkana South (KNBS, 2008; cited Earthview Geoconsultants, 2010). In terms of age profile, 0-14 year olds constitute 46 % of the total population and 59 % of households comprise more than 7 family members. The proportion of 0 - 5 year olds is lower as a result of high infant and under five mortality rates. Parents in the age bracket of 37 – 40 and those above 41 have an average of between 6 and 7 children respectively (KNBS, 2008; cited Earthview Geoconsultants, 2010).

### 8.5.2 Communities

The population within Turkana County are increasingly adopting a sedentary lifestyle, a change supported by GoK and NGOs (Earthview Geoconsultants, 2012). Villages cited as being (previously) located within the Study Area include: Kaepedru, Lopuruto, Lokosim Ekor, Kachalangikieni, Nakukulas and Lokicheda. It is however understood that due to insecurity in the Aol that most people have recently evacuated to larger villages within the area, namely: Lokicheda, Nakukulas and Lopii. This temporary (or permanent) evacuation was confirmed during the field visit; when several uninhabited *manyattas* were identified along the access route to the Amosing-1 well site. Livestock herding (high numbers of goats and sheep) was however still evident within the core Aol suggesting although the area is not currently habited, it is still used for grazing and movement routes by pastoralists.

Figure 6-3 shows the location of settlements that have relocated to form larger settlements. The location of the larger settlements are also shown, namely Nakukulas and Lokicheda.

Lokicheda and Nakukulas are situated along the course of the Lugga Nakukulas. Nakukulas is sited 4 km to the northwest of Amosing-1. Lopii is located approximately 12 km south of Amosing-1 along the road to Lokori. The population currently based at Lopii is reported as being 3,768; however, many are often absent and in attendance with grazing herds so that its permanent population is understood to be c. 800 in 136 households (Lopii Chief, pers. comm.) Turkana sub-clans residing within this mixed community include: Ngitab; Ngikelesos; Ngibocho; Ngissiger; Ngiliroto; and Ngimorok (Lopii Chief, pers. comm.) As confirmed during the site visit, there are no permanent settlements within - and therefore no demographic data for - the Aol.

### 8.5.3 Health

Kenya has a gender index of 0.25 % for 2012, and a Human Development Index score of 0.509 for 2011, placing it at 143 out of 187 countries (SIGI, 2012). The Ministry of Health has published a number of indicators for health in Turkana County covering the years of 2011 and 2012 and providing a comparison with the corresponding indicators for Kenya in 2012 (MHS, 2013). Table 12 presents a selected sample of that information.

**Table 12: Health indicators for Turkana County 2011 and 2012**

Theme	Indicator	2011	2012	Kenya 2012
Nutrition	Underweight (weight for age) (%)	23.7	22.7	15.0
	Stunted (height for age) (5)	30.9	25.9	30.0
Child health	Full immunisation coverage (%)	53.1	54.0	83.0
Maternal health	Births delivered a health facility (%)	14.7	18.6	44.0
	Contraception prevalence (%)	5.1	8.1	45.0
HIV/AIDS	Number of people tested for HIV	50,986	103,203	6,952,636
	Number of HIV carriers receiving antiretroviral treatment	2,290	2,297	524,010
	Mother-to-child transmission of HIV (%)	9.4	13.3	8.5
Malaria	Malaria test positivity rate (%)	48.4	50.6	30.0
	Malaria incidence / 100,000 people	17,293	18,293	21,945
Tuberculosis	Tuberculosis prevalence per 100,000 people	n/a	200	223
	Tuberculosis incidence per 100,000 people	n/a	66	79

The most prevalent condition in the region is however malnutrition (RSK, 2014). The Famine Early Warning System Network estimates that more than 34 % of children under five are at risk of malnutrition in parts of Turkana<sup>4</sup> with up to 75% of food input comprises food aid (RSK, 2014).

The infant mortality rate in Turkana is 6 in every 1000 and 12 in every 1000 under five (CRA 2011). In Turkana South the same health indicators are 66 per 1000 and 220 in every 1000 under five (Cardno, 2012).

### Nutrition and diet

The annual food needs/ diet of pastoralists within Turkana vary depending on the wealth of the households. Rather than the expected livestock, there were three main sources of food available to most pastoral households, which were of roughly equal importance:

<sup>4</sup> (<http://www.fews.net/east-africa/kenia/food-security-outlook-update/tue-2014-03-18>)

- The main staple was maize, much of which is purchased through barter of goats since there is no local cultivation;
- The second major source of maize was from food aid; and
- The third source of food was from gathering wild foods.

Poor households<sup>5</sup> get 5-10 % of their food needs from animal products; depending significantly on wild foods including a variety of roots, fruits, seeds and leaves. It was estimated that up to 60 % of the population received around a third of their calories from wild foods (Levine & Crosskey, 2006; cited in Cardno, 2012). For owners of larger herds, wild foods are substituted by milk, and to a lesser degree meat. The better off live largely from their animals. Around 60 % of food comes from meat or milk (blood contributes very little): most of the rest is from maize, traded for goats, and a small supplement is from wild fruits and from aid (mainly from school feeding programmes) (Levine & Crosskey, 2006; cited in Cardno, 2012).

As a result of poor general healthcare provision, many people still resort to traditional treatment using herbs collected directly from the bush or provided by medicine men. No data is available on the uptake of traditional medicines.

### **HIV / AIDS**

A 2007 study carried out by the National AIDS and STI Control Program (NASCO) and the National AIDS Control Council (NACC) determined that HIV prevalence among the rural Turkana population was 8 % in urban centres and 4.1 % in rural areas (NASCO/NACC, 2007). Also in 2007, data from the District AIDS and Sexually Transmitted Infections Coordinator (DASCO) in Turkana Central indicated an overall prevalence rate of 6.7 %, with some peaks of up to 14 % in some urban centres. Data from the 2009 Turkana Central District Ministry of Public Health and Sanitation (MPHS) puts the HIV prevalence rate at 7 %, close to the prevalence rates the IRC found during testing in the region (MPHS, 2009).

### **Illness and disease**

There is limited data available regarding human health in the project area. Malaria, diarrhoea, pneumonia, snake/scorpion bites, typhoid, respiratory tract infections and fever are the conditions commonly noted by health professionals in the area. Malaria and respiratory tract infections account for over 60 % of medical interventions in Turkana County. Flood events and contaminated water may also trigger epidemics of diseases like cholera. There is no data available on the frequency and severity of psychological illness (Earthview Geoconsultants (2012).

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<sup>5</sup> Classed as having very small herds (25-40 goats/shoats)(Levine & Crosskey, 2006; cited in Cardno., 2012).

### Health care provision

The Kenyan health sector is run by the GoK in collaboration with NGOs, faith based organisations and Aid Agencies; private healthcare is not well established.

Health care provision is generally poor in comparison to the rest of Kenya; for example:

- 37.5 % of Kenyan mothers deliver their babies in health institutions, whereas the rate is only 6.9 % in Turkana County; and
- Only 17.8 % of people in Turkana have access to sanitation facilities as compared to an average of 87.8 % in Kenya.

The lack of health care provision in Turkana is partly due to the prevailing factors of low population densities, poor communications and the unpredictable movements of nomads, which impact treatment costs and therefore the ability to deliver services. Healthcare budgets are also depressed compared to national levels – for example, in 2011 preventive services were budgeted at KES 401 per capita and curative services at KES 132 per capita compared to the corresponding national values of KES 669 and 408 respectively.

Healthcare in the Turkana is also hampered by:

- Lack of trained personnel (Ministry of Health Indicators showed that there were 16 nurses, 1 doctor 3 clinical officers and per 100,000 people in comparison to national levels of 49, 7 and 8 respectively);
- Lack of facilities such as operating theatres, wards, ambulances, medical supplies and laboratories (the Ministry of Health reported 65 public, 1 NGO, 41 Faith-based and 21 private health facilities in Turkana in 2012); and
- Lack of finances to organise transport to villages (many patients are unable to travel due to lack of transport).

### Education and Skills

Formal education levels are extremely low in the region. As many as 82 % of Turkana County residents have had no formal education, 15 % have only had primary level education, and just 3 % of have gone on to a secondary level of education or above (KNBS/SID, 2013). Literacy within Turkana South is 33 % in males and 22 % in females (Ministry of Planning and National Development, 2008; cited in Cardno, 2012). The formal education system is hampered by low enrolment levels (due to early marriages for girls and boys occupied with herding duties), lack of teachers and school books leading to increased school dropout. However, Earthview Geoconsultants (2012) reported an increased emphasis on early childhood education; an initiative is spearheaded by the government in collaboration with NGOs.

The Gross Enrolment Rate to Primary Education in Turkana County is 60% compared to the national average of 95 %. The drop-out rates for children joining primary school is 46 % while the transition rate from primary to secondary is 40 % compared to the national average of 70 % (Ministry of Education, 2009).

Table 13 shows early childhood development (ECD) and primary school enrolment in Turkana East and Turkana South counties as at April 2010; Table 14 depicts enrolment in secondary schools. Enrolment is lower than in other parts of Turkana County.

**Table 13: Enrolment in early childhood and primary schools in Turkana South and Turkana East counties**

	South	East	Total
<b>Number of ECD Schools</b>	84	55	139
<b>Boys</b>	7987	3248	11235
<b>Girls</b>	6672	2498	9170
Total children in ECDs	<b>14,659</b>	<b>5,746</b>	<b>20,405</b>
<b>Primary Schools (No.)</b>	51	24	75
<b>Boys</b>	9,574	4,066	13,640
<b>Girls</b>	8,068	3,599	11,667

**Table 14: Enrolment in secondary schools in Turkana South and Turkana East counties**

	South	East	Total
<b>Secondary Schools (No.)</b>	4	3	7
<b>Boys</b>	1,166	309	1,475
<b>Girls</b>	298	299	597
Total students in secondary schools	<b>1,464</b>	<b>608</b>	<b>2,072</b>
<b>Teachers</b>	41	22 (F 5)	683
<b>Shortfall of teachers<sup>6</sup></b>	42	18	60
<b>Mobile Schools (No)</b>	2	4	6
<b>Boys</b>	111	286	397
<b>Girls</b>	82	181	263
<b>Total children in mobile schools</b>	193	467	660
<b>Teachers</b>	2	4	6

<sup>6</sup> The staffing for secondary schools is based on the combination of subjects taught by particular teachers

## 8.6 Socio-cultural Characteristics

### 8.6.1 Ethnicity

The Turkana tribe is one of the Nilotic tribes having originally come from the Karamojong region of north-eastern Uganda. The Turkana tribe is a nomadic pastoralist people and constitutes the second largest pastoralist community in Kenya after the Maasai. Due to the remote area and harsh conditions, there was little interaction between the British and the Turkana, who successfully resisted colonial rule (Lamphear J., 1993).

All Turkana belong to one of two groups, Ngirisai (Leopard) or Ngimor (Stone or Mountain) and there are approximately 20 clans (ategerin). Each clan has a distinctive brand for their livestock and there are complicated "grazing" rights across geographical areas. The Ng'isonyoka clan predominates in the core Aol, whilst other clans identified as potentially present within the Study Area include the Ngitab, Ngikelesos, Ngibocho, Ngissiger, Ngiliroto and Ngimorok (Lopii Chief, pers. comm.).

The traditional way of life is currently subject to a number of pressures (including increasing movement to settlements as a result of widespread insecurity), although the majority of Turkana still adhere to traditional African religious beliefs, customs, language and dress (RSK, 2014).

### 8.6.2 Governance

The Turkana County is bounded by Ethiopia to the north, Marsabit County in the east, West Pokot County in the west, Samburu County in the east and south-east, Uganda and South Sudan in the north-west and Baringo County in the south. The county has 6 sub counties namely Turkana North, Turkana West, Turkana Central, Loima, Turkana South and Turkana East. The County is served by magistrates' courts based in Lodwar. Appeals to high court are handled by High court in Kitale. There are 2 local authorities; Municipal council of Lodwar and county council of Turkana. Lodwar town is the administrative unit (CRA 2011). The administrative divisions are:

**County level:** Turkana County, which is second tier of governance after the national government. The local authority in the area is therefore Turkana County Government.

**Sub-county level:** Turkana South Constituency has recently been divided into Turkana South and Turkana East. The administrative headquarters of the Turkana South Sub County are located in Lokichar, while that of Turkana East Sub County are centred in Lokori.

The traditional governance system is based upon spiritual leaders and the social unit's rules and beliefs (i.e. village, sub-clan or clan). At the individual community level, affairs such as security, control of traditional grazing areas, migration patterns and relations with neighbouring communities are controlled by the council of elders (Pavitt, 1997). It is under the council of elders that issues that affect the entire community are discussed, solutions sought and overall direction given.

In rural areas, the context of intra-clan and inter-community relations define attitudes to each other and influence the choice of elected representative or support for leaders in modern administrative units. Modern governance units and systems are however stronger in towns like Lokichar and Lodwar; however, they still exhibit traditional influence of intra-clan and clan rivalries. For example, town security is influenced by both the traditional and modern administrative leaders with competing objectives.

### 8.6.3 Land and Natural Resource Ownership

Land in Kenya is classified as public, communal (customary) or private (freehold). The land tenure system, as with most other ASAL areas, is communal. There is no public owned land and there are no individual free holdings (RSK, 2014).

'Communal' land systems are characteristic of pastoral communities who require a large area and flexibility for grazing to enable them to cope with climatic variability. Although 'communal' land cannot be purchased, many governments enable such land to be leased (for varying time periods) for other land uses (for example, from grazing to intensive irrigated agriculture). As such, most land is collectively owned by the residents of the area and is managed, on behalf of the community by the Turkana County Council as trustees. As the land has yet to be officially allocated by the Ministry of Lands and Settlement, pasture and settlement lands have no legal land ownership documents. Consequently, the competent Chief, Counsellor and Council of Elders comprise the trustee officials who decide on how land is allocated for use. The Chief and the Counsellor cannot give out any land without consulting the community's elders. When land-take is requested, the decision-makers determine who needs to be consulted, whether access to the land is granted and what conditions may apply (e.g. the routing of livestock movement corridors)(RSK, 2014).

Irrespective of the land tenure system, traditional ownership rights to trees (*Ekwar*), groups of trees, or areas with specific resources such as ochra clay, are of significant cultural importance. The *Ekwar* system is a Turkana traditional system through which the riverine (Riparian) eco-systems have been protected for sustainability. Such trees can be considered to be sacred, and can be owned by individuals who are located many kilometres away from the project site.

Oil in its natural state within Kenya belongs to the government (RSK, 2014).

#### 8.6.4 Pastoralism and Migration

A healthy Nomadic Pastoral System (NPS) is often determined by ability of the herders to move to where they want and when they need to do so. Even though each pastoral household is usually independent, the movements involving large numbers of households is sanctioned by elders of the community in consultation with the seers in cognizance of various factors including:

- Condition of the pasture in home ranges *vis-à-vis* away ranges;
- Intensity and distribution of seasonal rainfall;
- Balance and health of livestock populations in both home and away ranges;
- Security considerations; and
- Herders (e.g. the ability of families to allocate members to different roles).

Each family unit takes full responsibility of ensuring maximum survival and overall good health of its herds. Livestock herds are divided and sub-divided according to species, gender and age. Herds that are for long range movements normally comprise a single species or combinations of stronger animals. The ‘away-range’ stock is mostly made up of cattle, donkeys, sheep and goats. Transhumance<sup>7</sup> activities in the project area are seasonal and take one of two directions. During the dry season, herds move from the plains to the hills on the south around Kalapata River and its various tributaries. During the rainy season, the herd migrates in the opposite direction. The animals that are left behind are usually old and weak plus some lactating stock to cater for family needs; camels, being browsers, are usually left behind in the home ranges.

Migration may take place as a coordinated group of households or in single households or sections of the household. The nuclear family, which in most cases may be polygamous, may be organised into small nomadic units, each with its herds. These “property units” have to move frequently, sometimes more than three times a year, due to the harsh ecological situation (RSK, 2014).

Migration activities are seasonal and take the two directions, during the dry season from the plains to the hills to the south around Kalapata River and its various tributaries. During the rainy seasons, migration within the area goes in the opposite direction and mainly back to clan and sub-clan demarcated land areas and ancestral homes for the specific families. Reasons for migration and the locations targeted, as provided by the local communities during the stakeholder engagement in July 2014, are as follows:

- Livestock disease(s) have been identified in the target area;

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<sup>7</sup> The seasonal movement of people with their livestock between fixed summer and winter pastures.

- The Local spiritual leader has forecast about a particular area, event or action which attracts migration to or away from an area;
- Potential conflicts and general or specific security concerns;
- Drought/famine situation and pasture capacity of the local land area; and
- Clan boundaries and the resource agreements or disagreements.

### 8.6.5 Security

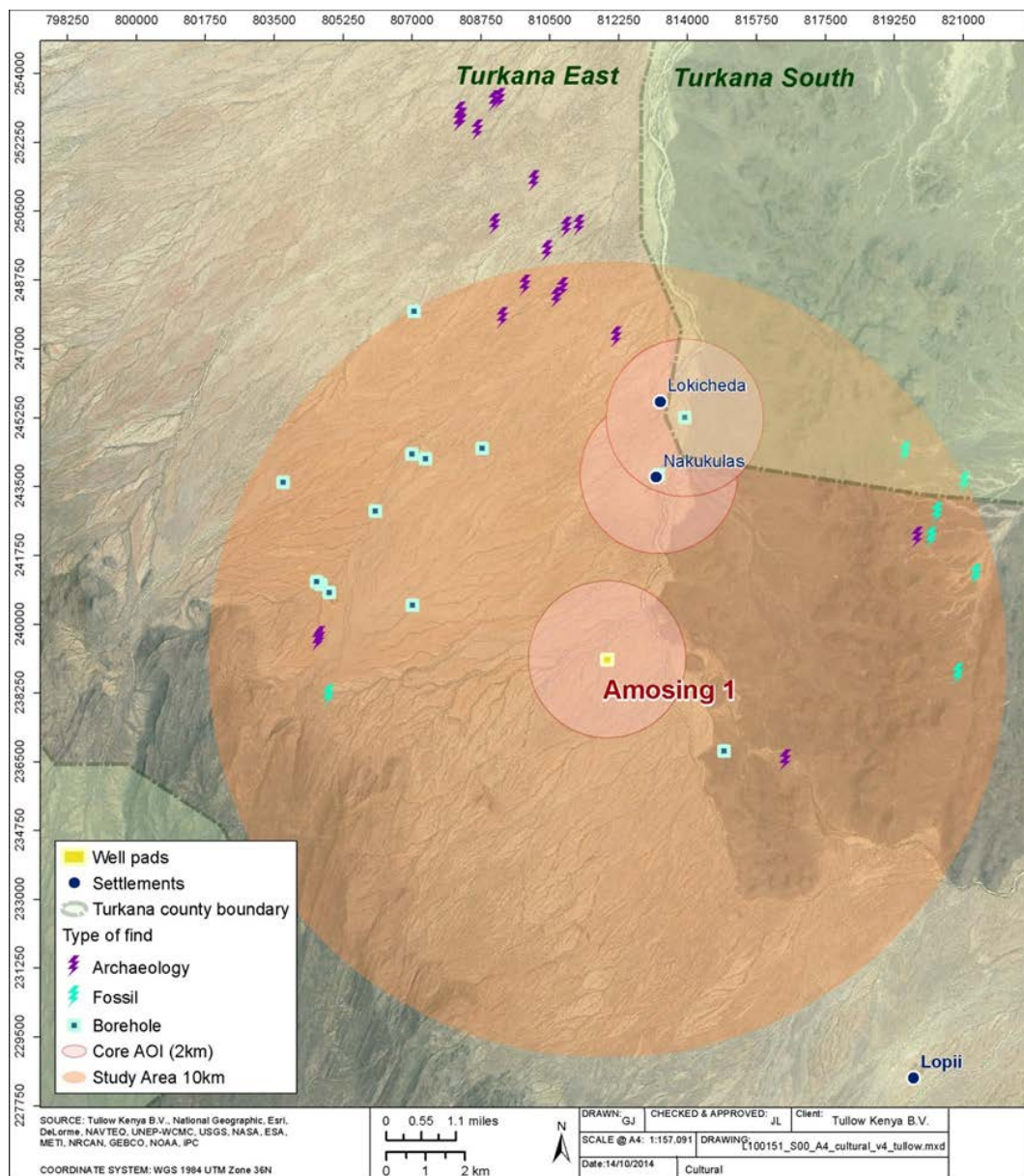
Conflict, often violent and based on ethnicity, resource ownership and livestock disputes, is a frequent occurrence in the region. Although many current conflicts may be classed as 'endemic' some conflicts are relatively new and in a state of flux due to shifting populations, population growth and periodic environmental events such as droughts (RSK, 2014).

The Aol has historically experienced inter-tribal conflict between Pokot and Turkana. Livestock rustling is endemic and small arms proliferation is considerable; coupled with the intent of Government agencies to pursue a disarmament program which has caused tensions, and these factors have resulted in a heightened security risk. A recent example of this status is the migration of local people from scattered smaller settlements into far larger settlements - Lopii, Lokwamosing, Lokicheda and Nakukulas - as a result of increased cattle rustling and associated security concerns.

### 8.6.6 Archaeology and Cultural Heritage

Over 50 years of intensive fieldwork by the National Museums of Kenya and the Turkana Basin Institute (TBI) has identified many of the visible locations of palaeo-fauna and hominid fossils in the Study Area. There are no gazetted archaeological sites in the Aol. Known archaeological and heritage features are presented in Figure 8.

Figure 8 : Map of archaeological / heritage sites



Other cultural heritage features with important aesthetic and existence values include present-day settlements and animal enclosures that represent the economy of the present-day occupants, their social interaction, and family and tribal associations. Maintaining such a way of life provides considerable value to international populations (RSK, 2014).

The Turkana have traditional / indigenous knowledge that helps the community to cope with and adapt to the harsh environment. Certain trees can be considered 'sacred' whilst some are owned by individuals who may be located away from their location. Traditional/clan ritual performance sites and ancestral worship shrines may also be present in the Study Area. Unauthorised interference with such sites or objects may provoke strong reactions from local communities.

The field visit and stakeholder consultation did not identify any community shrines, sites and other objects of local cultural importance in the Aol.

## 8.7 Socio-economic Environment

### 8.7.1 Employment

The most recent statistical data for Turkana County (2009) suggest an indicative workforce of circa 422,650 people, of whom 5.6% were in paid employment and 14.9% had no work. Family businesses accounted for 16.9% and family agricultural/pastoral undertakings employed 50.1%; the balance comprised 1.5 % interns / volunteers (NGOs and Aid Agencies), 4.0% full-time students, 6.5% retired / homemakers and 0.5% incapacitated (KNBS/SID, 2013).

The majority of the residents in Blocks 10BB area are involved in small scale or family business as a source of livelihood. Other sources of income include casual labour, civil service, teaching and farming, which are concentrated in centres like Lochwaa, Lokichar and Locheremoit.

In the Study Area, pastoralism (nomadic livestock husbandry), and its variants, constitutes the main economic activity; rural-based traders are very few in number (FAO, 2007). Pastoralism is however gradually dwindling due to changing socio-economic realities, climate shocks, loss of pastureland and livestock rustling (Cardno. 2012).

### 8.7.2 Economy

The percentage of people in Turkana County defined as being in absolute poverty is 94.3%, which is higher than the national rate of 45.9% and ranked 47/47 out of the counties in Kenya (CRA 2011). Such poverty is deep and structural and not a simple consequence of drought (Levine & Crosskey, 2006; cited in Cardno., 2012). Indicative total income per pastoralist household (main economic activity) within Northern Turkana is as follows (Levine & Crosskey, 2006; cited in Cardno., 2012):

Wealthy: trade about 20-25 goats per year, giving a 'cash equivalent' income of around KSh 15,000 – 22,000;

Middle income: a cash equivalent of KSh. 14 - 20,000; and

Poor: a cash equivalent of KSh. 14 - 18,000 - which is insufficient to be able to depend on pastoralism for their livelihood.

Aid dependency is very high; an indicative annual estimate of the value of external aid (cash plus food)<sup>8</sup> per household is > KSh. 20,000 - 25,000. Without

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<sup>8</sup> Relief food is provided by the respective central governments and WFP throughout the region.

aid, it is predicted that herds owned by poor households would have been sold off within 2 years. Migration would have been the only option in the longer run. Coping mechanisms, such as increasing charcoal sales, are not sufficient to compensate, since the market is so limited (Levine & Crosskey, 2006; cited in Cardno., 2012).

### **Livestock**

The low productivity of the rangelands means only indigenous livestock is raised; livestock needs to be moved frequently to exploit available resources. Livestock is considered to be a source of wealth and a symbol of status (e.g. it is used in dowries) however, there is a general lack of veterinary services in Turkana to deal with routine diseases and epidemics / epizootics.

Discussions with GoK livestock officers during a field visit indicated that households have an average of 15 sheep and/ or goats, 2 camels and between 2 and 3 cattle. The numbers of livestock estimated by the livestock officers to be in Turkana South are shown in Table 15.

**Table 15: Estimated population of livestock in Turkana South**

Division	Cattle	Sheep	Goat	Camels	Donkeys	Poultry
<b>Katilu</b>	169,740	416,396	594,970	59,410	39,400	27,213
<b>Kainuk</b>	150,880	370,131	563,655	31,361	32,840	11,655
<b>Lokichar</b>	56,588	138,801	407,086	74,260	59,130	20,447
<b>Total</b>	<b>377,208</b>	<b>925,328</b>	<b>1,565,711</b>	<b>165,031</b>	<b>131,370</b>	<b>59,975</b>

Livestock is either sold to directly traders at the Lokwamosing, Kalemung'orok, Kakong'u, and Lokichar markets or through the Livestock Marketing Authority (LMA). The LMA raises funds for its operations by charges recovered from every animal sold; they also facilitate transportation of livestock to external markets at as far away as Nairobi.

### **Charcoal making**

In recent years, there has been extensive burning of trees by charcoal burners. Target species include *Acacia tortilis*, *Acacia albida* and other valued species. The production and sale of charcoal was evident in the vicinity of Lokori and Lopii.

### **Retail / trade**

Many residents in the area are involved in small scale businesses as a supplementary source of income. Businesses include shops, kiosks, bars, and entertainment establishments and such activities are concentrated in shopping centres like Lochwaa, Lokichar and Locheremoit or along roads / at junctions. Other economic activities include bee-keeping, production of traditional brews and working for NGOs, Aid Agencies or other employers. Another major

household expenditure is the propensity to invest in livestock. Most (90%) of the earnings from the first harvest after the rain season will go towards re-stocking of the livestock herd.

## 8.8 Infrastructure

### 8.8.1 Housing

Habitation within Turkana South consists mainly of semi-permanent to temporary structures located within a common perimeter thorn fence. Temporary settlements are known as *manyattas* - defined as a group of huts forming a unit which serve as resting points for livestock herders in transit in search of water and pasture.

Larger semi-permanent settlements serve as administrative centres for the local communities, where essential social services like provision of potable water, schools and dispensaries are available (Earthview Geoconsultants, 2010). Within the perimeter fence each household has its own fenced area within which there is family kraal for small livestock. Camels are usually enclosed in a separate area within the perimeter fence while donkeys stay within the central area set aside for them. Security may be provided either by armed 'home guards' (GoK licensed weapon carriers) and/or directly by the residents. Each family aims at self-sufficiency, although sometimes a number of families may graze their animals collectively.

In Turkana, only 4 % of homes have either brick or stone walls. 27 % of homes have mud/wood or mud/cement walls, while 31 % have wood walls, 1 % has corrugated iron walls and 9% have tin or other walls. 28 % have grass/thatched walls. Grass and makuti roofs are installed in 72 % of homes, although less than 1 % have mud/dung roofs; approximately 12 % now have corrugated iron roofs. The majority of homes (91.4 %) have earthen floors and only 6.9 % use concrete. Similarly, very few households in Turkana have access to electricity. Firewood (87 %) and charcoal (11.4 %) are the main fuels used in cooking, whilst fuelwood (76.1 %) and lamps / lanterns (17.9 %) provide light (KNBS/SID, 2013). Lodwar town has the largest urban population in Turkana, taking 6 % of the county's population (CRA, 2011).

Of the settlements within the Study Area (Lokicheda, Nakukulas etc) all are semi-permanent or temporary, consisting of mud/ wood walls, grass and makuti roofs and earthen floors.

### 8.8.2 Schools

There are 275 primary schools in Turkana County, with 71 of them providing boarding facilities to learners. The nomadic nature of many communities has not encouraged the establishment of early childhood education (ECD) facilities. In

addition, Turkana has a total of 189 Adult Literacy Centres with the Government supporting 163 of them and the rest supported by Faith-based organizations.

Within Turkana South, there are 10 primary schools but no secondary school (Turkana South Education Officer, pers.comm.). Turkana East has 36 primary schools and 6 secondary schools; of which only half have attained the minimum standards to offer the Kenya Certificates of Primary or Secondary Education.

There are three primary schools at Nakukulas, Lokicheda and Lopii, but no secondary school within the EWT Study Area. The closest school to the proposed EWT operations is at Nakukulas, approximately 4.3 km from the Amosing-1 wellpad.

### 8.8.3 Transport

#### ***Roads***

The road network in Kenya is managed by the Kenya Roads Board (KRB). A survey undertaken by the Road Department of the Ministry of Roads between 2003 and 2006 indicated that about 32 % of the national road network was in poor condition (Tullow Data Book, 2014). As a result of this survey, Tullow commissioned an assessment of the major alternative road routes from Nairobi to Lokichar. The preferred route for use by EWT related transport passes from Mombasa through Nakuru, Eldoret, Kitali, and Lokichar en route to Lokori, primarily because it will require no civil works for convoy mobilisation. Nonetheless, small sections of the road within the last 80 km approaching Lokichar are in poor condition.

The only road through the Study Area is the road connecting Lokichar and Lokori with a total length of 66 km. The track was originally constructed in the late 1970s of the last century but was recently upgraded to a murram road by Tullow. This road serves as access to all Tullow existing facilities and serves villages along the way including Lopii and Lokwamosing.

The murram roads and dirt tracks within the Study Area, unless under Tullow's road improvement programme, are generally not well maintained, if at all. They are not all-weather roads, and are, in many cases, completely impassable during the rainy seasons. River/ lugga crossings are subject to flash floods that may endanger road users. There are also very few or no user road support facilities such as petrol stations and garages along these roads for several tens and sometimes over a hundred kilometres (Cardno, 2012).

#### ***Airstrips***

There are several airstrips in the general area. Many were constructed during the famine years of 1984 - 1985 to facilitate access to these remote areas and provide food aid assistance to the communities; however, most of these have since been abandoned.

The major airstrips in Turkana County are now under the control of the Kenya Airport Authority (KAA). These include Lokichar, Katilu, Kaputir and Lokori. Numerous other airstrips were cleared for use during the 1980s. A private airstrip has been constructed by Tullow at Kapese some 8 km southeast of Lokichar and is earmarked for expansion along with the development of the oil field.

### ***Health facilities***

The main local health facility in the Study Area is the Reformed Church Health Centre in Lokichar. This facility is supported by UNICEF, Merlin (a health-related NGO), Christian Association of Kenya, World Vision and the GoK. The Centre has an inpatient capacity of 26 beds, an operational laboratory with one laboratory technician, one ambulance and no operating theatre. There is no morgue and no regular doctor. The Centre handles a large number of out-patients estimated at between 150 to 200 on Mondays and Tuesdays and 50 per day the rest of the week. There is also a government run health centre at Lokichar, but it is ill-equipped in terms of personnel and facilities. Dispensaries are also located in Kanaodon, Lochwaa, Locheremoit and Kalemung'orok.

There are a few health facilities in the Study Area including a dispensary in Nakukulas with one qualified nurse, a community health worker, an attendant and subordinate staff. Another dispensary is being built in Lopii but is yet to be commissioned.

### ***Water infrastructure***

Water is currently available to the two main settlements within (or just on the periphery) the Study Area at water points connected to water boreholes drilled by Tullow and mobile bowzers replenished at the new water points. For example, Tullow has assisted Nakukulas with drilling a number of water boreholes. Tullow has also established a water supply scheme for Lopii. Local people outside of these villages access water predominantly through shallow hand-dug wells located in luggas.

### ***Waste management***

There are no waste management facilities in the Study Area so bulk waste is either burnt in soil pits or transferred to town centres or further afield like Lokichar for processing by NEMA approved waste management contractors. Liquid waste is normally managed through the use of pit latrines (local communities) or the use of septic tanks/ cess pits (e.g. Tullow at existing exploration well sites).

## **9 Stakeholder engagement**

### **9.1 Introduction**

This Section summarises the results of stakeholder engagement that were completed during preparation of the EPR. This section provides an overview of the consultation process, including stakeholders involved and consultation activities carried out to date. The section concludes with a summary of consultation findings.

### **9.2 Purpose**

Stakeholder engagement refers to a process of sharing information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration and partnership. It is a long-term process that requires the building of trust through open dialogue and the delivery of commitments. Stakeholder engagement is central to Tullow's vision. Tullow recognises that open and transparent communication is essential due to the importance of the wider exploration and production activities in which it is engaged and the impact on the local, regional and national economies and individuals.

### **9.3 Project stakeholders**

Project stakeholders are identified in order to understand the individuals or organisations that will be affected by or may influence the Project or related activities either positively or negatively. Previous and on-going consultation carried out by Tullow in the Study Area to inform the Lokichar Basin exploration and production activities was used to inform the EPR. This wider consultation has included project, site specific and strategic assessments as part of the ESIA for the Exploratory Well Drilling in Block 10BB, October 2010; and the Tullow SEA for the wider Lake Turkana Development Programme (LTDP).

The list of stakeholders for the EWT is presented in Table 16 and engagement was completed during the two field visits.

Table 16 : Stakeholder Map

Stakeholder Type	Location	Stakeholder Position	EWT Consultation Method			Justification
			Meeting	Round-table meeting	Letter	
Political Leadership	Nairobi	Turkana South MP	X		X	Elected political leader with responsibility to guide the community; Member of Turkana South County Advisory Committee (DAC) established to discuss development plans with Tullow.
	Nairobi	Women's Representative	X		X	Elected political leader and MP from southern Turkana, with responsibility to guide the local communities; a key member of a number of Parliamentary committees; and a member of the Turkana South DAC.
	Nairobi	Turkana East MP	X		X	Elected political leader with responsibility to guide the local communities; Member of Turkana South County Advisory Committee (DAC).
National Government	Nairobi	PS Min of Energy			X	Already consulted as part of wider Tullow communication plan so already aware of the E&P activities in the Lokichar Basin.
	Nairobi	NEMA	X		X	Environmental regulator.
	Nairobi	National Irrigation Board Managing Director			X	Given the scale of the EWT Project and existing knowledge of the wider Tullow E&P activities, a letter providing an update is most relevant.
	TBC	County Commissioner-Turkana County	X		X	Key government officer.
	Nairobi	National Museums of Kenya			X	Given the scale of the EWT Project and existing knowledge of the wider Tullow E&P activities and involvement, a letter providing an update is most relevant.

Stakeholder Type	Location	Stakeholder Position	EWT Consultation Method			Justification
			Meeting	Round-table meeting	Letter	
County Government	Lodwar	Governor		X	X	Government officials who will be commenting on the Environmental Project Report and establishing conditions for approval.
	Lodwar	Min for Lands		X	X	
	Lodwar	Min for Environment		X	X	
	Lodwar	Min for Culture		X	X	
	Lodwar	Turkana County Commissioner		X	X	
	Lodwar	NEMA		X	X	
	Lodwar	WRMA Manager Turkana		X	X	
	Lodwar	LOWASCO		X	X	Government regulatory officials
	Lodwar	County Director of Livestock		X	X	
	Lodwar	National Drought Management Authority		X	X	
	Lodwar	Turkana Rehabilitation Project- TRP		X	X	
	Lodwar	Minister for Energy	X		X	
	Lodwar	Sub-county administrators	X		X	
UN Agency	Lodwar	World Food Programme, Programme Officer			X	Given the small scale of the EWT Project and potential impacts, a letter providing an update and to notify them that the Environmental Project Report is being completed is underway is most appropriate.
NGOs	Lodwar	Secretary General of NGOs			X	Given the small scale of the EWT Project and potential impacts, a letter providing an update and to notify them that the Environmental Project Report is being completed is most appropriate.
	TBC	Friends of Lake Turkana	X		X	NGO with an active interest in the Aol.
	TBC	Turkana Basin Institute	X		X	NGO with an active interest in the Aol.
	TBC	Oxfam			X	Given the small scale of the EWT Project and

Stakeholder Type	Location	Stakeholder Position	EWT Consultation Method			Justification
			Meeting	Round-table meeting	Letter	
						potential impacts, a letter providing an update and to notify them that the Environmental Project Report is being completed is most appropriate.
	Turkana	Red Cross Turkana Office			X	Given the small scale of the EWT Project and potential impacts, a letter providing an update and to notify them that the Environmental Project Report is being completed is most appropriate.
County official (Turkana South County)	Lokichar	Sub-County Commissioner		X	X	Government officials who will be commenting on the Environmental Project Report and establishing conditions for approval. They are also members of the County Development Committee, which must approve activities within the county.
County official (Turkana South County)	Lokichar	Sub-County Water Officer		X	X	
County official (Turkana South County)	Lokichar	Sub-County Livestock Development Officer		X	X	
County official (Turkana South County)	Lokichar	Sub-County Council Representative		X	X	
County official (Turkana East County)	Lokori	Sub-County Commissioner		X	X	
County official (Turkana East County)	Lokori	Sub-County Water Officer		X	X	
County official (Turkana East County)	Lokori	Sub-County Livestock Development Officer		X	X	
County official (Turkana East County)	Lokori	Sub-County Council Representative		X	X	
National	Katilu	Katilu Manager		X	X	

Stakeholder Type	Location	Stakeholder Position	EWT Consultation Method			Justification
			Meeting	Round-table meeting	Letter	
<b>Irrigation Board (Katilu)</b>						
<b>Settlements (within the EWT Study Area)</b>	Nakukulas	Community group and/or representative (s)		X		Within the Soc Ec AoI (due to the difficulty in quantifying land use based on the number of 'home' range livestock and pastoralists that may potentially use the core AoI for grazing or temporary dwellings), also it is understood that people that may have had settlements within the core AoI may have relocated to Nakukulas.
	Lopii	Community group and/or representative (s)		X		Although outside of the SocEc AoI, it is understood that people that may have had settlements within the core AoI may have relocated to Lopii.
	Lokicheda	Community group and/or representative (s)		X		Within the SocEc AoI (due to the difficulty in quantifying land use based on the number of 'home' range livestock and pastoralists that may potentially use the core AoI for grazing or temporary dwellings), also it is understood that people that may have had settlements within the core AoI may have relocated to Lokicheda.

## 9.4 Consultation Findings

The findings of the stakeholder consultation are presented by impact in the following section.

#### 9.4.1 Consultation feedback on Environmental Impacts

**Site selection:** several questions were raised on why the Amosing-1 well was selected for well testing yet other wells had been drilled before. The participants of one particular county assembly session wondered if the decision to progress the Amosing-1 well site first were due to *“some interest being kept away from the community?”* It was acknowledged that the EWT well pad has already been constructed and this construction was not part of the scope of this specific project

**Land take:** many stakeholders wanted to confirm that there will not be a need for any additional land take for the EWT. This was confirmed.

**Climate change:** a number of stakeholders wanted to find out whether it was true that the changes in the rain (delayed rainy season earlier in the year) and general climate change in Turkana has resulted from activities related to oil exploration. One member of the Turkana East County Assembly enquired *“Would the planned EWT increase deterioration of climate as alleged?”*

**Environmental quality:** consultation on environmental quality issues associated with the project (including water and air quality and noise levels) did not generate many responses from stakeholders. Generally the perception of environmental issues by stakeholders has been secondary to the socioeconomic issues of concern and the perceived benefits that stakeholders believe Tullow may provide. The Study Area community stakeholders raised concern about environmental quality (air quality, noise) from a pastoralist perspective. The political leadership forum raised that the local communities would want to know about any buffer areas required to ensure residents and their livestock are safe from the oil drilling, pumping, processing and handling.

**Air quality:** Almost all of the stakeholders raised their concerns about potential air quality impacts, including potential for dust generation during construction and transport movements and decreasing air quality due to flaring.

**Water quality of aquifers:** the safety of the water aquifers from the oil drilling and pumping operations was questioned. A stakeholder requested details about the results of previous chemical analysis undertaken on nearby freshwater boreholes.

**Water availability:** the parliamentary members wanted reassurance that the abstraction of water during the well testing would not interfere with ground water availability and by extension impact the vegetative growth in the area.

**Waste management:** during the political leadership forum it was raised that the plans for waste management from the operations requires careful consideration given the lack of facilities in the area. Another member asked why it was necessary to dispose of waste generated from drilling and camp site in Kitale and, why it was not possible for NEMA to engage a local service provider to perform the waste disposal work.

**Land restoration:** many of the stakeholder groups requested reassurance that the land will be restored should the project become non-viable. Questions were also raised on whether it would be safe to use the affected land after planned activities are terminated.

#### 9.4.2 Consultation feedback on Ecosystem services

**Charcoal burning:** one stakeholder indicated that illegal charcoal burning is a major environmental threat to the fragile environment and suggested that activities underway by Tullow could contribute to reducing the threat to trees in Turkana County.

#### 9.4.3 Consultation feedback on Socio-cultural

**Archaeological finds:** the importance of avoiding interference with archaeological and cultural sensitive sites around the site was raised. It was advised that the Council of Elders be contacted to help identify any potential sites of archaeological interest.

**Cultural awareness:** there are no known cultural sites within the Aol. However, many people consulted asked that, *“local culture be respected, particularly sacred sites such as Ekwar”*. It was noted during consultation that failure to respect local culture, including cultural sites (particularly *Ekwar*) would represent a serious violation of the culture and could potentially cause serious problems.

**Role of traditional authorities:** Tullow was encouraged to establish regular courtesy visits to the traditional authorities to discuss plans for the area and seek advice since this would be welcomed by the local communities and demonstrate that the Project values their local culture. Furthermore it was observed that the traditional authority can be strengthened by being encouraged to play a role in promoting harmony within the community and encouraging peaceful co-existence.

**Insecurity:** the county assembly stated that experience internationally has shown that discovery and exploitation of oil reserves can result in problems such as increased demand for land and conflicts with neighbours. It was also felt that there are signs of increasing aggression from neighbours claiming that the exploration area belongs to them.

**Local interests in relation to oil exploitation:** the county assembly raised their concerns that when oil exploration and future production have been discussed in the past, the local interests in Turkana are not taken into consideration.

#### 9.4.4 Consultation feedback on Socio-Economic

**High expectations:** employment has been a dominant theme throughout stakeholder consultations, although this was linked to the wider ongoing exploration activities. The need for employment and training of local people continued to emerge as a key issue of concern for stakeholders, with over 80% of comments during the public meetings reinforcing the expectation of employment opportunities such as low-skilled housekeeping and security jobs.

**Prioritisation:** local people from the communities within, or adjacent to, the Study Area made it clear that they wanted to be prioritised for work positions and had concerns that they did not possess sufficient skills to be able to compete for jobs. They felt that local communities should be prioritised for unskilled jobs. The country assembly requested that Tullow consider the possibility of hiring of cars from locals to provide transport services to the project and issuance of tender to local businesses for service provision in both construction and other phases. It was also questioned *“Who will benefit from tender to transport cargo from Mombasa to the project area for construction of crude container tanks?”* One local community member raised that: *“it is felt that most jobs available for the indigenous Turkana people are casual in nature and not permanent”*, that *“people outside of the Turkana region are given menial jobs such as housekeeping and the Turkana people can easily provide such unskilled labour”*, and that *“the Turkana people are side-lined for plum jobs due to the lack of education”*.

**Land prices:** the Country Assembly raised the point that since Tullow discovered oil, the price of land in the region has soared; numerous people from down-country have purchased land, especially in Lokichar; some are opening businesses. There is danger of the local community over-reacting negatively to this. It was confirmed that there will be no additional land required for the project.

#### 9.4.5 Consultation feedback on health

**Air quality:** many of those consulted were concerned about the potential for health issues/acute respiratory diseases linked to air pollution and dust *“our children will be affected later in life by the prolonged inhalation of the dust from an increased number of vehicles during the exploration and production phases”*. Several stakeholders expressed concern that the local population had been experiencing coughing and chest pains since Tullow commenced flaring in the area (at one of the other exploration well sites - Agate II) *“Is the smoke and gas hazardous to livestock and humans?”*, *“Livestock grazing around Amosing-1 would be adversely affected due to air emissions from the flaring activity”*. A recommendation to minimise dust generated by Project related transport was given, i.e. control speed on the roads or *“tar the road from Lokichar to Lokori to reduce challenges from dust generated by vehicular movement”*.

**Noise and flaring:** it was raised that the noise from the project activities and flaring may lead to miscarriages and loss of sleep, one community member was concerned that the flaring *“would have adverse impacts to pregnant women in their community which could result in miscarriages”*.

**Road safety:** Consultation on road safety issues associated with the project did not generated significant responses from stakeholders; although further information on measures put in place to ensure that haulage traffic does not result in road accidents was requested.

**Health facilities:** during consultation one recurring comment raised was the lack of medical structure and resources in the region and the poor quality of facilities and a lack of medication and insufficient numbers of beds for patients. Requests were made for the construction of dispensaries to provide the much needed health services to the community.

**Emergencies:** a female community member requested that Tullow to provide medical services within the vicinity to address emergency issues related to the EWT activities. She further felt that Tullow needed to do more for them with regards to offering assistance during emergencies even if they may not be as a result of the EWT activities.

## 9.5 Consultation Findings on the Project and the EPR Process

**Engagement:** on the whole the local communities expressed their pleasure at being involved in the preparation of the EPR. Different stakeholder groups expressed their appreciation that the Project is engaging them and also for Tullow’s proactive steps to involve external stakeholders. One community member expressed that he *“was grateful that Tullow organised this meeting and he felt better informed about EWT activities and their potential environmental and social impacts”*. It was however also raised during a local community meeting that *“whenever public meetings are held, Tullow provides them with a biased positive opinion about the exploration activities and does not address the adverse impacts”*.

**Overall support of the Project provided they receive benefits:** the consultation process showed overall support of the project provided the local communities receive benefits (such as jobs, access to water and better health care facilities). The local community members consulted stated that the community will support the project providing that sufficient benefits are experienced in the local communities.

**Grievance mechanism:** a female local community member requested Tullow to consider providing an office closer to them or having a mobile office as the one at Lokichar is quite far for them to seek information or air their grievances.

**Local community involvement:** the political leader forum wanted reassurance that the local communities will be involved fully at the grass-roots in coordination with the leaders. The Area Chief expressed that prior to the community meeting held in Lokicheda he had collected the views of the community regarding the project. He said that there were misconceptions about the EWT activities prior to this public meeting which were resolved after the community understood what EWT entailed. He also went on to say that he was supportive of the EWT program as he understood what it entailed and was subsequently going to continue educating the community about it.

**International knowledge and experience:** the political leader forum rose that Kenya is new to Oil & Gas developments so they are keen to review experiences elsewhere in the world on the oil industry and social linkages and borrow appropriate solutions. The County Assembly also requested guidance on whether there were any relevant international laws that guide the process of environmental and ecology assessment issues associated with the Project.

**Legal parameters:** members of the County Assembly rose that if the Project is carried out in accordance with national laws, they exclude the county from contributing to the process taking place within their jurisdiction. Members of the Turkana South East government assembly stated that they would like NEMA to localise its presence so as to explain issues related to environment to the local community. They also felt that having access to local lawyers to explain the legal implication of the contracts and other engagement in oil business would be a great help to creating awareness among the community.

**Youth:** in order to ensure that locals are employable in the oil industry, stakeholders requested that Tullow provide facilities for young people to be suitably trained and capacity built to enable them to compete for jobs. *"How much has Tullow given for bursaries in the past three years?"* It was raised that more children should be allowed to benefit from bursaries therefore Tullow should consider increasing funds allocation. It was also felt by a female youth that *"the job opportunities tended to be skewed in favour of men and requested Tullow to provide equal opportunities for employment"*.

**Vulnerable groups:** the need to engage more with the physically challenged was raised. Some stakeholders felt that Tullow has not taken positive steps to engage with the physically challenged. Special engagement should be considered, including allowance including engaging sign language specialist to help those with hearing challenges to follow discussions and other verbal communication, or a stipend to the disabled, the orphaned children and the elderly from the local community. It was also raised by a female member of the local community that *"since Tullow operations commenced, some benefits to the community were stopped"*. For example, the Government funded "help-age" project where the old people were given financial support ceased, the community perception being that the Government withdrew the support as they felt that Tullow operations in the area would generate the needed assistance through CSR programs and other income generating activities.

**Environment committee:** the members of parliament suggested formation of Environment Committee to monitor and report on the environment during construction and operation. They relayed that they expected Tullow to lead in the formation of such a committee.

**On-going consultation:** the parliamentary members requested a follow up meeting once the EPR had been completed.

**Lack of prior information:** the country assembly stated that they had been briefed of the issues to allow them raise appropriate issues and that the same should be undertaken at a community level. A summary of the stakeholder consultations is provided in Table 17.

**Table 17: Summary of stakeholder consultations**

Categories	Issues raised	Relevance to the EWT Project
<b>Livelihoods</b>	<ul style="list-style-type: none"> <li>• Increase in dust from use of road network affecting vegetation quality and consumption by livestock.</li> <li>• Potential increased risk of livestock miscarriage due to flaring activities.</li> </ul>	<ul style="list-style-type: none"> <li>• Dust will be generated from use of the public road network. The use of the road network by project-related vehicles will be evaluated in the impact assessment.</li> <li>• No crude oil will be flared. Gas will be flared into a ground pit.</li> <li>• Air dispersion and noise modelling to be undertaken as part of the impact assessment process.</li> </ul>
<b>Biodiversity</b>	<ul style="list-style-type: none"> <li>• Potential for impacts on birds from flaring.</li> <li>• Potential for increased soil contamination from oil spills and potential effects on wildlife and livestock.</li> </ul>	<ul style="list-style-type: none"> <li>• Gas will be flared into a ground pit.</li> <li>• An emergency response plan will be used.</li> </ul>
<b>Waste management</b>	<ul style="list-style-type: none"> <li>• EWT will generate quantities of hazardous and non-hazardous waste.</li> </ul>	<ul style="list-style-type: none"> <li>• All waste to be transported to Tullow's existing waste management facilities in the field. The treatment and disposal of waste is outside the scope of the EWT EPR</li> </ul>
<b>Climate change</b>	<ul style="list-style-type: none"> <li>• EWT may contribute towards climate change.</li> </ul>	<ul style="list-style-type: none"> <li>• The project will generate small quantities of GHG.</li> </ul>
<b>Water availability &amp; quality</b>	<ul style="list-style-type: none"> <li>• Impacts to water quality through pollution and availability from</li> </ul>	<ul style="list-style-type: none"> <li>• The EWT requires quantities freshwater and this will be evaluated as part of the impact</li> </ul>

Categories	Issues raised	Relevance to the EWT Project
	abstraction.	assessment process.
<b>Demographics/ social</b>	<ul style="list-style-type: none"> <li>Tullow needed to help reduce potential adverse socio-economic and socio-cultural impacts and potential for conflicts.</li> <li>Need to develop ways to meet the needs of local people in a manner that will bring benefits to the unemployed and their communities.</li> <li>Exacerbation of conflicts due to resource stress, changes in culture and lifestyles.</li> <li>Consider implementing benefit sharing opportunities.</li> </ul>	<ul style="list-style-type: none"> <li>No additional land is required.</li> <li>No additional local employment is required for the project.</li> </ul>
<b>Health</b>	<ul style="list-style-type: none"> <li>Potential health issues/ acute respiratory diseases linked to air pollution and dust.</li> <li>Road safety from use of vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>No crude oil will be flared. Air dispersion modelling and noise to be undertaken as part of the impact assessment process.</li> <li>All road vehicles to be operated in accordance with Tullow's existing procedures.</li> </ul>
<b>Economic activity</b>	<ul style="list-style-type: none"> <li>Expectation for local job opportunities.</li> <li>Expectation for wider benefit sharing with local communities.</li> </ul>	<ul style="list-style-type: none"> <li>No additional local employment is required for the project.</li> <li>Benefit sharing issue is outside the scope of the EWT Environmental Project Report.</li> </ul>
<b>Cultural heritage</b>	<ul style="list-style-type: none"> <li>Possible threats to valued cultural heritage or archaeological sites.</li> </ul>	<ul style="list-style-type: none"> <li>No additional land is required.</li> <li>No trees or shrubs that may have intangible cultural heritage value will be removed.</li> </ul>

## **9.6 Next Steps**

### **9.6.1 On-going stakeholder engagement**

Tullow will continue stakeholder engagements before, during and after the project so that key stakeholders are informed of the project's activities. This process of consultation and engagement will enable all stakeholders, local, regional and national, to provide feedback to Tullow with any complaints or comments throughout the project.

## 10 Impact Assessment

This chapter provides an analysis of impacts, both positive and negative, that will result from the project using the methodology described in Section 4.

The anticipated environmental and social impacts are summarised in Table 18.

Table 18: Findings of Impact Assessment

Aspect	Potential impact	Receptor	Existing control measures	Significance justification	Impact significance	Additional control measures	Residual impact significance
<b>Routine events</b>							
<b>The generation of noise.</b>	<p>Creation of a nuisance to local communities.</p> <p>Disturbance of local fauna (NB where fauna is used in this table, it is also taken to include livestock).</p>	Local communities. Fauna.	<p>Use of well testing rig that is designed and operated in accordance with Good International Industry Practice (GIIP).</p> <p>The rig and all other equipment to be maintained according to the manufacturer's specifications.</p> <p>Well testing rig to be located in the centre of the well pad to provide the maximum distance for noise attenuation to the site boundaries.</p> <p>Construction of an earth berm around perimeter of site to act as a noise barrier.</p>	Operations are not expected to attract local people moving in the regional area with animals towards the site.	<b>Minor</b>	<p>Noise modelling results indicate that the radial area impacted by the generation of noise, in accordance with applicable Kenyan legislation, is 1.7km during the night, and 1.1km during the day. The nearest community (Nakuklas) is located approximately 7km from the site and so well testing operations are unlikely to cause a nuisance.</p> <p>Inform local communities of project activities</p>	<b>Negligible</b>
<b>The generation of air emissions (GHG and non-GHG) from the use of equipment and road vehicles.</b>	<p>Deterioration to local air quality (non-GHG emissions).</p> <p>Contribution to global climate change (GHG emissions).</p>	Local air quality. Local communities. Global climate.	<p>Use of well testing rig that is designed and operated in accordance with Good International Industry Practice (GIIP).</p> <p>The rig and all other equipment to be maintained according to the manufacturer's specifications.</p> <p>Separators to be designed to effectively separate oil from associated gas to ensure only gas is flared.</p> <p>Use of well-maintained road vehicles.</p>	The nearest community (Nakuklas) is located approximately 7km from the site.	<b>Minor</b>	<p>Air modelling results indicate that the radial area where higher concentration of pollutants are present, above the level suitable for a 24-hour exposure, comprises a 700m radius.</p> <p>Inform local communities of project activities</p>	<b>Negligible</b>

Aspect	Potential impact	Receptor	Existing control measures	Significance justification	Impact significance	Additional control measures	Residual impact significance
<b>The generation of dust from the use of vehicles.</b>	<p>Deterioration to local air quality.</p> <p>Creation of a nuisance to local communities.</p> <p>Reduction in availability of vegetation used for animal grazing due to the settlement of dust on plant leaves.</p>	<p>Local air quality.</p> <p>Local communities.</p>	<p>Existing road networks to only be used.</p> <p>All off-road driving prohibited without approval from the site supervisor.</p> <p>Drivers to adhere to Tullow vehicle management requirements, which include speed limits that reflect the specific type of road, driver behaviour and training.</p>	<p>The overall quantity of vehicle traffic is expected to be moderate and the existing controls are expected to be effective. However, the generation of dust is extremely difficult to control in such a dry environment and the significance is considered to be moderate.</p>	<b>Moderate</b>	<p>Inform local communities of project activities, including use of vehicles on the road network.</p> <p>Use road marshals along frequently used road networks to warn local people of vehicle movements.</p>	<b>Minor</b>
<b>The generation of sewage from the presence of a workforce.</b>	<p>Soil and groundwater contamination.</p>	<p>Soil.</p> <p>Groundwater.</p>	<p>Sewage treatment system to be adequately sized to reflect the expected number of workers present.</p> <p>System to be maintained according to the manufacturer's specifications and monitored closely during operation to ensure it is functioning correctly.</p>	<p>There are no permanent surface water features in the vicinity of the site.</p>	<b>Minor</b>	<p>Tullow has extensive experience in the use of sewage treatment systems from Kenya and operates similar facilities in a variety of locations across Kenya.</p>	<b>Negligible</b>
<b>The abstraction of groundwater from boreholes.</b>	<p>Reduction in the availability of local groundwater supplies.</p> <p>Groundwater over abstraction resulting in deeper saline water mixing of with upper freshwater horizons.</p>	<p>Groundwater.</p> <p>Local communities.</p>	<p>All water abstraction to occur using existing boreholes that Tullow regularly uses for ongoing operations which have already been permitted by WRMA (Nakuklas 9 and 10). No new boreholes to be drilled.</p> <p>Boreholes to be monitored in accordance with the existing groundwater monitoring programme that periodically checks groundwater elevation and water quality.</p>	<p>The project is located in a water-scarce region of Kenya. However, the total quantity of water required is relatively low and EWT activities have been designed to minimise the quantity of water required. On this basis, impact significance is minor.</p>	<b>Minor</b>	<p>No additional controls required but ongoing monitoring is necessary.</p>	<b>Minor</b>

Aspect	Potential impact	Receptor	Existing control measures	Significance justification	Impact significance	Additional control measures	Residual impact significance
<b>The use of road vehicles on the public road network and a road traffic incident.</b>	Increased risk to community health and safety resulting in an injury/fatality, or damage to private property.  Loss of livestock resulting in economic loss.	Local communities.	Drivers to adhere to Tullow vehicle management requirements, which include speed limits that reflect the specific type of road, driver behaviour and training.  Existing road networks to only be used.  All off-road driving is prohibited unless authorised by the Site Supervisor.	The overall quantity of vehicle traffic is expected to be moderate and the existing controls are expected to be effective. However, there remains a risk that a road traffic incident could still occur and this is considered to be of moderate significance.	<b>Moderate</b>	Inform local communities of project activities, including use of vehicles on the road network.  Use road marshals along frequently used road networks to warn local people of vehicle movements.	<b>Moderate</b>
<b>The use of road vehicles to transport equipment, materials and workers.</b>	Introduction of alien and invasive species affecting existing plant species, biodiversity and pastoralist livelihoods.	Biodiversity. Local communities.	None.	Kenyan vehicles only to be used.	<b>Minor</b>	None.	<b>Minor</b>
<b>The generation of hazardous and non-hazardous waste.</b>	Soil and groundwater contamination.	Soil. Groundwater. Biodiversity. Local community health.	All waste to be segregated and placed into receptacles that are appropriate based upon the type of waste in accordance with standard Tullow waste management procedures.  Waste containers to be securely strapped to road vehicles during transit, to make sure content does not escape.  All waste to be transported to Ngamia-1 in accordance with established Tullow waste management procedures.	The quantity of waste to be generated from EWT activities is relatively low. All waste will be transferred using road vehicles and secure containers, to existing Tullow waste management facilities. On this basis, impact significance is minor.	<b>Minor</b>	No additional controls required but ongoing monitoring of waste movements is necessary.	<b>Minor</b>
<b>The presence of a security fence surrounding</b>	Animal injury or mortality resulting from an interaction between fauna and the security fence/site.	Fauna.	The existing security fence surrounding the site will prevent the entry of fauna.  During site operations the security fence	There are no protected or endangered species that have been observed in the vicinity of the site. However small mammals,	<b>Minor</b>	Tullow Wildlife and Livestock Protection Guidelines are in place for rescue and recovery of wildlife.	<b>Negligible</b>

Aspect	Potential impact	Receptor	Existing control measures	Significance justification	Impact significance	Additional control measures	Residual impact significance
<b>the site and interactions with wildlife.</b>			will be regularly inspected to check its integrity, overall condition and remove any climbing vegetation that could attract fauna.  Any fauna that has managed to enter the site shall be immediately removed.	birds, reptiles and invertebrates may be present in small quantities and will be excluded from the site by the security fence.		Biodiversity Management Plan already place.	
<b>The physical presence of crude oil storage tanks within the site.</b>	Local change in landscape character from the presence of unnatural structures/features.  Negative visual impact including reflection of sunlight from structures/features.	Landscape. Local communities.	All oil storage tanks and other equipment to be placed within the existing site.	The nearest community (Nakuklas) is located approximately 7km from the site and lies outside of the area that will be affected by the visual change. There are no protected or endangered species that have been observed in the vicinity of the site.	<b>Minor</b>	Local communities to be informed about EWT activities and presence of crude oil storage tanks.	<b>Negligible</b>
<b>The generation of artificial light.</b>	Creation of a nuisance to local communities.  Disturbance of local fauna.	Local communities. Fauna.	Artificial lighting will be positioned so that the extent of light emissions beyond the site boundary will be minimised to the extent possible.  The use of artificial lighting will be minimised to the extent possible.	The nearest community (Nakuklas) is located approximately 7km from the site and lies outside of the area that will be affected by any light spill beyond the site boundary. There are no protected or endangered species that have been observed in the vicinity of the site.	<b>Minor</b>	Local communities to be informed about EWT activities and the use of artificial lighting.	<b>Negligible</b>

## **11 Environmental and Social Management Plan**

### **11.1 Introduction**

This Section presents the Environmental and Social Management Plan (ESMP) for the EWT Project and consolidates all mitigation and control measures for the identified environmental and social risks and impacts. The objectives of the ESMP are to:

Consolidate the mitigation and control measures into a concise summary that can be used during implementation of the project; and

Define the associated roles and responsibilities.

### **11.2 Environmental and social monitoring during the project**

The ESMP will be used during pre-mobilisation discussions with Tullow's EWT Project contractor(s) that will focus on environmental and social mitigation and control measures. During implementation of the project itself, Tullow will monitor the performance of the EWT contractor(s) to check that they are adhering to the requirements of the ESMP through a series of inspections and audits. All non-compliances will result in a formal corrective action request being sent to the contractor in addition to further checks by Tullow to ensure that the ESMP is being adequately implemented.

Table 19: Environmental and Social Management Plan – Routine events

Routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
<b>The generation of noise.</b>	<ul style="list-style-type: none"> <li>• Creation of a nuisance to local communities.</li> <li>• Disturbance of local fauna</li> </ul>	<ul style="list-style-type: none"> <li>• Local communities.</li> <li>• Fauna.</li> </ul>	<ul style="list-style-type: none"> <li>• Use of well testing rig that is designed and operated in accordance with Good International Industry Practice (GIIP).</li> <li>• The rig and all other equipment to be maintained according to the manufacturer's specifications.</li> <li>• Well testing rig to be located in the centre of the well pad to provide the maximum distance for noise attenuation to the site boundaries.</li> <li>• Construction of an earth berm around perimeter of site to act as a noise barrier.</li> </ul>	<ul style="list-style-type: none"> <li>• Tullow.</li> <li>• Contractor.</li> <li>• Contractor.</li> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Before mobilisation.</li> <li>• During testing activities.</li> <li>• Well pad preparation.</li> <li>• Well pad preparation.</li> </ul>
<b>The generation of air emissions (GHG and non-GHG) from the use of equipment and road vehicles.</b>	<ul style="list-style-type: none"> <li>• Deterioration to local air quality (non-GHG emissions)</li> <li>• Contribution to global climate change (GHG emissions).</li> </ul>	<ul style="list-style-type: none"> <li>• Local air quality.</li> <li>• Local communities.</li> <li>• Global climate.</li> </ul>	<ul style="list-style-type: none"> <li>• Use of well testing rig that is designed and operated in accordance with Good International Industry Practice (GIIP).</li> <li>• The rig and all other equipment to be maintained according to the manufacturer's specifications.</li> <li>• Separators to be designed to effectively separate oil from associated gas to ensure only gas is flared.</li> <li>• Use of well-maintained road vehicles.</li> </ul>	<ul style="list-style-type: none"> <li>• Tullow.</li> <li>• Contractor.</li> <li>• Contractor.</li> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Before mobilisation.</li> <li>• During testing activities.</li> <li>• Before mobilisation and ongoing monitoring.</li> <li>• During entire project.</li> </ul>

Routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
<b>The generation of dust from the use of vehicles.</b>	<ul style="list-style-type: none"> <li>Deterioration to local air quality.</li> <li>Creation of a nuisance to local communities.</li> <li>Reduction in availability of vegetation used for animal grazing due to the settlement of dust on plant leaves.</li> </ul>	<ul style="list-style-type: none"> <li>Local air quality.</li> <li>Local communities.</li> </ul>	<ul style="list-style-type: none"> <li>Existing road networks to only be used.</li> <li>All off-road driving prohibited without approval from the site supervisor.</li> <li>Drivers to adhere to Tullow vehicle management requirements, which include speed limits that reflect the specific type of road, driver behaviour and training.</li> <li>Inform local communities of project activities, including use of vehicles on the road network.</li> <li>Use road marshals along frequently used road networks to warn local people of vehicle movements.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor.</li> <li>Contractor.</li> <li>Contractor.</li> <li>Tullow.</li> <li>Tullow.</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>During entire project.</li> <li>Contractor.</li> <li>Before mobilisation.</li> <li>During entire project.</li> </ul>
<b>The generation of sewage from the presence of a workforce.</b>	<ul style="list-style-type: none"> <li>Soil and groundwater contamination.</li> </ul>	<ul style="list-style-type: none"> <li>Soil.</li> <li>Groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>Sewage treatment system to be adequately sized to reflect the expected number of workers present.</li> <li>System to be maintained according to the manufacturer's specifications and monitored closely during operation to ensure it is functioning correctly.</li> </ul>	<ul style="list-style-type: none"> <li>Tullow.</li> <li>Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>Before mobilisation.</li> <li>During entire project.</li> </ul>
<b>The abstraction of groundwater from boreholes.</b>	<ul style="list-style-type: none"> <li>Reduction in the availability of local groundwater supplies.</li> <li>Groundwater over</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater.</li> <li>Local communities.</li> </ul>	<ul style="list-style-type: none"> <li>All water abstraction to occur using existing boreholes that Tullow regularly uses for ongoing operations which have already been permitted by WRMA (Nakuklas 9 and 10). No new boreholes to be drilled.</li> <li>Boreholes to be monitored in accordance with the existing groundwater monitoring programme that</li> </ul>	<ul style="list-style-type: none"> <li>Tullow.</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>Ongoing</li> </ul>

Routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
	abstraction resulting in deeper saline water mixing of with upper freshwater horizons.		periodically checks groundwater elevation and water quality.	• Tullow.	monitoring in accordance with wider monitoring programme.
<b>The use of road vehicles on the public road network and a road traffic incident.</b>	<ul style="list-style-type: none"> <li>Increased risk to community health and safety resulting in an injury/fatality, or damage to private property.</li> <li>Loss of livestock resulting in economic loss.</li> </ul>	<ul style="list-style-type: none"> <li>Local communities.</li> </ul>	<ul style="list-style-type: none"> <li>Drivers to adhere to Tullow vehicle management requirements, which include speed limits that reflect the specific type of road, driver behaviour and training.</li> <li>Existing road networks to only be used.</li> <li>All off-road driving is prohibited unless authorised by the Site Supervisor.</li> <li>Inform local communities of project activities, including use of vehicles on the road network.</li> <li>Use road marshals along frequently used road networks to warn local people of vehicle movements.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor.</li> <li>Contractor.</li> <li>Contractor.</li> <li>Tullow</li> <li>Tullow</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>During entire project.</li> <li>During entire project.</li> <li>Before mobilisation.</li> <li>During entire project.</li> </ul>
<b>The use of road vehicles to transport equipment, materials and workers.</b>	<ul style="list-style-type: none"> <li>Introduction of alien and invasive species affecting existing plant species, biodiversity and pastoralist livelihoods.</li> </ul>	<ul style="list-style-type: none"> <li>Biodiversity.</li> <li>Local communities.</li> </ul>	<ul style="list-style-type: none"> <li>Kenyan vehicles only to be used.</li> </ul>	<ul style="list-style-type: none"> <li>Tullow and contractor.</li> <li>Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>During entire project.</li> </ul>

Routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
<b>The generation of hazardous and non-hazardous waste.</b>	<ul style="list-style-type: none"> <li>Soil and groundwater contamination.</li> </ul>	<ul style="list-style-type: none"> <li>Soil.</li> <li>Groundwater.</li> <li>Biodiversity.</li> <li>Local community health.</li> </ul>	<ul style="list-style-type: none"> <li>All waste to be segregated and placed into receptacles that are appropriate based upon the type of waste in accordance with standard Tullow waste management procedures.</li> <li>Waste containers to be securely strapped to road vehicles during transit, to make sure content does not escape.</li> <li>All waste to be transported to Ngamia-1 in accordance with established Tullow waste management procedures.</li> <li>Ongoing monitoring of waste movements using Waste Transfer Notes.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor.</li> <li>Contractor.</li> <li>Contractor and Tullow.</li> <li>Tullow.</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>During entire project.</li> <li>During entire project.</li> <li>During entire project.</li> </ul>
<b>The presence of a security fence surrounding the site and interactions with wildlife.</b>	<ul style="list-style-type: none"> <li>Animal injury or mortality resulting from an interaction between fauna and the security fence/site.</li> </ul>	<ul style="list-style-type: none"> <li>Fauna.</li> </ul>	<ul style="list-style-type: none"> <li>The existing security fence surrounding the site will prevent the entry of fauna.</li> <li>During site operations the security fence will be regularly inspected to check its integrity, overall condition and remove any climbing vegetation that could attract fauna.</li> <li>Any fauna that has managed to enter the site shall be immediately removed. Tullow Wildlife and Livestock Protection Guidelines are in place for rescue and recovery of wildlife.</li> </ul>	<ul style="list-style-type: none"> <li>Tullow.</li> <li>Tullow.</li> <li>Tullow.</li> </ul>	<ul style="list-style-type: none"> <li>During entire project.</li> <li>During entire project.</li> <li>During entire project.</li> </ul>
<b>The physical</b>	<ul style="list-style-type: none"> <li>Local change in</li> </ul>	<ul style="list-style-type: none"> <li>Landscape.</li> </ul>	<ul style="list-style-type: none"> <li>All oil storage tanks and other equipment to be placed</li> </ul>	<ul style="list-style-type: none"> <li>Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>Well pad</li> </ul>

Routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
<b>presence of crude oil storage tanks within the site.</b>	<p>landscape character from the presence of unnatural structures/features.</p> <ul style="list-style-type: none"> <li>Negative visual impact including reflection of sunlight from structures/features.</li> </ul>	<ul style="list-style-type: none"> <li>Local communities.</li> </ul>	<p>within the existing site.</p> <ul style="list-style-type: none"> <li>Local communities to be informed about EWT activities and presence of crude oil storage tanks.</li> </ul>	<ul style="list-style-type: none"> <li>Tullow.</li> </ul>	<p>preparation.</p> <ul style="list-style-type: none"> <li>Before mobilisation.</li> </ul>
<b>The generation of artificial light.</b>	<ul style="list-style-type: none"> <li>Creation of a nuisance to local communities.</li> <li>Disturbance of local fauna.</li> </ul>	<ul style="list-style-type: none"> <li>Local communities.</li> <li>Fauna.</li> </ul>	<ul style="list-style-type: none"> <li>Artificial lighting will be positioned so that the extent of light emissions beyond the site boundary will be minimized to the extent possible.</li> <li>The use of artificial lighting will be minimized to the extent possible.</li> <li>Local communities to be informed about EWT activities and the use of artificial lighting.</li> </ul>	<ul style="list-style-type: none"> <li>Contractor.</li> <li>Contractor.</li> <li>Tullow.</li> </ul>	<ul style="list-style-type: none"> <li>Well pad preparation.</li> <li>During entire project.</li> <li>Before mobilisation.</li> </ul>

Table 20: Environment and Social Management Plan – Non-routine events

Non-routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
<b>The storage of crude oil on site in tanks and loss of primary containment.</b>	<ul style="list-style-type: none"> <li>• Soil and groundwater contamination.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil.</li> <li>• Groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>• All crude oil tanks to be fitted with impermeable bunding with a minimum capacity of 110% of total tank volume.</li> </ul>	<ul style="list-style-type: none"> <li>• Tullow and contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Well pad preparation.</li> </ul>
<b>The storage of chemicals and diesel on site in tanks and loss of primary containment.</b>	<ul style="list-style-type: none"> <li>• Soil and groundwater contamination.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil.</li> <li>• Groundwater.</li> </ul>	<ul style="list-style-type: none"> <li>• All chemical and diesel tanks to be fitted with impermeable secondary bunding with a minimum capacity of 110% of total tank volume.</li> <li>• Spill kits to be available on site.</li> <li>• Regular inspection of all chemical and diesel storage tanks during the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Tullow and contractor.</li> <li>• Contractor.</li> <li>• Tullow and contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Well pad preparation.</li> <li>• Well pad preparation.</li> <li>• During entire project.</li> </ul>
<b>The storage of produced water in a lined pit and loss of primary containment following a leak.</b>	<ul style="list-style-type: none"> <li>• Soil and groundwater contamination.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil.</li> <li>• Groundwater.</li> <li>• Local communities.</li> </ul>	<ul style="list-style-type: none"> <li>• Before use the existing lined pit will be visually inspected to check the integrity of the liner.</li> <li>• Regular inspection of the produced water pit during the project.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor.</li> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Well pad preparation.</li> <li>• During entire project.</li> </ul>
<b>The potential for a release of gas to occur due to a surge in gas volume during well testing.</b>	<ul style="list-style-type: none"> <li>• Deterioration to local air quality (non-GHG emissions).</li> <li>• Contribution to global climate change (GHG emissions).</li> </ul>	<ul style="list-style-type: none"> <li>• Local air quality.</li> <li>• Local communities.</li> <li>• Global climate.</li> </ul>	<ul style="list-style-type: none"> <li>• The testing rig to be continuously monitored.</li> <li>• Adherence to existing Tullow Well Monitoring Procedures.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor.</li> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• During entire project</li> <li>• During entire project.</li> </ul>

Non-routine events					
Aspect	Potential impact	Receptor	Summary of mitigation and monitoring measures	Responsibility	Timing
			<ul style="list-style-type: none"> <li>• Use of an emergency well shutdown valve downstream on the well head.</li> <li>• A series of audible alarms will be installed to check for the presence of unignited gas.</li> <li>• Site-specific Emergency Response Plan to be prepared which will describe the actions to be taken in the event of a sudden surge in gas volume.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor.</li> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Well pad preparation.</li> <li>• Before mobilization.</li> </ul>
<b>The potential for fire/explosion to occur during well testing.</b>	<ul style="list-style-type: none"> <li>• Soil and groundwater contamination.</li> <li>• Deterioration to local air quality (non-GHG emissions).</li> <li>• Contribution to global climate change (GHG emissions).</li> <li>• Community health and safety.</li> </ul>	<ul style="list-style-type: none"> <li>• Soil.</li> <li>• Groundwater.</li> <li>• Local air quality.</li> <li>• Local communities.</li> <li>• Global climate.</li> </ul>	<ul style="list-style-type: none"> <li>• Site-specific Emergency Response Plan to be prepared which will describe the actions to be taken in the event of a fire/explosion.</li> </ul>	<ul style="list-style-type: none"> <li>• Contractor.</li> </ul>	<ul style="list-style-type: none"> <li>• Before mobilization.</li> </ul>

## 12 Conclusions

This Environmental Project Report has used existing baseline information that was supplemented by a field visit to gather additional information associated with environmental and social receptors present within the EWT project Aol. The results of fieldwork and the outcome of stakeholder engagement activities have been used to prepare the impact assessment presented in this EPR. The output from the impact assessment process has been used to develop an ESMP that captures all of the relevant mitigation and controls measures to be used throughout the EWT project.

Before Tullow's contractor(s) mobilize to the field, the content of the ESMP will be used so that Tullow's expectations from an environmental and social perspective, are clearly presented and roles and responsibilities are discussed and agreed. During the completion of the EWT project, Tullow will also undertake a series of audits and inspections. Any corrective actions identified will be immediately recorded and written notices will be issued to the relevant contractors, supplemented by additional checks.

Tullow will continue to engage local communities to inform the EWT activities and scope before the start. This process will be closely managed by the Social Performance team, using Field Stakeholder Engagement Officers (FSEO).

## 13 References

Cardno, 2012. Socio Economic Baseline Survey, Phase 1. Data Gathering and Scoping Services. Draft Final Report.

CRA (2011). <http://www.crakenya.org/cra-overview/>.

Earthview Geoconsultants Ltd., (2010). Environmental Impact Assessment of the Proposed Exploratory Well Drilling In Block 10BB, Turkana South And Turkana Central Districts By Africa Oil Kenya B.V.

Millennium Ecosystem Assessment (2005). 'Ecosystems and Human Well-being: Biodiversity Synthesis'.

World Resources Institute (2011). 'Ecosystem Services Review for Impact Assessment: Introduction and Guide to Scoping', 'Ecosystem Services Guidance: Biodiversity and Ecosystem Services Guide and Checklists',

OXFAM (2012). Inter-Governmental Authority for Development (IGAD) Climate Prediction and Application Centre data cited in the 2010-2011 Post Drought Situation Analysis for Northern Kenya – with Special Reference to Turkana & Wajir Counties.

International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD) (2009) - Workers' accommodation: processes and standards - A guidance note by IFC and the EBRD.

Invasive Species Specialist Group (ISSG) of the Species Survival Commission (SSC) of the International Union for Conservation of Nature (IUCN): Global Invasive Species Database (accessed on-line at: <http://www.issg.org/database/welcome/> in August 2014)

IPIECA (2010) - Alien invasive species and the oil and gas industry

World Health Organisation (2010). Kenya: Seismic Hazard Distribution Map.

Kenya National Bureau of Statistics (KNBS) (2009). Kenya population and housing census.

Kenya National Bureau of Statistics (KNBS) and the Society for International Development (SID) (2013). Exploring Kenya's Inequality – Turkana County.

Kiringe, J. W. and Okello, M. M. (2007). 'Threats and their relative severity to wildlife protected areas of Kenya', Applied Ecology and Environmental Research, 5(2): 49–62.

Kiringe, J. W. and Okello, M. M. (2007). 'Threats and their relative severity to wildlife protected areas of Kenya', Applied Ecology and Environmental Research, 5(2): 49–62.

Lamphear, J. (1992). *The Scattering Time: Turkana Responses to Colonial Rule*, Oxford: Clarendon Press.

Maingi, 2008 – Kenya Soil Survey at [http://www.infonet-biovision.org/default/ct/689/agrozones?search=lower midlands 5](http://www.infonet-biovision.org/default/ct/689/agrozones?search=lower+midlands+5) (accessed 08/09/2014).

Millennium Ecosystem Assessment, (2014). [www.maweb.org](http://www.maweb.org).

Ministry of Health (2013). *Turkana County – Health at a Glance* (downloaded in August 2014 from [www.healthpolicyproject.com](http://www.healthpolicyproject.com)).

Ministry of Public Health and Sanitation (MPHS)(2009). *Health report, Turkana Central and Loima Districts*.

Notenbaer, A. Thornton, P. and Herrero, M. (2008). 'Discussion Paper No. 7 Targeting and Innovation: Livestock development and climate change in Turkana district, Kenya', Annex 1: International Livestock Research Institute.

Pavitt, N. (1997) *Turkana*, London: Harvill Press.

Radar Technologies International (2013) *Advanced Survey of Groundwater Resources of Northern and Central Turkana, Kenya, Final Technical Report*.

Rao, S. (2013). *Assessing seismic risk in Kenya*. GSDRC Helpdesk Research Report 964. Birmingham, UK: GSDRC, University of Birmingham.

RSK (2014). *Lake Turkana Development Plan. Strategic Environmental Assessment. Scoping Report (Final)*

Tullow (2013) – T-KE-EHS-PLN-0014: *Biodiversity Management Plan*

Tullow (2013) - T-EHS-GUD-0019: *Wildlife and Livestock Protection Guidelines*

Tullow: *Code of Business Conduct* (available on-line for consultation or free download via <http://www.tullowoil.com/index.asp?pageid=379>)

Tullow Safety Rules, T-EHS-STD-001, current revision (copy downloaded in June 2014 from [http://www.tullowoil.com/supplier\\_centre/index.asp?pageid=52](http://www.tullowoil.com/supplier_centre/index.asp?pageid=52) )

USGS National Earthquake Information Center, there (<http://comcat.cr.usgs.gov/>).

US Geological Service : *Earthquake Hazards Program - Kenya* website at: [http://comcat.cr.usgs.gov/earthquakes/eventpage/pde20120122210335950\\_10#summary](http://comcat.cr.usgs.gov/earthquakes/eventpage/pde20120122210335950_10#summary) (accessed 21<sup>st</sup> August 2014)

WHO (2011) *The WHO e-atlas of disaster risk for the African Region. Volume 1. Exposure to natural hazards. Version 2.0*.

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