ESIA REPORT *VOLUME III*

Project Oil Kenya - Upstream Environmental and Social Impact Assessment (ESIA)

Submitted to:

Tullow Kenya BV

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September 2021

1433956.718.A1

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ANNEX I

ESIA ToR and Scoping Report

A

A1 ESIA Terms of Reference

14 March 2016 Project No. 1433956.517/A.1

David Ongare
National Environment Management Authority
P.O. Box 67839 - 00200
Popo Road
Nairobi
Kenya

ENVIRONMENTAL IMPACT AND SOCIAL ASSESSMENT (ESIA) TERMS OF REFERENCE FOR THE PROPOSED SOUTH LOKICHAR UPSTREAM DEVELOPMENT PROJECT SOUTH LOKICHAR, NORTH EAST TURKANA COUNTY

The following presents a redrafted Terms of Reference (TOR) for the Environmental and Social Impact Assessment (ESIA) for the proposed South Lokichar Upstream Development Project South Lokichar. This TOR has been redrafted in a format according to NEMA's request. It supersedes the ToR presented as an appendix to our Project Report (14514160360.516/A.2, dated December 2015).

The ToR should be read in conjunction with the Project Report, which contains significant detail on the Project Description, the proposed ESIA methodology, the Policy, Legal and Institutional Framework, and data availability, data requirements and potentially significant effects for each technical topic in the ESIA.

The objective of the TOR is to prepare the ESIA for the proposed South Lokichar Upstream Development Project South Lokichar, north east Turkana County. The ESIA will be prepared incompliance with national legislation to commence environmental and social assessments that will be required for permitting and other authorization purposes of the proposed Project.

The ESIA will describe impacts of the proposed project activities and infrastructure within the project area and investigate cumulative impacts.

The ESIA will assure stakeholders that environmental impacts associated with the proposed development are taken into consideration, that stakeholders have been effectively consulted and that mitigation measures and future monitoring have been agreed.

Attached please find the draft Terms of Reference for your review and approval

Yours Faithfully

1.0 INTRODUCTION

Tullow Kenya B.V. (TKBV), a subsidiary of Tullow Oil plc (Tullow), is evaluating the Development of a series of oil discoveries in the South Lokichar Basin, northeast Kenya. Tullow is planning to develop its discoveries to enable production and further exploration to proceed in parallel. The South Lokichar Development Project includes oil discoveries within Blocks 10BB and 13T and represents the Full Field Development (FFD). The intention is to construct an Export Pipeline to the Kenyan coastline, with a Marine Export Terminal.

In accordance with the *Environmental (Impact Assessment & Audit) Regulations 2003 (as amended)* TKBV will need approval from the National Environment Management Authority (NEMA) before the project can proceed. In order to obtain this approval, an Environmental Impact Assessment (EIA) is required.

This Terms of Reference (TOR) covers the Upstream activities of oil production and export, excluding the oil export pipeline to the Kenyan coastline and Marine Export Terminal. Separate ESIAs will be prepared for the Export Pipeline and Marine Export Terminal.

2.0 PROJECT DESCRIPTION

Description of the Project and Project Components

This Project Description in the ESIA will follow a similar approach to the presentation of project description in the Project Report. It will focus on the development of wells, a gathering system, a CPF and associated infrastructure. The Upstream Project Area of the South Lokichar Development Project spans several oil fields and each field has multiple compartmentalised reservoirs.

The project description will draw upon information generated by various infrastructure and logistics studies commissioned by Tullow to study options associated with the provision of power, location of key facilities and the use of existing road and rail routes for the transport of goods and materials to project locations.

The Project Description will describe the following:

- The environmental and social setting;
- Design Parameters;
- Infrastructure during construction and operations including:
  - Well pads;
  - Central Processing Facility;
  - Water;
  - The integrated waste management facility;
  - Transportation;
  - Power;
  - Accommodation;
  - Interface with the proposed oil pipeline;
  - Infield pipelines; and
  - Fuel storage.
- Decommissioning; and
- Associated facilities.

The Upstream activities include the following key components:

- Well pads in different fields within the South Lokichar Basin;
- Interconnecting flowlines;
- A Central Processing Facility (CPF); and
- Support facilities and infrastructure.

Justification for the Project

The South Lokichar Development Project will generate significant capital economic flows that will support financial and socio-economic policies of the Government of Kenya (GoK). Kenya is aiming to become an East African hub for the export of oil to international markets, where crude oil from Uganda and potentially other countries, is channelled through a Marine Export Terminal on the Indian Ocean coast of Kenya.

The Project requires the direct (and indirect) employment of national citizens and businesses, many of whom will receive training and skill development opportunities which will increase the technical and vocational capacity of Kenyans within the rapidly emerging oil and gas sector. The use of national citizens to the maximum extent possible during the ESIA, completion of technical studies and during construction and operation of the South Lokichar Development Project, is also in alignment with national government policy.

Glossary of terms

A glossary of technical project terms, acronyms and abbreviations included in the ESIA will be provided before the main text of the ESIA report.

Project proponent

This section of the ESIA will provide details of the project proponent including details of joint venture partners associated with the project.

Project objectives and scope

This section of the ESIA will outline the project objectives and events which have contributed to the formation of the project including: project alternatives, the timescale for implementation, the projected project life time, construction and establishment costs, and any actions undertaken to date within the project area. The current status of the project will be described including the relationship of the project to other developments or actions which could affect the project now or at a later date. Implications of not proceeding with the proposed project will also be discussed.

3.0 METHODOLOGY OF PREPARING FULL STUDY ESIA

The ESIA methodology will describe each stage of the project and the process, timing and decisions involved at each stage. A brief description of studies which have been undertaken to develop the project and inform the ESIA will be provided. Baseline studies undertaken before the ESIA process started will be described.

This section will ensure that the relevant legislation is addressed, that the process to be followed by the reader is clear, and that stakeholders are aware of opportunities for input and participation.

The ESIA and the scope of work under these TOR also will be carried out through two phases and will have two main deliverables: **(i) Project Report);(ii) Environmental and Social Impact Assessment (ESIA).**

4.0 PROJECT REPORT

The Project report (14514160360.516/A.2, dated December 2015) has been completed and has been delivered to NEMA.

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Identification of Potentially Significant Effects

Under each of the subsections in Section 6 of the Project Report, potentially significant effects are described based on a literature search and current understanding of the project description and likely environmental and social effects of the Project. Section 6 of the Project Report also presents the next steps for baseline data gathering and impact analysis of the potentially significant effects identified.

Stakeholder Engagement

The objective of this engagement is to ensure that legislative requirements are met; sources of information and expertise are identified; stakeholder concerns and expectations are registered and addressed; and affected communities have the opportunity to discuss Project risks and impacts, and proposed mitigation and monitoring measures.

This section of the Project Report describes early engagement with NEMA, the project report stage consultation and provides results. It includes the identification of the relevant stakeholders, identifying the range of community, public and (international) stakeholders concerns about the proposed project as recorded in consultations.

5.0 BASELINE ENVIRONMENTAL AND SOCIAL INFORMATION AND DATA

Table 1 presents a summary of the likely approach to the ESIA Baseline per technical topic.

Table 1: likely approach to ESIA baseline data gathering

Topic	Potentially significant effects	Likely Approach
Biodiversity and Ecology	Direct loss/conversion of natural habitats Indirect loss, conversion or disturbance of natural habitats Introduction of invasive species, pests or diseases Barriers to movement Contamination Population influx (Harvesting of plants, fibre and wood; bush meat hunting)	Baseline: Seasonal vegetation and flora surveys Vegetation community mapping, including mapping of modified and natural habitat Seasonal bird surveys Wet season herpetofauna surveys Seasonal terrestrial invertebrate surveys Seasonal large mammal transect surveys Continuous remote camera trapping survey for mammals (up to 1 year) Seasonal small mammal trapping surveys Seasonal bat acoustic monitoring surveys Long wet season fish, macro invertebrate and wetland surveys
Ecosystem Services	All potential effects presented above for biodiversity Ecosystems affecting capacity to supply services Population influx Changes or restricted access to water resources for livestock and human consumption Changes to land uses Changes to cultural heritage links and socio-economic patterns relevant to ecosystem services	Baseline Liaison between biodiversity, cultural heritage and social and land specialists to compile a targeted questionnaire on provisioning ecosystem service demand for use during stakeholder engagement and focus groups Targeted community engagement (focus group or key informant) to understand current ecosystem services and their uses Relevant baseline data will be gathered from review of baseline biodiversity, water, and soil studies to assess the condition and capacity of ecosystems to deliver services
Soil, Terrain and Geomorphology	Soil quality Erosion Compaction Land suitability	Baseline: Soil sampling and analysis Terrain descriptions
Water	Surface and groundwater quality Surface water flow and runoff regime Groundwater levels	Baseline: Water sampling and analysis Surface water flow and rainfall-runoff characterisation Groundwater levels

Topic	Potentially significant effects	Likely Approach
Seismicity and Geology	Built structures Infrastructure	Baseline: Desk based study using existing data from national institutions and other secondary sources
Air and Climate	Air quality Direct and indirect acidification, eutrophication, toxicity Fugitive dust deposition leading to soiling or smothering Odour nuisance Contribution to global emissions of greenhouse gases	Baseline: Air quality monitoring of key pollutants: fine particulates, combustion gases and VOCs Monitoring of dust deposition rates.
Noise and Vibration	Noise for human and ecological receptors, inc livestock Vibration causing structural damage.	Baseline: Ambient noise levels at representative locations including diurnal variation.
Landscape and Visual	Existing views and visual amenity of receptors Physical changes to the character and aesthetics of the existing landscape	Baseline: Preparation of Zone of Theoretical Visibility Mapping the location and type of visual receptors, plus type and extent of landscape character areas If required, photographic recording of receptors and key views during a site visit.
Cultural Heritage	Loss or damage to surface or buried remains, above-ground features and/or sacred or historic places Changes to culturally distinct patterns of life and traditional cultures	Baseline: Review of available information Field survey to gather site specific information Consultations with local communities and leaders to identify culturally or historically significant sites and traditional practices and beliefs.
Social	Influx and migration. Changes in taxes and other payments. Direct and indirect employment for skilled and non-skilled labour. Business opportunities/local content. Inflation Physical and economic displacement Changes in community health, safety and security provision. Changes in the workforce through skill and training development opportunities. Disadvantaged and vulnerable groups.	Baseline: Data collection through site specific surveys (e.g. land use), focus group, key informant interviews at the community and non-community levels and secondary literature research; Collect local and regional health data through database research by medical practitioners and focused key local informant interviews

6.0 POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

This section will describe the applicable legislation, regulations, policies and standards which will apply to the project including:

- Governance and Administrative Structure
- Kenyan Policy and Legislative Requirements
- International Guidance and Standards
- International Conventions
- TKBV Policy
- Required Authorisations

This section will outline procedures, which will be followed to obtain the relevant permits to begin construction and define future steps including the timeline of the permitting process.

7.0 ENVIRONMENTAL AND SOCIAL ISSUES

Table 2 presents a summary of the likely approach to the impact analysis per technical topic.

Table 2: likely approach to impact assessment

Topic	Potentially significant effects	Likely Approach
Biodiversity and Ecology	Direct loss/conversion of natural habitats Indirect loss, conversion or disturbance of natural habitats Introduction of invasive species, pests or diseases Barriers to movement Contamination Population influx (Harvesting of plants, fibre and wood; bush meat hunting)	Impact Assessment: Habitat-area based impact analysis using selected ecosystem or community-level indicators or biodiversity features using GIS Quantification of effects relative to baseline conditions by association of particular species or species groups with mapped vegetation communities or habitat types identified as indicators Specific analysis will be conducted for species of concern identified in the baseline Analysis of predicted changes to any areas identified as Critical Habitat
Ecosystem Services	All potential effects presented above for biodiversity Ecosystems affecting capacity to supply services Population influx Changes or restricted access to water resources for livestock and human consumption Changes to land uses Changes to cultural heritage links and socio-economic patterns relevant to ecosystem services	Impact Assessment: Identification of priority ecosystem services Analysis of changes to priority ecosystem services
Soil, Terrain and Geomorphology	Soil quality Erosion Compaction Land suitability	Impact Assessment: GIS soil mapping and land suitability mapping Analysis of changes to soil quality
Water	Surface and groundwater quality	Impact Assessment:

Topic	Potentially significant effects	Likely Approach
	Surface water flow and runoff regime Groundwater levels	Hydrological modelling of rainfall-runoff and analysis of changes to flow Analysis of changes to surface water quality and groundwater quality Changes to groundwater level Quantification of changes to community water supplies.
Seismicity and Geology	Built structures Infrastructure	Impact Assessment: Identification of risks and mitigation required from the engineering design team
Air and Climate	Air quality Direct and indirect acidification, eutrophication, toxicity Fugitive dust deposition leading to soiling or smothering Odour nuisance Contribution to global emissions of greenhouse gases	Impact Assessment: Evaluate impact to air quality through predictive air dispersion modelling Evaluate impact of additional dust deposition Evaluate impact of odour emissions and sources Quantification of greenhouse gas emissions
Noise and Vibration	Noise for human and ecological receptors, inc livestock Vibration causing structural damage.	Impact Assessment: Evaluate effects on noise environment through predictive modelling Identification of potential vibration sources and prediction of vibration levels
Landscape and Visual	Existing views and visual amenity of receptors Physical changes to the character and aesthetics of the existing landscape	Impact Assessment: Updated ZTV's based on final scheme design to provide viewsheds Visual and landscape impact analysis
Cultural Heritage	Loss or damage to surface or buried remains, above-ground features and/or sacred or historic places Changes to culturally distinct patterns of life and traditional cultures	Impact Assessment: Evaluate effects based on baseline findings and develop cultural heritage management plan Intangible impact analysis will inform the socio economic impact analysis
Social	Influx and migration. Changes in taxes and other payments. Direct and indirect employment for skilled and non-skilled labour. Business opportunities/local content. Inflation Physical and economic displacement Changes in community health, safety and security provision. Changes in the workforce through skill and training development opportunities. Disadvantaged and vulnerable groups.	Impact Assessment: Detailed analysis to evaluate potential effects on project-affected people. Develop mitigation and management plans.

8.0 MITIGATION/MONITORING AND ALTERNATIVE DEVELOPMENT

The section will present a comprehensive description of the mitigation and monitoring measures and alternatives that will be considered for project activities and infrastructure.

Environmental and Social Management Plan

The consultant will prepare an Environmental and Social Management Plan (ESMP) for construction, operational and decommissioning phases to identify:(a) these to mitigation responses to potentially adverse impacts;(b) management processes and benefit enhancement to be developed throughout construction, operation and at closure to manage adverse impacts; and(c) the monitoring program to implement to verify compliance with the recommended mitigation, and measure the level of impacts produced by the proposed project.

9.0 PUBLIC CONSULTATIONS AND COMMUNICATION

A Stakeholder Engagement Framework has been prepared by TKBV for the Development Project and a Stakeholder Engagement Plan (SEP) has been prepared for the Upstream ESIA. The stakeholder engagement process has been discussed with NEMA to comply with Kenyan EIA Regulations; and to provide NEMA with an opportunity to comment on the consultation and disclosure activities that will be conducted during the ESIA process.

10.0 ESIA TABLE OF CONTENTS

The following presents an indicative Table of Contents of the South Lokichar Development Upstream ESIA Study:

- Non-Technical Executive Summary;
- Introduction;
- Project Description;
- Project Need and Alternatives;
- Approach to the ESIA;
- Scoping;
- Policy, Legal and Institutional Framework;
- Stakeholder Engagement;
- Environmental including:
  - Climate;
  - Soil, Terrain and Geomorphology;
  - Seismicity and Geology;
  - Air and Climate;
  - Noise and Vibration;
  - Water Quality;
  - Water Quantity;
  - Landscape and Visual;
  - Biodiversity and Ecology;

- Social, including;
  - Administrative Divisions and Governance Structure;
  - Demographics;
  - Infrastructure and Services;
  - Economics, employment and livelihoods;
  - Land Use and Ownership;
  - Community Health and Safety;
  - Education;
  - Social Maladies;
  - Social Capital and Conflict; and
  - Cultural Heritage.
- Ecosystem Services;
- Waste Management;
- Occupational Health;
- Emergency, Accidental and Non-Routine Events Accidents;
- Summary of Impacts and Proposed Mitigation;
- Cumulative Impact Assessment;
- Conclusion; and
- Environmental and Social Management Plans.

11.0 TIME SCHEDULE OF EXECUTING THE ESIA

The environmental and baseline data collection required for the ESIA will take place during 2016 for a duration of not less than 12 months. Following this, the ESIA report will be developed in parallel with the Front End Engineering Design (FEED) phase.

12.0 QUALIFICATIONS AND EXPERIENCE REQUIRED

Experts to execute the Environmental and Social Impact Assessment should comply with NEMA requirements. Key staff in the technical complement may include but not limited to the following:

- **Environmental Specialist/Team Leader** - (with 10 yrs experience). He/she will be well familiar with IFC and World Bank Environmental and Social safeguards policies.
- **Social Development expert**- (with 10 yrs experience). She/he will establish the socio-economic environment of the proposed project area, including land use; assess likely impact of the project and proposed mitigation or management.
- **Ecologist/Natural Resources Management expert** (with 10 yrs experience) - will review the ecosystem, and other biophysical aspects of the project area and assess the likely impact of the project, including cumulative, induced ecosystem wide impacts within the area of influence.

We attach a selection of CVs for key specialists in the ESIA team.

EMC/GOLDER ASSOCIATES (UK) LTD

Andrew Morsley
ESIA Project Manager

Tito Kodiaga
ESIA Asst Project Manager

AJM/ss

Attachments: Curriculum Vitae

ANNEX I

A

ESIA ToR and Scoping Report

A2 ESIA Scoping Project Report

December 2015

TULLOW KENYA B.V.

South Lokichar Development, ESIA Project Report

Submitted to:
Tullow Kenya B.V.
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West End Towers
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P.O Box 63298-00619
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REPORT

Report Number 14514160360.516/A.2

Distribution:

Tullow Kenya B.V. - 1 copy
Golder Associates (UK) Ltd - 1 copy

EMC Consultants
ENVIRONMENTAL KNOWLEDGE IN PRACTISE

Golder Associates

Abbreviations

AEWA	The African-Eurasian Water-bird Agreement
AFEX	Africa Expeditions
AOI	Area of Influence
BLM	Bureau of Land Management
BSI	British Standards Institute
CEC	Cation Exchange Capacity
CHAA	Critical Habitat Assessment Area
CIA	Cumulative Impact Assessment
CITES	Convention on International Trade in Endangered Species
CFA	Central Facilities Area
CPF	Central Processing Facility
E&A	Exploration and Appraisal
EBA	Endemic Bird Areas
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIAAR	The EMCA (Impact Assessment and Audit) Regulations
EMCA	Environmental Management and Coordination Act
ERC	Energy Regulatory Commission
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FEED	Front-End Engineering Design
FFD	Full Field Development
FPIC	Free, Prior and Informed Consent
GBIF	Global Biodiversity Information Facility
GIIP	Good International Industry Practice
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GoK	Government of Kenya
HCV	High Conservation Value
IBAT	Integrated Biodiversity Assessment Tool
IBA	Important Bird Areas
ICMM	International Council on Mining and Metals
IFC	International Finance Corporation
ILRI	International Livestock Research Institute
IPIECA	International Petroleum Industry Environmental Conservation Association
ISB	Integrated Support Base
IWMF	Integrated Waste Management Facility
KBA	Key Biodiversity Areas
KNBS	Kenya National Bureau of Statistics
KPHC	Kenya Population and Housing Census

BPD	Barrels per Day
Mbopd	Thousand barrels of oil per day
Mbwpd	Thousand barrels of water per day
MCA	Member of County Assembly
MEWNR	The Ministry of Environment, Water and Natural Resources
MMscfd	Million Standard Cubic Feet per Day
MRF	Materials Recovery Facility
MW	Megawatts
NDMA	National Drought Management Authority
NEC	National Environmental Council
NEMA	National Environment Management Authority
NGOs	Non-Government Organisations
NMK	National Museums of Kenya
NRT	Northern Rangelands Trust
NTS	Non-Technical Summary
OM	Organic Matter
PAP	Project Affected Peoples
PCC	Public Complaints Committee
PCP	Progressing cavity pumping
PS	Performance Standards
RCIAs	Rapid Cumulative Impact Assessments
SBM	Synthetic Based Mud
SSEA	Safety Sustainability and External Affairs
SEPs	Stakeholder Engagement Plans
SERC	Standard and Enforcement Review Committee
SID	Society for International Development
SPM	Single Point Mooring
SSEA	Safety Sustainability and External Affairs
TKBV	Tullow Kenya B.V.
TOES	Tullow Oil Environmental Standards
TOR	Terms of Reference
VOCs	Volatile organic compounds
WBM	Water Based Mud
WHO	World Health Organisation
WRI	World Resources Institute
ZTV	Zone of Theoretical Visibility

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APPENDICES

1.0 INTRODUCTION

1.1 Overview of the Proposed Development

Tullow Kenya B.V. (TKBV), a subsidiary of Tullow Oil plc (Tullow), is evaluating the Development of a series of oil discoveries in the South Lokichar Basin, northeast Kenya. Tullow is planning to develop its discoveries to enable production and further exploration to proceed in parallel. The South Lokichar Development Project includes oil discoveries within Blocks 10BB and 13T and represents the Full Field Development (FFD) of up to 5 fields: Amosing, Ngamia, Ekales, Twiga, Agete fields. The intention is to construct an Export Pipeline to the Kenyan coastline, with a Marine Export Terminal.

In accordance with the *Environmental (Impact Assessment & Audit) Regulations 2003 (as amended)* TKBV will need approval from the National Environment Management Authority (NEMA) before the project can proceed. In order to obtain this approval, an Environmental Impact Assessment (EIA) is required. The strategy TKBV have adopted is to prepare an Environmental and Social Impact Assessment (ESIA) for the Upstream activities of the Project, with separate ESIAs prepared for the Export Pipeline and Marine Export Terminal. A Cumulative Impact Assessment (CIA) will also be prepared to identify and assess cumulative impacts that arise from the impacts associated with the Export Pipeline and Marine Export Terminal, plus other third-party projects likely to be implemented in the future within the same geographical region.

The location of the South Lokichar Development Project is illustrated in Plate 1-1.

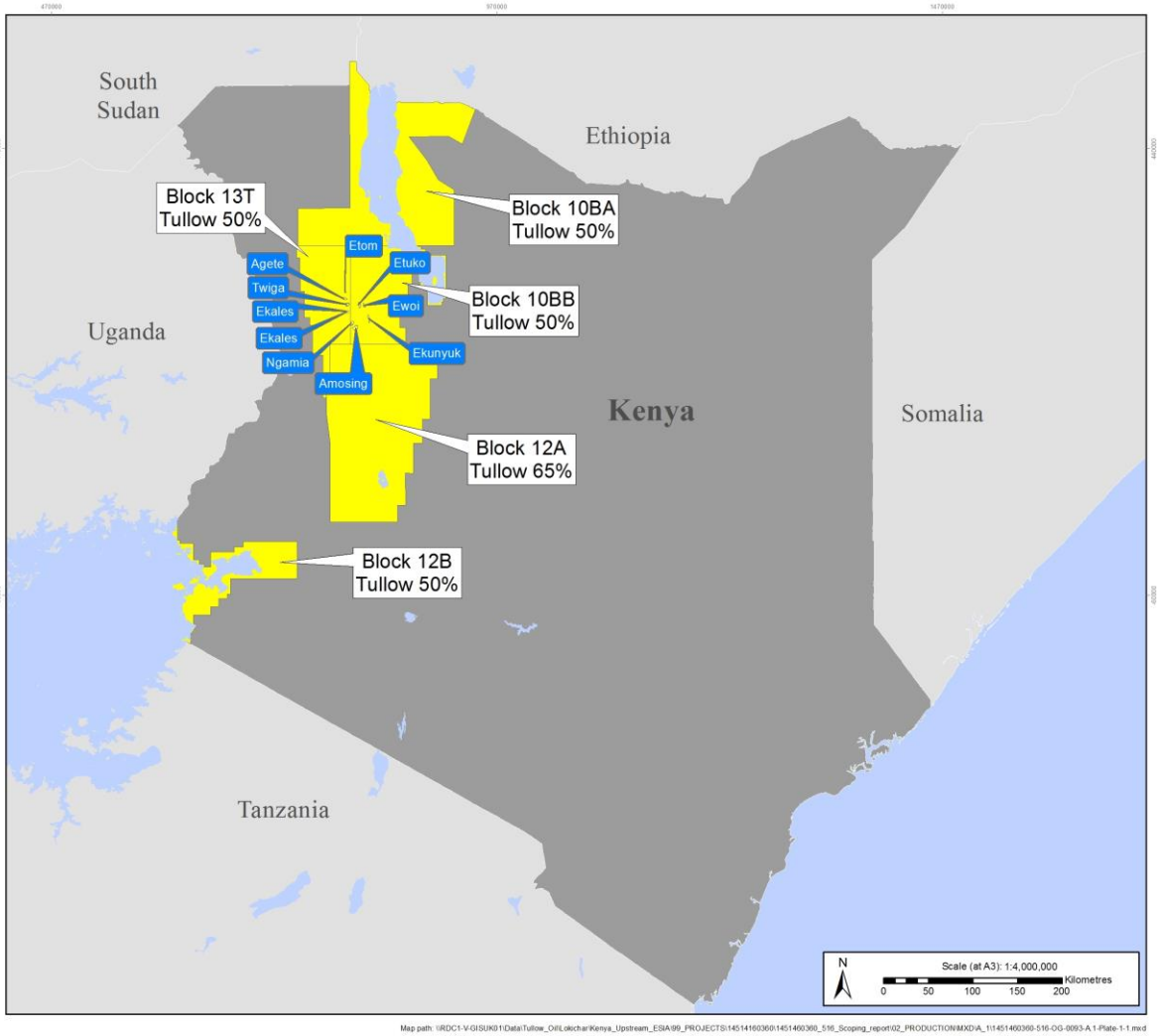

Plate 1-1 Location of the South Lokichar Development Project

1.1.1 Upstream Project

The Upstream activities include the following key components:

- Well pads in different fields within the South Lokichar Basin;
- Interconnecting flowlines;
- A Central Processing Facility (CPF); and
- Support facilities and infrastructure.

The likely Area of Influence (AOI) for Upstream activities is shown in Figure 1. At this stage it includes all infrastructure and activities under consideration. The likely AOI includes options currently being considered for water abstraction, logistics and power supply, for which an optioneering process is currently being undertaken. The preferred option will be based on engineering, financial, environmental and social considerations and will be confirmed before the commencement of the impact analysis. Once preferred options have been confirmed the AOI will be reduced accordingly.

1.1.2 Export Pipeline and Marine Export Terminal

The South Lokichar Development Project will require facilities for the transportation and export of the crude oil. This is expected to comprise a buried, heated crude oil export pipeline to a terminal on the Indian Ocean coast of Kenya. Tullow are currently reviewing a variety of oil export pipeline routes and marine terminal locations. Discussions between the Government of Kenya and other key stakeholders are ongoing to agree on the final route of the pipeline.

Separate ESIAs will be completed for the export pipeline and the marine export terminal in the future. Tullow's future role in the environmental permitting process required for the oil export pipeline and marine terminal is not yet determined and this aspect forms part of the ongoing discussion with various stakeholders.

1.2 Purpose of the Project Report

In accordance with the *Environmental (Impact Assessment & Audit) Regulations 2003 (as amended),* Part III Section 11 (1) an EIA study shall be conducted in accordance with the Terms of Reference developed during a scoping exercise and approved by NEMA. The purpose of the Project Report and accompanying Terms of Reference (TOR) is to present the results of the EIA scoping phase and seek NEMA's approval of the TOR that will be used to complete the rest of the ESIA process.

This Project Report and TOR covers the Upstream activities of the Project only.

1.3 Developer and the Project Team

In 2007 Turkana Drilling Consortium (Kenya) signed a Production Sharing Contract (PSC) for a 100% working interest in newly designated Block 10BB. In 2008 Platform Resources Inc. signed a PSC for a 100% interest in newly designated Block 13T. In 2009 Africa Oil Kenya B.V. (a wholly owned subsidiary of Africa Oil Corporation) acquired Turkana Drilling Consortium (Kenya).

In 2010 Africa Oil Corporation acquired Platform Resources Inc. giving Africa Oil Kenya B.V a 100% interest in both Blocks 10BB and 13T. In 2011 Africa Oil Kenya B.V and Tullow Kenya B.V agreed a farm-in deal whereby Tullow acquired a 50% interest and Operatorship in both Blocks 13T and 10BB. At the time of writing, Africa Oil Kenya B.V and Tullow Kenya B.V have a 50% working interest in both blocks.

The first onshore well in the South Lokichar Basin, Ngamia-1, in Block 10BB, commenced drilling in January 2012 and discovered over 200 m of net oil pay opening up this entire rift basin as a potential major oil province. This has been followed by several further discoveries in the South Lokichar Basin during the exploration phase.

As TKBV's activities move away from the exploration phase and into development, TKBV's Safety Sustainability and External Affairs (SSEA) function has been established to coordinate the three component-specific development ESIAs. The Kenya SSEA team are based in Nairobi and London.

For the Upstream Project ESIA, TKBV has contracted an international ESIA contractor (Golder Associates (UK) Ltd) that is supported by Kenyan-based ESIA consultants (EMC Consultants Ltd).

This Project Report and TOR are submitted by the following NEMA Lead Expert:

Name: Tito Kodiaga (Licence No. 0160)

Name of Firm: EMC Consultants (License No. 6669)

1.4 Structure of Project Report

The structure of the Project Report is summarised below:

Section 1: Introduction

Section 2: Project Need and Alternatives

Section 3: Project Description

Section 4: Approach to the ESIA

Section 5: Policy, Legal and Institutional Framework

Section 6: Technical Topics

Section 7: Emergency Preparedness and Response to Unplanned Events

Appendix A: Terms of Reference.

Appendix B: Scoping Consultation presentation slides.

2.0 PROJECT NEED AND ALTERNATIVES

2.1 Need for the Project

The South Lokichar Development Project will generate significant capital economic flows that will support financial and socio-economic policies of the Government of Kenya (GoK). Kenya is aiming to become an East African hub for the export of oil to international markets, where crude oil from Uganda and potentially other countries, is channelled through a Marine Export Terminal on the Indian Ocean coast of Kenya.

The Project requires the direct (and indirect) employment of national citizens and businesses, many of whom will receive training and skill development opportunities which will increase the technical and vocational capacity of Kenyans within the rapidly emerging oil and gas sector. The use of national citizens to the maximum extent possible during the ESIA, completion of technical studies and during construction and operation of the South Lokichar Development Project, is also in alignment with national government policy.

2.2 Main Alternatives

The Upstream Area was defined using data from seismic surveys, and exploration and appraisal drilling activities. The proposed plan to develop resources is based on results of such exploratory activities. Due to the nature of extraction of such resources, there is no geographical alternative to the Upstream Area of the proposed development.

However, Tullow are considering a number of options for various key elements of the Project, within the upstream project footprint. This optioneering process takes into account environmental, social, financial and operational considerations and will lead to a Project Description which will be included in the Front-End Engineering Design (FEED) and will be assessed by the ESIA.

The options under consideration for the following key elements of the Project are described in Chapter 3.0, and include the following:

- Locations for the CPF;
- Sources of water supply;
- Waste management treatment and disposal options;
- Locations for workforce accommodation areas;
- Locations of infield roads;
- Locations of an airfield; and
- Potential changes to road and rail connections.

3.0 PROJECT DESCRIPTION

This Project Description focuses on the development of wells, a gathering system, a CPF and associated infrastructure. The Upstream Project Area of the South Lokichar Development Project spans five oil fields and each field has multiple compartmentalised reservoirs.

The project description draws upon information generated by various infrastructure and logistics studies commissioned by Tullow to study options associated with the provision of power, location of key facilities and the use of existing road and rail routes for the transport of goods and materials to project locations. These studies include the following:

- South Lokichar Basin Stage1 Development Overall Study Report, A01, 2 February 2015 (Xodus Group Ltd.); and
- Environment Project Report Study for the Proposed Kapese Integrated Support Base, October 2014 (Kurrent Technologies Ltd.).

3.1 Environmental and Social Setting

The Upstream Area lies in a remote, unindustrialised, location, circa 1,000 km from any commercial sea port. No existing infrastructure exists except for some local murram roads and infrastructure associated with the exploration and appraisal drilling campaign completed by TKBV.

The proposed development sites in South Lokichar are located in the Rift Valley to the south and west of Lake Turkana. The whole of the Lokichar area is volcanic and is seismically active.

The Upstream Area of the Project is located in a semi-arid environment with an extensive network of wide shallow ephemeral streams. There are two rainy seasons in the Upstream Project Area, between March and June and between October and December, but rainfall can be sporadic. There are extensive seasonal floodplains in places around the shores of Lake Turkana, particularly at the deltas of the mouths of the rivers that flow into the southern region of the lake. Seasonal wetlands are also located along the Kerio, Turkwel and Lokichar rivers, tributaries of which are located within the Upstream Area, and the Kalamata River which may pass through the Upstream Area pending the completion of the optioneering studies.

The Rift Valley zone is known for its archaeological and anthropological importance with respect to early hominid fossils and artefacts and Lake Turkana itself and adjoining national parks have been declared World Heritage sites. Lake Turkana is also an important ecosystem supporting large populations of Nile crocodile, hippopotamus and fish, and unique flora and fauna assemblages.

Lake Turkana, which is located within the Study Area and extends past the Upstream Area, does form an international border (with Ethiopia). Consequently, there is a possibility that the AOI of the Project could extend to form trans-boundary effects. The ESIA will determine whether or not any effects of the Project are likely to extend to habitats and communities across the border. Until such effects can be demonstrated, the ESIA will

not consider trans-boundary effects, and therefore this scoping study only considers the study area and baseline data gathering within Kenya.

No environmental protected areas have been identified within the Upstream Area. South Turkana National Reserve is located 7 km to south of the Upstream Area southern boundary.

In the Lake Turkana area, there are no large-scale agricultural initiatives planned, primarily due to limited water being available. Tourism activities in the South Omo and Lake Turkana areas provide an alternative source of income for some local communities, although tourism infrastructure is not extensively developed and it remains difficult to travel to the area due to poor-quality roads and a lack of supporting tourism infrastructure.

The population in the local area is characterised by tribal pastoralists and consequently the available, appropriately skilled, human resource pool is small and does not currently match the skill requirements for either the construction or operational stage of the Project. Literacy and educational levels across Turkana are low.

Turkana supports a number of tribal groups, amongst whom there has historically been antagonism, which has periodically escalated into episodes of localised conflict, presenting a potential security issue for the Project.

Conflict in Turkana can often be based on tribal affiliation, and is driven by a complex combination of the increasing availability of small arms, competition over pastoral grazing lands and livestock, tribal claim to land based upon their grazing value, and the socio-cultural importance of keeping large quantities of livestock for socio-economic status.

3.2 Design Parameters

The key design parameters for the Project include the following:

- Project infrastructure has a design life of 25 years for continous oil production during this period;
- Existing infrastructure from the exploration and appraisal stage has been re-used to the maximum extent possible to reduce the requirement for additional areas of land to be cleared and fenced;
- New infrastructure is designed to use the minimum amount of land required to minimise the footprint of the Project;
- There will be no routine flaring during the operational phase of the project. The presence of associated gas within reservoir fluids will be optimised and used for power generation to the maximum extent possible. However, the CPF will have a flare system designed to dispose of asssociated gas in an emergency or non-routine event. Fugutive emissions will be minimised by the design and the continous venting of associated gas;
- Where applicable, project facilities are designed using a closed drains system that will collect discharge from equipment (e.g. tanks, vessels) during routine operations and maintenance and direct the liquids to a dedicated storage vessel to prevent release to the environment;
- All hazardous material storages feature a secondary bund to prevent the release of pollutants to the environment following failure of primary containment;
- Materials to be used for the Project have been selected to take into consideration specific reservoir fluids and operating conditions whilst trying to use materials with a low environmental toxicity to reduce the volume and type of waste generated;
- Best Available Technology will be used. The Project is designed so that all emissions and discharges meet applicable environmental standards; and
- The project will be designed in line with the commitments to environmental mitigation measures defined in the ESIA.

3.3 Provisional ESIA Schedule

The provisional ESIA schedule is summarised below:

- Baseline data collection started in October 2015 and will continue for a minimum of 12 months;
- A FEED process will be completed to refine the existing design of the Project. This will have a minimum duration of 9 months;
- The ESIA Report will subsequently be submitted to NEMA; and
- NEMA will take no more than 3 months to review the ESIA for approval.

3.4 Operational Infrastructure

3.4.1 Well pads

The number of well pads may range from 30 to 50, and each well pad will be designed for 24 well slots per pad with alternative designs under consideration. Each wellpad will have several manifolds and each production well will have a pump and electric well bore heating. The well pads will be fully rated for well-head shut-in pressure and have an associated gathering system that follows the infield road network.

Each well pad will be accessed via all-weather access roads. Power and communications will be required at each well pad and security at the well pads will be managed through fences and CCTV.

It is expected that each well pad will have a temporary waste storage area. These will be transfer facilities where waste from construction activities as well as operational waste will be stored for either recycling or pre-treatment and then transferred to the Integrated Waste Management Facility (IWMF) near the CPF. These pad areas will be relatively small and the bulk of waste materials will be drill cuttings and spent drilling muds. An evaluation will be undertaken during the ESIA to identify the optimum type of drilling additives used with the aim of minimising the generation of Synthetic Based Mud (SBM) waste that is generated, with Water Based Mud (WBM) used to the maximum extent possible.

3.4.2 Central Processing Facility

The CPF will be made up of the following components:

- Processing Plant: The processing plant will have a design life of 25 plus years with operations planned to commence following commissioning;
- Processing Facility Ancillaries: including accommodation, helipad, offices, site clinic, emergency response facilities, waste handling facilities, fuel and chemical storage and dispensing areas, fuel storage areas, water storage and treatment facilities; and
- Centralised gas turbine power generation with waste heat recovery with additional heating provided by a combination of oil and gas fired heaters.

Based on the preliminary investigations, the current preferred option is a single facility. It will be designed to process circa 80 Thousand Barrels of Oil per Day (Mbopd), 480 Thousand Barrels of Water per Day (Mbwpd) and 28 Million Standard Cubic Feet per Day (MMscfd) gas. Note that the CPF layout is designed to be readily expandable to an additional 50% above these flow rates.

3.4.3 Water

3.4.3.1 Water supply options

The process of identification of a water source or a combination of water sources to support appraisal drilling, construction, field camps, community water schemes and to support all operational project needs is subject to a range of ongoing studies. The water supply options (options 1 to 7) that have been considered for project water supply are presented in Figure 2.

Options 1 (Nile River), 5 (Indian Ocean) and 7 (Lake Victoria) have been discounted during the early phases of the selection process. The four options, which are still under consideration, are described in sections 3.4.3.1.1. to 3.4.3.1.4.

A quantity of potable water for the operations stage will be necessary. The source(s) of piped water for all infield requirements will be identified from Tullow specialist studies and be adopted in the planning.

Surface water would be abstracted at a selected area to minimise disturbance to flora and fauna in the vicinity of the offtake. A pipeline would run from the abstraction point to the CPF. The pipeline would be buried.

3.4.3.1.1 Option 2: Turkwel Dam

The Turkwel Dam is on a tributary of the Turkwel River and has an integrated hydro-electric scheme producing 106 megawatts (MW). Sustainable abstractions directly from the reservoir and from downstream of the dam are being considered.

3.4.3.1.2 Option 3: Lake Turkana

Lake Turkana is an important natural habitat and will be considered sensitively in this context. Should this option be further considered, the ESIA will characterise the sensitivities associated to the lake. Detailed water supply studies are underway to consider sustainable use of the lake as a water supply.

3.4.3.1.3 Option 4: Local groundwater (within 13T and 10BB)

Groundwater abstraction from a network of boreholes within Blocks 13T and 10BB, is under consideration. There is an ongoing programme of drilling and findings to date indicate that the most productive water supply boreholes are likely to be along the valleys of the Turkwel River and Kerio River. A pipeline system could link several sources and distribute water as required. It is likely that several tens of boreholes would be needed to provide the volume of water required for the Project, although partial supply of water from these boreholes is also being considered.

3.4.3.1.4 Option 6: Distant groundwater

Studies to identify a candidate aquifer are ongoing. One option may be to install a network of boreholes in the Suguta Valley, north of Lake Baringo. A network of boreholes would be required to feed into a collection point and then be pumped to the Upstream Area.

3.4.3.2 Water treatment and storage

Water from whichever source(s) is eventually developed to supply the Project will arrive to the water treatment plant within the CPF via a water trunk line. Where required, make-up water for reinjection will be treated within the processing plant and will be stored in two buffer tanks. A separate water treatment plant is planned within the Central Facilities Area (CFA) for the supply of potable water to the CPF and other areas.

A potable water storage tank, located within the CFA, is planned and will be sized to store approximately four to five days requirement of potable water. Two tanks will be provided for service water needs.

A further water storage tank, to be used to store off-spec water for dust suppression, and for operation and maintenance purposes, is also planned for the CFA. Two fire water tanks, sized to provide a minimum of 30 minutes of water at calculated deluge rates, will also be located within the CPF.

3.4.3.3 Water injection network

Pipelines carrying water for re-injection will be connected to the well pads from the processing plant. Pipelines (oil and water injection) will be aligned with the infield road network where practical.

The water injection network is buried, heavily insulated (using the same insulation and heat tracing system as the gathering network i.e. insulated to a maximum U value of 0.5 W/m2.°C) and electrically heat traced.

Superheating is provided at the CPF to ensure correct water arrival temperature and to optimise heat and power consumptions. Heat tracing is supplied but is not normally on (used for upset and start-up conditions).

The requirement for heat tracing and the value of always-on heat tracing should be assessed at a later stage of design.

During normal operation, the arrival temperature at the well pads is controlled via the level of superheat added at the CPF. In an upset condition, additional heat can be provided via the CPF or by use of the electrical trace heating.

Injection water must be at least 80°C for injection at the wellhead. During start-up, water not meeting this temperature specification may be returned to the CPF via the production gathering network.

3.4.4 Integrated Waste Management Facility

A number of waste management options are being considered as part of the design and construction of an Integrated Waste Management Facility (IWMF). Options relating to the reuse of construction waste, wastewater, recycling and composting of organic waste will be considered to minimise the total quantity of waste generated, and treatment and disposal options will also be assessed during the design.

The IWMF will handle all waste generated at the CPF site and wastes from construction and operational activities as they are initiated, through the use of a modular design. The facility will continue being developed during construction until it is complete and fully functional.

Waste management for the Upstream Area will operate using the Waste Hierarchy as a central principle. Waste generated will be handled, segregated, treated and/or disposed of in a dedicated facility. A Materials Recovery Facility (MRF) will be constructed within the IWMF for waste sorting, where reusable and recyclable materials will be removed from the waste stream for transfer to relevant external facilities. Compost from the facility will be transferred to off-site receivers. Effluent treatment facilities will also be designed as part of the facility and the potential for energy from waste will be investigated.

It is anticipated that smaller ancillary waste handling facilities will be located strategically to service the more remote areas within the Upstream Area where waste can be temporarily stored and pre-treated prior to being transported to the IWMF facility, if necessary. These smaller facilities will be constructed as the Project expands. They will include source separation and removal of recyclable materials where feasible, and temporary storage of waste streams, including construction waste, and drill cuttings pre-treatment.

3.4.5 Transportation

3.4.5.1 Roads

Infield roads linking the CPF to all facilities and well site locations will consist of upgraded and new access roads to support access to all operational locations in the Lokichar Basin. Within the field there will be a hierarchy of roads provided. Some of these roads may be shared with the public whilst others will only be intended for use by Tullow.

The main access road C46 and airfield access will consist of a two-lane single, sealed, all weather, carriageway with public access used to facilitate the movement of vehicles from the CPF to/from the well pad access roads and to the national road network.

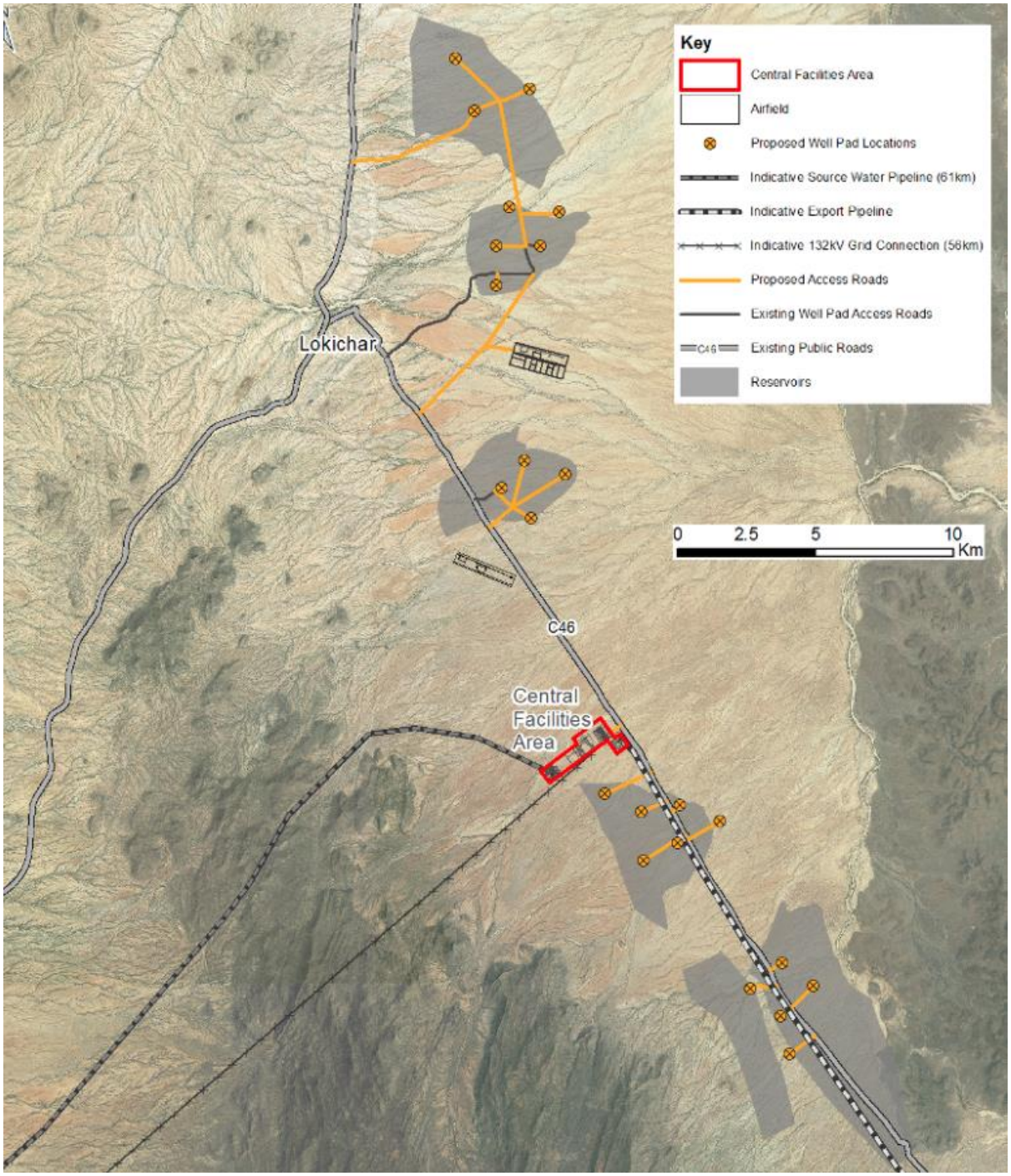

Plate 3-1 Proposed Field Layout (indicative only)

Other components of the infield road network include the following:

- Internal access roads: two lanes, all weather, carriageway not intended for public access. These roads will facilitate the movement of vehicles to/from the well pads to the main access road;
- Well pad access roads: single lane, all weather, gravel riding surface not intended for public access. These roads will facilitate access to/from well pads; and

- Internal CPF roads: these will be single lane. Permanent roads will be bituminous surfaced and temporary/construction road will be gravel surfaced. Internal CPF roads are not intended for public access and will facilitate access within the CPF area.

3.4.5.2 Air transport

A permanent airfield will be required in the vicinity of the CPF.

There are two existing airfields that are within driving distance of the CPF: Kapese and Lokichar. These options were investigated and it was found that due to expansion constraints, the poor standard of the Kapese airfield, the distance from the CPF to both airfields (25 km and 30 km) and the relative insecurity of the area, these existing airfields were unsuitable.

After discounting the Kapese and Lokichar Airfields, preliminary investigations undertaken as part of the Master Plan Study identified three potential sites where a new airfield could be developed.

Airstrip

The new airfield will be designed for a Dash 8 Q400 or similar airframe. This requires a runway length of up to 1.8 km, the final length and width is to be confirmed. It is calculated that the maximum traffic for Tullow's requirements will be several flights per day. This will be during the construction stage, based on the manpower requirements.

In addition to the runway, there will be a need for a small terminal building, workshop and store for airport related vehicles, a bus terminal, a small number of parking bays and aircraft refuelling and maintenance facilities.

Helipad

A helipad will be required to facilitate the extraction of injured or ill staff to external medical facilities in the event of an emergency, transporting VIPs to and from the Site, or field maintenance activities. This facility may be located within the CPF or at the adjacent airfield depending on the location of the airfield.

3.4.5.3 Road and rail connection

Road and rail options are being considered for the importing of construction and operational materials and plant from the port.

A rail connection from the CPF to the current rail network is unlikely to occur. Therefore for rail to be considered as part of an option, a multimodal solution would be required i.e. rail from the port to a railhead/transfer station at Eldoret or Webuye, which would need to be constructed, and a road thereafter. An evaluation of the capacity of the existing rail infrastructure is being conducted. Road transportation would then be used from Eldoret or Webuye to Lokichar via the A1 and the Lokichar bypass to the C46 down to the CPF location.

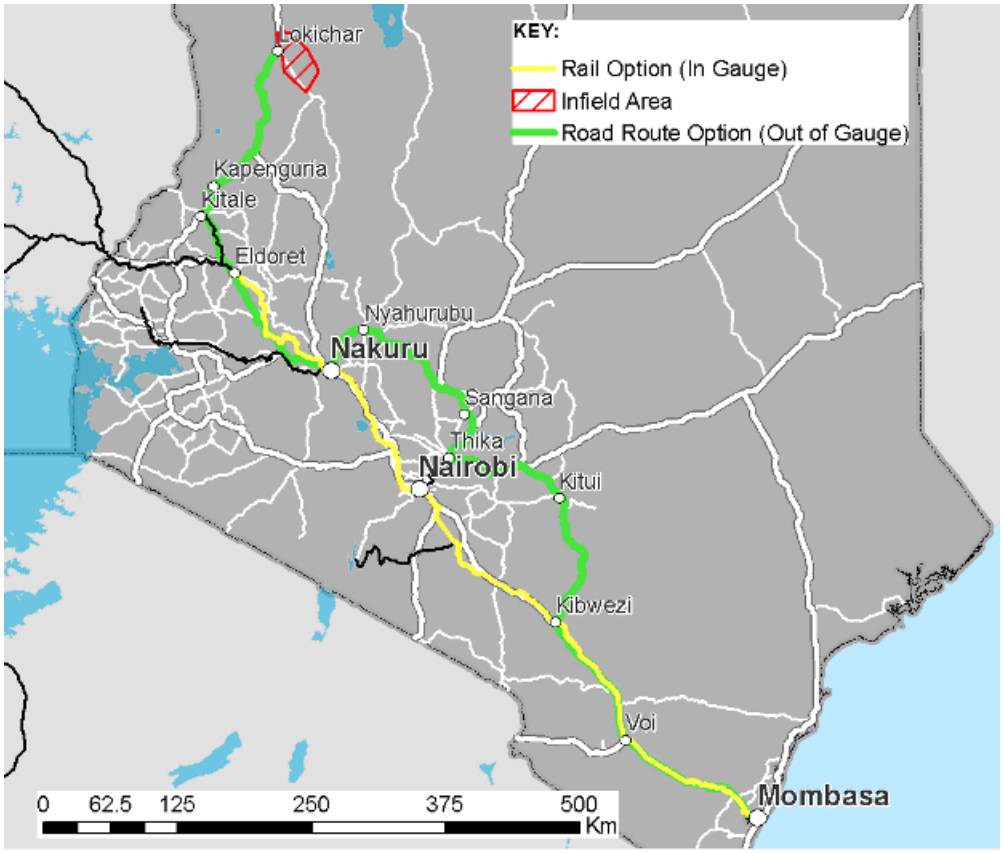

Plate 3-2 Rail/Road Option (indicative only)

3.4.5.4 Power

Tullow will commission a power plant that will be used to provide electricity to the entire operation. Power will be required by all facilities within the CPF. Power will be generated within the process plant area and distributed throughout the Project site (CPF and field) via an above ground network. Diesel generators will provide back-up power, along with other potential sources.

A Best Available Technology (BAT) assessment will be completed to identify the optimum source(s) of electrical energy required for the project. The BAT assessment will consider a range of options associated with the generation of energy and consider renewable energy sources including solar energy, wind energy and also electrical power through a connection to the national grid.

3.4.6 Accommodation

A number of options are being considered for accommodation during operations. Accommodation options will be evaluated to minimise environmental and social effects, including indirect effects of the Project relating to influx.

During operation, permanent accommodation will be required for staff associated with the operation of the process plant and ongoing field maintenance/operations as well as consultants, and contractors working within the Lokichar operation.

Temporary accommodation will be provided during the construction phase for a period of up to 3 years. This will be located close to the main CPF where the majority of the activity will be taking place. Temporary accommodation will be mothballed after the construction phase.

The permanent accommodation facility will have a design life of 25 plus years.

3.4.7 Interface with oil pipeline

An export pipeline is currently planned from the process plant to the coast where export facilities are to be constructed for the Project. An alignment for this pipeline is still being investigated. Provision for a corridor to access the process plant site will be required and provision for inlet facilities and storage interface shall also be accommodated. There is a separate ESIA process for the oil pipeline.

The interface location between the Upstream Area and the pipeline area is at the central process plant. Therefore there will be a length (to be confirmed) of pipeline within the study area for the Upstream Project ESIA.

3.4.8 Infield pipelines

Infield pipelines will connect the well pads to the process plant within the CPF, transporting well fluids from the well pads and water for re-injection back to the well pads. All pipelines (well fluids and water) will be buried and will be aligned with roads where practical.

Flow lines will feed into a manifold at well pad locations. A single infield pipeline will then connect the well pads to the CPF via infield trunklines.

3.4.9 Fuel storage

All fuel requirements for project operations, including refuelling facilities, will be stored and managed from an appropriate location. All fuel required on-site will be stored in a designated bunded area or a fuel drainage area. All refuelling will take place within designated areas.

3.5 Construction

3.5.1 Well pads

Construction of well pads will commence during the construction phase but will continue along with the Project throughout the operational phase.

3.5.2 Central Processing Facility

During construction, the CPF will also include temporary facilities (a construction camp and temporary laydown areas including warehouse and fabrication shops). These areas will be returned to an open area outside the perimeter fence following construction.

3.5.3 Water

Within the Upstream Area water is scarce. Therefore, the construction plan for water usage will identify how construction water can be minimised and water recovery maximised. It is assumed that construction water will be sourced from one of the options currently under evaluation and brought to site via a pipeline prior to treatment on-site.

Depending on route and the quality of the source water, connections along the pipeline route may be a solution to support bowser truck filling points that are nearer to the work fronts.

During construction, water will be required for:

- Soil compaction;
- Equipment, piping and pipeline hydro-testing;
- The construction camp – drinking water and ablutions; and
- Dust suppression – low quality water.

3.5.4 Solid waste and wastewater

The construction stage will generate significant quantities of inert wastes and incidental quantities of hazardous materials. Wastes will be generated from physical construction activities (off-cuts and surplus materials, combined with any arising from demolition, site clearance and preparatory ground works) but also waste from

the various construction camps. Basic waste management facilities will be established at each camp with an objective of segregating and reducing waste and promoting recycling where possible. The waste management facilities will have to use simple technologies and be relatively mobile as it is assumed that the camps may have to re-locate on occasions to suit the construction operation and, as such, waste management equipment will have to be readily mobile. Processes will be established to reduce to a minimum the quantity of wastes from construction activities including but not limited to 'designing out' waste where possible and reduction of the need for off-cuts by pre-fabrication.

Inert wastes that cannot be recycled or re-used will be stored and later directed to the waste management facility at the CPF location for temporary storage until disposal capability at that site is available. Alternatively local waste disposal locations will be used where available. Wastes will be transported by dedicated vehicles or if possible, back-hauled by construction deliveries. It is unlikely that significant hazardous waste quantities will be encountered, although processes and protocols will be established to adequately store (temporary) such materials before haulage and final disposal at the IWMF.

A wastewater treatment plant is envisaged for the camp, to be constructed in during the appraisal stage, with the extension of this planned during development drilling, when the larger camp is envisaged.

3.5.5 Transportation

It is envisaged that construction personnel will be able to walk to the CPF construction area and the fabrication/assembly workshops from the temporary construction camp. Shuttle buses are proposed to transport construction personnel to and from the well pad areas. Buses will be used to transport construction personnel to and from the airport and drop off/collection points.

3.5.6 Power

There will not be any electrical power network during the majority of the construction period. Diesel generators will be utilised for the provision of electricity prior to first production, with each contractor being required to provide adequate power for their own use. A range of potential electrical energy sources, which will include use of a connection to the grid and solar energy, will be considered to supplement the use of diesel generators.

3.5.7 Accommodation

A number of options are being considered for accommodation during construction. Accommodation options will be evaluated to minimise environmental and social effects, including indirect effects of the project relating to influx.

Specifically, accommodation capacity during construction will need to account for the revised construction manpower estimate which could be in the range of several thousand people at the Central Infrastructure Area.

3.5.7.1 Integrated Waste Management Facility

It is proposed that the IWMF described in Section 3.4.4 will handle all waste (except produced water) that is generated at the CPF site will also be designed to handle construction waste produced during the construction stage. The first stage of the IWMF will be built during the enabling works phase (first 12 months of the construction phase) so that it is available for the rest of the construction phase.

3.6 Decommissioning

Decommissioning and closure of the Upstream Project will comply with international best practice, IFC Standards, NEMA, Tullow's environmental and social policies and also Kenyan legislative and regulation requirements. As part of the ESIA, a Site Closure and Restoration Plan will be developed.

Tullow will also adopt appropriate measures during the operational life of the Upstream Project to minimise and mitigate any impacts upon decommissioning.

3.7 Associated facilities

Associated facilities may include but not be limited to the following:

- Road upgrades outside of the AOI; and
- Railhead and transfer station.

4.0 APPROACH TO THE ESIA

4.1 The ESIA process

4.1.1 Overview

The ESIA is a process and management technique which allows consideration of the likely environmental and social impacts of a development prior to it proceeding. This provides an opportunity to ensure that the design is optimised in an integrated manner, minimising negative environmental and social impacts and maximising positive impacts.

The ESIA will be undertaken in accordance with the applicable requirements of:

- Kenyan EIA legislation and policy;
- IFC Performance Standards (PS) on Environmental and Social Sustainability (2012);
- Tullow internal policies and standards; and
- Good International Industry Practice (GIIP).

The ESIA process in Kenya is shown schematically in Plate 4-1:

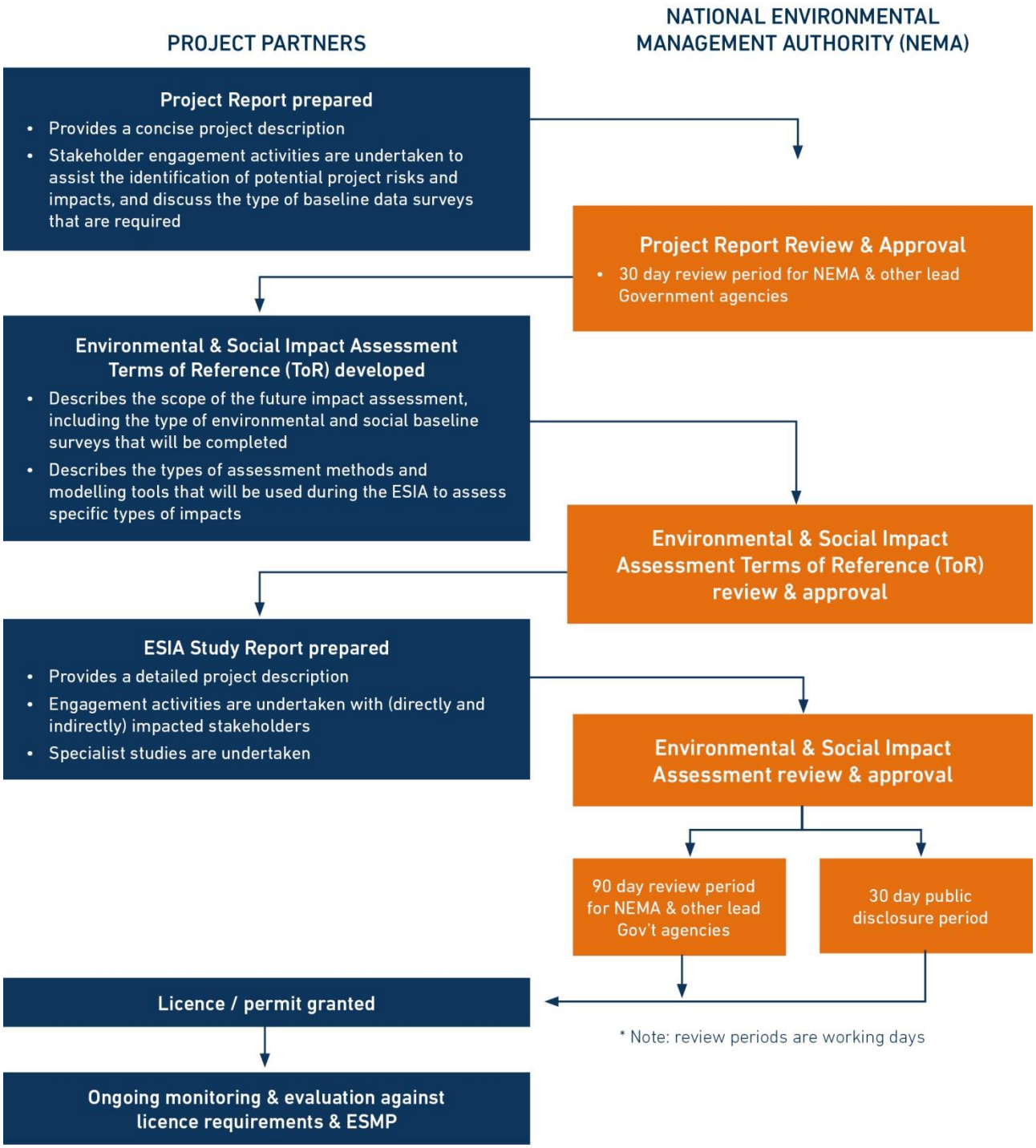

Plate 4-1 Overview of the ESIA Process in Kenya

4.1.2 Scope of the ESIA

The technical scope refers to the range of topics to be addressed in the ESIA. The technical topics proposed to be considered in the ESIA are set out in Chapter 6.0.

The ESIA temporal scope will include consideration of effects arising from the construction, operation and decommissioning of the Project.

The spatial extent of the ESIA is described as the geographical area potentially affected by the Project. The following definitions have been used to determine the Study Area and AOI:

The Study Area is defined as the spatial area within which data will be required to provide the context to inform the assessment of effects within the AOI (see below). The Study Area may be larger than the AOI and may cover local, regional, national and international scales. The Study Area may vary between the topic areas.

Based on the IFC definition, the AOI for the Project is defined as encompassing:

"*The area likely to be affected by: the Project and the client's activities and facilities that are directly owned, operated or managed (including by contractors) and that are a component of the Project; impacts from unplanned but predictable developments caused by the Project that may occur later or at a different location; and indirect project impacts on biodiversity or on ecosystem services upon which Affected Communities' livelihoods are dependent. Associated facilities, which are facilities that are not funded as part of the Project and that would not have been constructed or expanded if the Project did not exist and without which the Project would not be viable."*[1]

The AOI does not include cumulative impacts, which will be assessed under a separate CIA for the entire project and presented as a separate report.

A summary of the various steps in the ESIA process are set out below.

4.1.3 Scoping stage

The aim of scoping is to identify potential impacts on environmental and social receptors arising from Project activities that will need to be further considered in baseline data collection, the impact assessment and to determine how such an assessment will be undertaken.

The primary output of scoping is the preparation of a Project Report and ToR, setting out potential impacts that will be considered in the ESIA as well as those scoped out (with reasons why). For those impacts scoped in, the method and approach proposed to predict and evaluate their significance will also be presented in the report. The Project Report and ToR will be submitted to NEMA for approval.

4.1.4 Establishment of baseline conditions

Baseline data will be collected to characterise the existing environmental and social receptors and conditions in the Study Area, and trends in such conditions including the situation that would prevail in the absence of the Project. Baseline data determination largely comprises:

- Review of existing published sources; and other available secondary information, including those held by government agencies, Non-governmental Organisations (NGOs), research agencies; and
- Site reconnaissance visit and field surveys and the subsequent analysis and interpretation of data.

4.1.5 Stakeholder engagement

Stakeholder engagement will be incorporated at all stages of the ESIA process. The objective of this engagement is to ensure that legislative requirements are met; sources of information and expertise are identified; stakeholder concerns and expectations are registered and addressed; and affected communities have the opportunity to discuss Project risks and impacts, and proposed mitigation and monitoring measures. A Stakeholder Engagement Framework has been prepared by TKBV for the Development Project and a Stakeholder Engagement Plan (SEP) has been prepared for the Upstream ESIA. The stakeholder engagement process has been discussed with NEMA to comply with Kenyan EIA Regulations; and to provide NEMA with an opportunity to comment on the consultation and disclosure activities that will be conducted during the ESIA process.

[1] IFC Performance Standard 1 Assessment and Management of Environmental and Social Risks and Impacts, January 2012

Engagement during the Scoping stage informs the Environmental Project Report and Terms of Reference for the full ESIA.

During baseline studies and prior to completion of the draft ESIA, all baseline research, such as key informant interviews and focus groups will be used to disclose project information and provide participants in primary research with an opportunity to raise issues comments and questions.

Upon competition of the draft ESIA, all stakeholders will be invited to participate in consultation meetings linked to the draft ESIA. These meetings, conducted prior to the submission of the final ESIA for approval, will meet and exceed the NEMA requirements for a public hearing, specifically Environmental (Impact Assessment & Audit) Regulations (2003) (as Amended), Reg. (17), which requires at least three public meetings with affected parties and communities. In this regard, the number, location and format of public meetings will be discussed with NEMA prior to the publication of the disclosure schedule.

4.1.5.1 Engagement during Exploration and Appraisal

TKBV has been active in Kenya since 2010 and oil exploration activities have been occurring within the area of operations (North West Kenya) since 2011. During this period, the extent and complexity of stakeholder engagement activities at a national, county and community level has increased substantially, which has been driven by several factors including:

- An increase in exploration activities and associated work (e.g. seismic and drilling operations);
- The geographic footprint of the operations has expanded significantly as new basins/areas have been targeted within the extensive licence areas;
- The on-going management of new contractors with different operating models and experience;
- Changes in Government roles and responsibilities as a result of newly devolved County Government powers; and
- Fluid and shifting community dynamics.

Considering that Kenya is a new hydrocarbon province, engagement activities to date at both national and local levels have focused on building broad based understanding of the oil and gas industry in parallel to operational specific engagement and consultation activities.

During the course of previous engagement and consultation activities, a range of issues have been raised by external stakeholders. Given the current stage of the oil lifecycle (exploration), many of the issues raised focus on more immediate activities and short-term impacts. However, these can often be relevant for future lifecycle phases such as construction and operations. Stakeholders have also raised issues that have longer term and far reaching implications and can require a multi-stakeholder consultation approach.

The following provides a summary of some key issues raised by key stakeholder groups, which will inform focused engagement activities in the ESIA programme.

- From community level stakeholders:
  - Expectations of and access to employment opportunities;
  - Land take and associated land use, including compensation and consideration of traditional use;
  - Access to water; and
  - Benefits and opportunities.
- From National level Government stakeholders:
  - Revenue and transparency;
  - Natural resource use and the effective use of revenues;

- National content/capacity building;
- Security; and
- Project association and relationship to other major infrastructure projects.

- From Non-Government Organisations and Civil Society Groups:
  - Transparency and disclosure of Project documents;
  - Distribution of revenues;
  - Land rights with specific emphasis on livelihoods;
  - National content / capacity-building; and
  - Avoiding a “Niger Delta”-type situation.

4.1.5.2 Early engagement with NEMA

At the inception of the development stage of the Project and the scoping stage for the ESIA in October 2014, Golder met with NEMA. The Golder Project Manager (Andrew Morsley), Socio-economic and Stakeholder Engagement Lead (Paul Lawrence) and Kenyan Project Coordinator (Tito Kodiaga) briefly presented the ESIA team for the Upstream Project, the approach to scoping and the scoping consultation (including a communications plan), and the approach to the ESIA. Since then, Tullow have engaged with NEMA regularly to further discuss the approach and progress of the Upstream ESIA. NEMA has confirmed that they are comfortable with the completion of a single ESIA assessment that addressed the requirements from applicable national legislation and the IFC Performance Standards.

4.1.5.3 Project report stage consultation

In accordance with Regulation 11 of L.N. 101: Environment (Impact Assessment and Audit) Regulations, 2003, the Project Report and ToR will be submitted to NEMA for approval. NEMA will liaise with the relevant lead agencies in the review and approval of the Project Report and ToR.

The Environmental Management and Coordination Act (1999) and the Environmental (Impact Assessment and Audit) Regulations (2003) establish the basis of Kenyan regulatory requirements for stakeholder engagement in ESIA. It is the responsibility of the project proponent to make sure that all the concerned parties (government and non-government) are given adequate opportunity to participate in the ESIA exercise. Regulation 17 of L.N. 101: Environment (Impact Assessment and Audit) Regulations, 2003 states that an applicant shall take all measures necessary to seek the views of the people or communities which are likely to be affected by the project during the scoping exercise.

The main objectives of Scoping consultation is to:

- Provide information on the Project to key stakeholders;
- Align the ESIA approach with national regulations and international lender requirements; and
- Document issues, questions and concerns that need to be considered and addressed during the later stages of the ESIA and reflected in the Terms of Reference (Appendix A).

Scoping consultation was targeted at key national and regional stakeholders. NEMA had stipulated that at scoping, consultation should only occur down to sub county level. Through this process, Golder identified how expanded consultation with potentially affected communities should be facilitated during the later stages.

Early engagement helps test the cultural appropriateness and level of details in materials. The following key outcomes/learnings came from scoping consultation

The EIA Guidelines (2002) state that a Communication Plan must be developed in liaison with NEMA. The preliminary list of stakeholders for scoping consultation was shared with NEMA during the meeting in October 2014 (Section 4.1.5.1). A Communication Plan to complement the preliminary stakeholder list for the

Upstream Project will be submitted to NEMA as a standalone document. The methods of engagement will include, but will not be limited to:

- One-to-one meetings;
- Workshops; and
- Targeted interest groups.

All methods will seek to provide consistent messages about the Project through the presentation or distribution of presentations, maps and documents.

4.1.5.4 ESIA scoping consultation

ESIA Scoping Consultations were initiated in November 2015 and included a series of meetings to disclose the Project concept and explain the ESIA process. Consultations were held with government, international organisations, international, national and regional NGOs and regional media.

The objectives for each meeting were the same:

- Provide information on the Project and details of the ESIA process to key stakeholders;
- Align the ESIA approach with national regulations and international lender requirements;
- Document issues, questions and concerns that need to be considered and addressed during the later stages of the ESIA and reflected in the ToR; and
- Solicit feedback from key national and regional stakeholders on our approach to consultation with a wider group of stakeholders, especially potentially project affected people (PAPs).

Two teams comprised of Golder and Tullow staff facilitated meetings. One team conducted the majority of meetings in Nairobi and the second team helped with meetings in Turkana with regional stakeholders.

The list of stakeholders consulted was drafted in consultation with NEMA. Based on NEMA's advice, Golder was not advised to hold formal public meetings at the community level. The main reason for delaying broader disclosure is to wait until there is a more clearly defined Project Description. However, all stakeholders were encouraged to share information. While none of the meetings were advertised to the general public, participants invited to the non-governmental events received a letter of invitation and were welcome to bring other interested stakeholders.

All meetings were started with two brief presentations. The first outlined the development Project Description as well as the ongoing technical and engineering studies underway to further define the Project design. The second presentation provided information on the ESIA and stakeholder engagement process. Presentations were provided to all stakeholders on request. A copy of the slides is provided in Appendix B.

In addition to the presentations, two Topic Sheets were used on (1) Oil and Gas Life Cycle; and (2) The ESIA Process were provided to all participants in English and Swahili. All presentations were delivered in English, but participants were invited to ask questions in their preferred language. Turkana-speaking Tullow staff were present at all meetings held in Lodwar for the purpose of translation, if desired, however, no translation was requested.

The ESIA presentation stressed the on-going role of the grievance mechanism. All meeting attendees were encouraged to contact the grievance officer in relation to any outstanding complaints.

Table 4-1: ESIA Scoping Meetings – Total Attendees

Date	Meeting / Type	Total Participants
04 Nov 2015	Ministerial Forum - Nairobi	19
04 Nov 2015	Northern Rangelands Trust - Nairobi	1

Date	Meeting / Type	Total Participants
04 Nov 2015	Deputy Governor/Turkana County Ministers - Lodwar	6
05 Nov 2015	Regional National Environment Management Authority (NEMA) Water Resources Management Authority (WRMA) – Lodwar	2
06 Nov 2015	UN Forum - Nairobi	4
09 Nov 2015	International NGOs (Development) – Nairobi	8
09 Nov 2015	International NGOs (Environmental) – Nairobi	9
10 Nov 2015	Kenyan National NGOs – Nairobi	7
10 Nov 2015	Turkana County Commissioner and Police Coordinator - Lodwar	3
10 Nov 2015	National Land Alliance – Nairobi	1
11 Nov 2015	Turkana Media Briefing – Lodwar	10
12 Nov 2015	Turkana NGO Forum - Lodwar	30
12. Nov 2015	International Organisations (General Re-invited) – Nairobi	7
13. Nov 2015	National Assembly Committee on Environment and Natural Resources - Nairobi	1
18 Nov 2015	Turkana Basin Institute - Nairobi	1
Total Attendees		109

Several key meetings did not take place due to scheduling conflicts and many meetings had lower participation that expected. Key government meetings that were cancelled include:

- Parliamentary Committee on Environment & Natural Resources – Nairobi;
- Senate Committee for Environment & Natural Resources – Nairobi;
- Turkana Governor – Lodwar; and
- MCAs, County Speaker – Lodwar.

The Tullow Social Performance and Government and Public Affairs teams will provide disclosure materials to all key government officials and conduct follow-on meetings, as requested.

During the meetings listed above, a total of 188 issues, questions and concerns were documented. They are presented below with the first listed topic being the most commonly raised topic:

- ESIA General Inquiries – 18%
- Engagement – 16%
- Environment – 16%
  - Water – 9%
  - Biology – 3%

    - Pollution/Waste – 3%
- Land Access & Acquisition – 15%
- Community Aspects – 11%
    - Benefits – 4%
    - Health, Safety & Security – 3%
- General Project Updates / Inquiries – 8%
- National Content – 5%
- Security – 3%
- Northern Rangelands Trust – 3%

The most commonly raised topic was in relation to the ESIA, its scope and clarity on how the process would be conducted. These issues represented 18% of the total comments made. Attendees also sought clarity on the difference between the development ESIA and previous impact assessments conducted during the exploration and appraisal work.

Both engagement and environment issues represented 16% of the total of all comments. Among environmental issues, the most commonly raised question was in relation to water, where the Project might source water and whether usage might affect local communities. In response, attendees were informed of the process used to consider numerous options for water and that there are currently the following four options under consideration - the Turkwel Dam, Lake Turkana, local ground water and distant ground water.

Questions on engagement underlined the importance and the challenge of including local communities and project-affected people in all ESIA work. All attendees agreed that holding public consultations at the settlement level would be unhelpful unless there was more specific clarity on the Project footprint and associated engineering design. Participants raised the issue of developing various methods for information disclosure, especially in the context of high illiteracy rates. Each meeting highlighted the importance of the Project SEP, which will outline methods for continued engagement and the methods to be used. The SEP will be a public document. Attendees to these meetings will be informed once it is made public. Attendees were encouraged to review and provide feedback on the schedule and methods proposed presented in the SEP.

Land access and acquisition represented 15% of the total issues raised and was a clearly emotive issue for many participants. Several comments highlighted the regulatory challenges in acquiring land while the Kenyan Community Land Bill has not yet been passed into law. Question on land also focused on how land acquisition will take into account the pastoralist livelihoods of local residents near the Project. Numerous participants, especially at the County-level stressed the importance of regional and community participation in the development of the Land Access Framework (LAF). Given the regulatory uncertainty, attendees were told that the land acquisition process and consultation would be on-going and would include inputs from a broad number of stakeholders, including local communities. It was also frequently explained that the LAF and all work related to land acquisition would comply with IFC Performance Standard 5, which would ensure issues related to traditional land use would be taken into consideration.

National content questions, especially those related to employment and procurement opportunities, were especially important in County-level meetings. Many stakeholders explained the acute tension between national content and local content, indicating that employment given to people outside the County of operation needs to be clearly justified. Many general comments stressed that the Project needs to demonstrate that training for more skilled employment will start as early as possible. Responses summarised what TKBV have done to date through support for vocational education in Lodwar and the Enterprise Development Centre.

Inquiries about the Northern Rangelands Trust (NRT) were raised in several meetings. The 28 October 2015 public announcement of a new project supported by Tullow Oil in Turkana led many stakeholders to assume

the ESIA might be related to the NRT project. The announced project was linked to a five-year grant agreement with the NRT that will support communities in Turkana and West Pokot Counties to establish and operate six community conservancies. Questions raised during the ESIA Scoping meetings were primarily linked to land access.

The issues raised during the ESIA Scoping meetings are reflected in this Upstream Project Report and accompanying Terms of Reference (Appendix A).

4.1.6 Impact Assessment

The term "effect" will be used when describing the consequence of a change arising from the Project on a receptor. The term "impact" will be used to describe an effect that results in a change which requires mitigation or management to be considered. The types of effect that will be considered in the ESIA include:

- Direct – an effect that arises directly from activities that form an integral part of the Project (e.g. new infrastructure) and is within the control of the developer;
- Indirect – an effect that arises from activities not explicitly forming part of the Project but as a "knock on effect" of it, that may not be within the control of the developer (e.g. changes to water availability due to increased influx of people); and
- Combined – the combination of other direct or indirect effects of the Project on any one or group of receptors.

The impact assessment process will comprise the following main steps:

- Identification of the effects of the Project on receptors taking into account incorporated environmental and social measures (see Section 4.2.5);
- Evaluation of the significance of the effect;
- Development of mitigation measures; and
- Where necessary, prediction of the significance of residual effects.

An overarching framework for the impact assessment of environmental and social topics, based on these steps is provided in Section 4.2. The details of the methodology will however be developed for each topic based on: professional judgement; comparison with topic-specific regulations or standards; comparison with experience on other similar projects; and consultation with stakeholders.

In addition to the standard ESIA methodology the impact analysis for each environmental and social topic will be accompanied with a hazard analysis of malfunction/accidents, which will be reported in a separate chapter and will feed into a hazard management plan.

4.1.7 Environmental and Social Management Plan

An Environmental and Social Management Plan (ESMP) will be prepared, based on the findings in the ESIA. The ESMP will consist of a set of management, mitigation and monitoring measures to be taken during Project construction, operation and maintenance to manage key potential environmental and social impacts identified in the ESIA.

4.1.8 Cumulative Impact Assessment

Cumulative impacts are defined by the IFC as impacts that *"result from the incremental impact, on areas or resources used or directly impacted by the Project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted"*. Cumulative impacts will be assessed as part of an analysis of the Project, and will be prepared as a separate report to the ESIAs. The assessment of cumulative impacts will consider the effects of other developments in the vicinity of the Upstream Project which are under construction or have been consented, which when combined with the effects of the Upstream Project may have an incremental effect.

A Cumulative Impact Assessment is not required by NEMA, however, Tullow will undertake such an assessment in accordance with GIIP and IFC Performance Requirements and guidelines. The CIA will consider the cumulative impacts associated with the three components of the Project (Upstream, Pipeline and Port).

4.1.9 Reporting and disclosure

The outputs of the above tasks will be drawn together into an EIA Study Report and accompanying Non-Technical Summary (NTS) for NEMA's approval. Comments received on the Report from NEMA's review, stakeholders' written comments, and the outcome of any public hearings, will be addressed and detailed in an updated EIA Study Report.

4.2 Assessment Methodology

An overarching framework for the impact assessment methodology is provided below. The approach to the analysis of significance of environmental and social impacts has been separated to reflect the different approaches required assess environmental (Section 4.2.3) and social (Section 4.2.4).

4.2.1 Receptor importance and sensitivity

The term 'receptors' will be used to describe features of the environment such as water resources, habitats and species which are valued by society for their intrinsic worth and/or their social or economic contribution; and social groups or PAPs such as individuals and communities that may be affected by the Project.

The importance of a receptor will be determined by the consideration of a range of criteria depending on the topic under consideration, including: the economic, social and cultural value of the receptor, locally, nationally and internationally; any local, national or international designations; and the rarity of the receiving environment; the benefits or services provided.

Receptor sensitivity will be determined by the consideration of a receptors' ability to resist or adapt to changes and its resilience to change. The category of the importance or sensitivity of a receptor will be determined based on professional judgement of technical topic leads. Table 4-2 provides an example of categories of importance and/or sensitivity.

Table 4-2: Illustrative Example for Determining Receptor Importance and/or Sensitivity

Importance/Sensitivity of Receptor	Example of importance of receptors	Example of sensitivity of receptors
Very high	An attribute with a high quality and rarity on an international, regional or national scale with little or no potential for substitution.	Sensitive area or receptor with little resilience to imposed stresses.
High	An attribute with a high quality and rarity on a local scale with little or no potential for local substitution, or with a medium quality or rarity on a regional or national scale with limited potential for substitution.	
Medium	An attribute with a medium quality and rarity on a local scale with limited potential for substitution, or an attribute of low quality and rarity on a regional or national scale.	The receiving environment or receptor has a moderate natural resilience to imposed stresses.
Low	An attribute of low quality and rarity on a local scale with potential for substitution locally.	The receiving environment or receptor has a high natural resilience to imposed stresses.

4.2.2 Identifying the magnitude of environmental effects

The magnitude of effect will be determined by taking into account several factors. This will vary per topic but may include one or several of the following:

- Intensity of change;
- Geographic extent of change;
- Duration of change; and
- Frequency.

It is proposed that probability is not considered as part of the criteria for the prediction of effects. Probability will be considered only when assessing hazard analysis of malfunctions/accidents, which will be addressed separately in the ESIA.

4.2.3 Evaluating the significance of environmental impacts

Impact significance will be determined by consideration of the importance/sensitivity of the receptor in combination with the magnitude of the effect. Table 4-3 demonstrates how these parameters are considered in the assessment of significance.

Table 4-3: Determination of significance of impact

		Magnitude of Impact			
		High	**Medium**	**Low**	**Negligible**
Receptor Sensitivity or importance	**Very High**	Major	Major	Moderate	Minor
	High	Major	Moderate	Minor	Negligible
	Medium	Moderate	Minor	Minor	Negligible
	Low	Minor	Minor	Negligible	Negligible

Predicted significance of impacts will be classified according to whether they are considered to be Major, Moderate, Minor or Negligible; and Beneficial, Adverse or Neutral. Significance criteria will be specific to each environmental and social topic and will be defined in the impact assessment using a combination of environmental standards, guidance and professional judgement.

4.2.4 Evaluating the significance of social impacts

The evaluation of social impacts will differ from the evaluation of environmental impacts. The significance of a social impact will not depend on a characterisation of the magnitude of the effect and the definition of sensitivity or importance. Most social impacts will not be evaluated in the same quantitative way that can be applied to physical and biological impacts. Evaluation of social impacts will rely on a narrative which will bring together the evaluation of the following four criteria to reach a conclusion for the overall social impact:

- Direction, i.e.
  - Positive direction– impact provides a net benefit to the affected person(s);
  - Negative direction – impact results in a net loss to the affected persons(s); and
  - Mixed direction – mixed directions or no net benefit or loss to the affect person(s).
- Consequence, i.e.
  - Negligible consequence – no noticeable change anticipated;

- Low consequence – predicted to be different from baseline conditions, but not to change quality of life of the affected person(s);
- Moderate consequence – predicted to change the quality of life of the affected person(s); and
- High consequence – predicted to seriously change quality of life.

- Geographic extent of change; and
- Duration.

Each impact will be considered in relation to other impact topics and sub-topics. The objective of the narrative in the evaluation of social impacts is to show the relative importance of social impacts.

4.2.5 Incorporated environmental and social measures

Incorporated environmental and social measures, and industry proactive mitigation/management, are those measures that have been incorporated into the design of the Project. These may include:

- Design changes undertaken to remove or minimise effects that are not considered to be mitigation in terms of ESIA; and
- Good operational practice or construction.

The impact assessment will be undertaken assuming that the above are applied as an integral element of the Project design; and these measures will be set out clearly within the ESMP.

4.2.6 Mitigation of impacts

Additional measures will be committed to if, as a result of the ESIA, mitigation is required. Mitigation will be identified in accordance with a hierarchy of options in accordance with good practice and comply with IFC Performance Standards.

- Avoid - making changes to the Project's design or location to avoid adverse effects on an environmental feature or adverse social impacts
- Minimise - reduction of adverse effects through sensitive environmental treatments/design, or different project design to reduce adverse social impacts.
- Restore - measures taken during or after construction to repair/reinstate and return a site to the situation prior to occurrence of impacts.
- Compensate/offset - where avoidance or reduction measures are not available, it may be appropriate to provide compensatory/offsetting measures. Compensatory measures do not eliminate the original adverse effect; they merely seek to offset it with a comparable positive one.
- Improvement measures - projects can have positive effects as well as negative ones, and the Project preparation stage presents an opportunity to enhance these positive features through innovative design.

4.2.7 Identification of residual Impacts

Residual impacts are those that remain following the implementation of the proposed mitigation. These will be identified for each of the specialist topics by reviewing the predicted impacts against the mitigation measure proposed and then identifying any residual impacts. Residual impacts will be defined based on the same process applied to the evaluation of impacts.

5.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The following chapter provides the relevant policy, legal and institutional framework governing the ESIA. The ESIA will be carried within the Kenyan legislative and regulatory framework and in line with the IFC

Performance Standards on Environmental and Social Sustainability (2012) and IFC's General Environmental, Health and Safety (EHS) Guidelines (2007), and Tullow's corporate standards and policies (refer to Section 5.6). Project standards will comprise the more stringent of Kenyan and GIIP.

5.1 Context

Kenya has undergone regulatory reforms over the past two decades, culminating in the enactment of a new constitution in 2010 replacing that of 1969. This has in turn driven new policies and strategies relating amongst others to environmental management and conservation (including Environmental Impact Assessments), and more generally to the energy sector including oil and gas.

The new constitution establishes the structure of the Kenyan government, the Bill of Rights, and provides the basic and comprehensive principles for environmental protection and management in the country. Under Chapter 5 (Part 1) of the constitution (Land and Environment), it requires that land be used and managed in *"a manner that is equitable, efficient, productive and sustainable, and in accordance with the following principles: (a) equitable access to land; (b) security of land rights; (c) sustainable and productive management of land resources; (d) transparent and cost effective administration of land; (e) sound conservation and protection of ecologically sensitive areas; (f) elimination of gender discrimination in law, customs and practices related to land and property in land; and (g) encouragement of communities to settle land disputes through recognised local community initiatives consistent with this constitution".* Furthermore, Part 2 of Chapter 5 is dedicated to environment and natural resource utilisation, management and conservation, with reference to the establishment of EIA, environmental audit and monitoring of the environment.

The constitution also stipulates that all minerals and mineral oils shall be vested in the national government in trust for the people of Kenya. The constitution also specifies the devolution of powers from the central government to the newly established 47 Counties. County governments are in charge of planning and development among other services, and can enact legislation with possible implications to planned and current projects.

Other recent reforms include the establishment of key administrative and legislative organisations that regulate oil and gas development in Kenya.

5.2 Governance and Administrative Structure

The following key administrative agencies regulate oil and gas development and its environmental implications in Kenya and have a key role in the EIA authorisation process:

Ministry of Environment and Natural Resources (MENR)

The Ministry of Environment and Natural Resources (MENR) mission statement and key objective is to facilitate good governance in the protection, restoration, conservation, development and management of the environment and natural resources for equitable and sustainable development.

Following the passage of the Environmental Management and Coordination Act (EMCA) 1999, now recently amended and referred to as EMCA (amendment) 2015, several administrative structures were established under the MENR. These include the National Environmental Council (NEC), National Environment Management Authority (NEMA), National Environment Tribunal (NET) the National Complaints Committee (NCC), and the Standard and Enforcement Review Committee (SERC).

Following the passage of the Environmental Management and Coordination Act (EMCA) 1999, now recently amended and referred to as EMCA (amendment) 2015, several administrative structures were established under the MENR. These include the National Environment Management Authority (NEMA), National Environment Tribunal (NET) and the National Environment Complaints Committee (NCC).

Ministry of Water and Irrigation

The Ministry of Water and Irrigation (MWI) mission statement is to contribute to national development by promoting and supporting integrated water resource management to enhance water availability and accessibility. The MWI has the following technical departments: Water Services, Water Resources, Water Storage and Land Reclamation, and Irrigation and Drainage.

National Environment Management Authority

NEMA is the administrative body that is responsible for the coordination of the various environmental management activities in Kenya. NEMA is also the principal government authority for implementing all environmental policies.

NEMA is also responsible for granting EIA approvals and for monitoring and assessing activities in order to ensure that the environment is not degraded by such project activities.

Water Resources Management Authority

WRMA is a state corporation, established under the Water Act 2002 and charged with being the lead agency in water resources management. Among other functions, WRMA is responsible for issuing permits for water use.

National Environmental Council

The NEC is the main body under the EMCA, whose key function is to formulate and set national policy and direction for the protection of the environment as prescribed in the EMCA.

National Complaints Committee

The NCC investigates allegations and complaints of suspected cases of environmental degradation. The Committee also prepares and submits to the NEC periodic reports of its activities.

Standard and Enforcement Review Committee

SERC's key function is to advise NEMA on the criteria and procedures for the measurement of environmental standards including but not limited to water quality, effluent discharge, air quality and noise quality.

The National Environment Tribunal

The National Environment Tribunal (NET) has the following functions including to hear and determine appeals from NEMA's decisions and other actions relating to issuance, revocation or denial of Environmental Impact Assessment (EIA) licences or amount of money to be paid under the Act and imposition of restoration orders; to give direction to NEMA on any matter of complex nature referred to it by the Director General; and in accordance with the Forest Act No. 7 of 2005, NET is mandated to review decisions of the board under sections 33 and 63.

Ministry of Energy and Petroleum

The Ministry of Energy and Petroleum is responsible for facilitating the provision of clean, sustainable, affordable, reliable, and secure energy services for national development while protecting the environment.

Relevant departments include the Energy Regulatory Commission (ERC), which was established under the 2006 Energy Act. The ERC's objectives and functions include regulating electrical energy, petroleum and related products, renewable energy and other forms of energy, and setting and reviewing tariffs, regulation enforcement and approval of power purchase agreements. The ERC must be notified of accidents or incidents causing significant harm or damage to the environment or property, which has arisen in Kenya.

Ministry of Sports, Culture and the Arts

The mission of the Ministry is to develop, promote, preserve and disseminate Kenya's diverse cultural, artistic and sports heritage through formulation and implementation of policies which enhance national pride and improve the livelihood of the Kenyan people.

The mandate areas of relevance to the Project include the following:

- National Heritage Policy and Management;
- National Archives/Public Records management;
- Management of National Museums and Monuments; and

- Historical Sites Management.

Following the passage of the National Museum and Heritage Act, the National Museum of Kenya was established under the Ministry, which has the following function:

- Heritage promotion, collection and documentation, research;
- Research;
- Preservation and conservation; and
- Information dissemination.

Ministry of Transport and Infrastructure

The Ministry has two Departments, namely the State Department of Transport and the State Department of Infrastructure. The Ministry is mandated to perform the following functions (among others): National Roads Development Policy Management, Transport Policy Management, National Road Safety Management, Development and Maintenance of Airstrips, National Transport and Safety Policy, and Implementation of LAPSSET Project.

Other Government Agencies

Relevant government agencies to the Project at the national level include:

- Kenya Forest Services;
- Kenyan Wildlife Services;
- National Land Commission; and
- Kerio Valley Development Authority.

5.3 Kenyan Policy and Legislative Requirements

Table 5.1 and Table 5.2 below provide a summary of Kenyan legislation and policy documents respectively, which are applicable to the ESIA.

Table 5.1: Key Kenyan Policy Documents

Policy	Description
The National Water Policy (2012)	The National Water Policy includes details of the national government's policies and plans for the mobilisation, enhancement and deployment of financial, administrative and technical resources for the management and use of water resources.
The Wetland Policy (2013)	The Wetland Policy aims at providing a framework for mitigating the diverse challenges that affect wetlands conservation and use in Kenya. Adoption of the policy also fulfils Kenya's obligations under the Ramsar Convention.
The Wildlife Policy (2012)	The Wildlife Policy makes provision for an overarching framework for the prudent and sustainable conservation, protection and management of wildlife and wildlife resources in Kenya, with incidental provision on access and the fair and equitable distribution of benefits accruing there-from, and its alignment with other sector-specific laws and the environment policy.

Policy	Description
Kenya Vision 2030 (2010)	Kenya Vision 2010 is a national long-term development blue-print to create a globally competitive and prosperous nation with a high quality of life by 2030. The vision is anchored on three key pillars; economic, social and political governance.
National Land Policy (2009)	The Policy was a key component towards addressing questions in the previous regulatory framework and contained the vision to provide Kenyans with "sustainable and equitable" access to and use of land.

Table 5.2: Relevant National Legislation

Name of Legislation	Description
Environmental Management and Coordination Act (EMCA) (1999) and Amendments (2015), and the subsidiary Regulations notably:	The EMCA (Amendment) 2015 and its subsidiary regulations set out requirements and procedures for conducting EIAs, auditing and environmental monitoring in Kenya. Furthermore, they establish environmental standards for water quality, noise, fossil fuel emission, and waste management. It also regulates activities impacting wetlands, river banks, lake/sea shores, and the conservation of biological diversity.
The EMCA (Impact Assessment and Audit) Regulations (EIAAR) (2003)	These Regulations contain rules relative to the content and procedures of an EIA, to environmental audit and to monitoring and strategic environmental assessment. These rules regulate other matters such as the appeal for, and registration of, information regarding EIA. The draft ESIA and EA Guidelines for the Downstream Petroleum Sub-sector (2012) issued by the ERC provide advice on their interpretation to that sector.
The EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management Plan) Regulations (2009)	These Regulations require the protection of wetlands, river banks, lake shore and sea shore areas which provide ecological habitats.
The EMCA - (Fossil Fuel Emission Control) Regulations (2006)	These Regulations set emission standards for internal combustion engines, provide for the licensing of persons responsible for treating fuel, provide for the appointment of environmental inspectors required to inspect emissions, and authorise the NEMA to enter into partnerships in order to conduct emission inspections.

Name of Legislation	Description
The EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations (2006)	These Regulations ensure that activities do not have an adverse impact on any ecosystem.
The EMCA (Water Quality) Regulations (2006)	These Regulations outline the water quality standards that should be met for different uses including effluent discharge. The following schedules in the Water Quality Regulation set out the relevant standards and monitoring requirements: ■ First Schedule: Quality Standards for Sources of Domestic Water; ■ Second Schedule: Quality Monitoring for Sources of Domestic Water; ■ Third Schedule: Standards for Effluent Discharge into the Environment; ■ Fourth Schedule: Monitoring Guide for Discharge into the Environment; ■ Fifth Schedule: Standards for Effluent Discharge into Public Sewers; and ■ Sixth Schedule: Monitoring for Discharge of Treated Effluent into the Environment. The Water Resources Management Authority and NEMA are key administering authorities.
The EMCA (Noise and Excessive Vibration Pollution) Control Regulations (2009)	This regulation establishes environmental standards that should be met for noise. NEMA is a key administering authority. The following schedules in the Noise and Excessive Vibration Pollution Control Regulation set out the relevant standards and monitoring requirements: ■ First Schedule – Maximum Permissible Intrusive Noise Levels. ■ Second Schedule – Maximum Permissible Noise Levels for Construction Sites. ■ Third Schedule – Maximum Permissible Noise Levels for Mines and Quarries. ■ Fourth Schedule– Application for a License to Emit Noise/Vibrations in Excess of Permissible Levels. ■ Fifth Schedule–License to Emit Noise/Vibrations in Excess of Permissible Levels.

Name of Legislation	Description
	■ Sixth Schedule – Application for a Permit to Carry out Activities. ■ Seventh Schedule - Permit to Emit Noise in Excess. ■ Eighth Schedule - Minimum Requirements for Strategic Noise and Excessive Vibrations Mapping. ■ Ninth Schedule – Minimum Requirements for Action Plans. ■ Tenth Schedule – Improvement Notice.
The EMCA (Waste Management) Regulations (2006)	These Regulations set rules for general waste management and for the management of solid waste, industrial waste, hazardous waste, biomedical waste, radioactive waste, pesticides and toxic waste. These Regulations prohibit the pollution of public places, provide for the granting of licences for waste transportation and waste disposal facilities, and require an EIA to be undertaken on any site disposing of or generating biomedical waste.
The Water Act, (2002) and subsidiary legislation contained including the Water Resources Management Rules (2007)	This Act provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water supply and sewerage services. The Rules implement the Act.
The Wildlife Conservation and Management Act (WCMA) (2013)	An Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya and for connected purposes. It also regulates wildlife conservation and management in Kenya, through the protection of endangered and threatened ecosystems. Specifically, it prohibits the disturbance or harm of flora and fauna within public places, community and private land, and Kenyan territorial waters. The Act also establishes Kenya Wildlife Service (KWS) as the implementing agency.
The National Museums and Heritage Act (2006)	An Act of Parliament to consolidate the law relating to national museums and heritage; to provide for the establishment, control, management and development of national museums and the identification, protection, conservation and transmission of the cultural and natural heritage of Kenya. The Act also establishes a notification of discovery requirement, and sets restrictions on

Name of Legislation	Description
	moving objects of archaeological or paleontological interest.
Physical Planning Act (2012)	An Act of Parliament to provide for the preparation and implementation of physical development plans and for connected purposes.
Occupational Health and Safety Act (2007), and subsidiary legislations and rules.	An Act of Parliament to provide for the safety, health and welfare of workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. This Act includes requirements for the control of air pollution, noise and vibration in every workplace where the level of sound energy or vibration emitted can result in hearing impairment, be harmful to health or otherwise dangerous.
Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005	These rules require that where the noise level is above ninety dB(A), the employer shall post conspicuous signs reminding employees that hearing protection must be worn, supply hearing protection and ensure all employees wear hearing protection.
Prevention, Protection and Assistance to Internal Displaced Persons and Affected Community Acts (2012)	An Act of Parliament on internal displacement in Kenya that includes vital provisions to secure the participation of displaced people in decision-making that affects them.
Agriculture, Fisheries and Food Authority Act (2013)	The Agriculture, Fisheries and Food Authority Act consolidate the laws on the regulation and promotion of agriculture and makes provision for the respective roles of the national and county governments in agriculture and related matters.
Traffic Act (2014)	The Traffic Act relates to traffic on all public roads.
Kenya Roads Act (2007)	An Act of Parliament to provide for the establishment of the Kenya National Highways Authority, the Kenya Urban Roads Authority and the Kenya Rural Roads Authority, to provide for the powers and functions of the authorities and for connected purposes.
Petroleum (Exploration and Production) Act,1984	An Act of Parliament to regulate the negotiation and conclusion by the government on petroleum agreements relating to the exploration, development, production and transportation of petroleum and for connected purposes.

Draft legislation and guidelines which are expected to be relevant to this study are provided in Table 5.3.

Table 5.3: Draft Legislation and Guidelines

Name of Legislation	Description
The Energy Bill, 2014	The Energy Bill provides for a National Energy Policy and for the establishment of energy related entities and will provide for the regulation of midstream and downstream activities.
The Petroleum Exploration, Development and Production Bill, 2014, and subsidiary regulations: ■ Petroleum Exploration, Development and Production (Local Content) Regulations, 2014	The Bill once it comes into force is to provide a framework for the contracting, exploration, development and production of petroleum and cessation of upstream petroleum operations. The local content regulation will apply to local content with respect to the upstream petroleum operations.
The Water Bill, 2014	The Water Bill provides for the regulation, management and development of water resources and water and sewerage services in line with the constitution. The Bill will provide for the repeal of the Water Act, 2002.
The EMCA (Air Quality Standards) Regulations, 2008	This Regulation's objective is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources such as mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries). The Regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas.
The Forest Conservation and Management Bill, 2014	The Bill provides for the declaration and management of forest areas and for the protection of such areas by establishing management boards to regulate all activities in such areas.
Draft Community Land Bill (2013)	The draft bill provides a legislative framework to give effect to Article 63 of the Constitution and makes provision for the recognition, protection, management and administration of community land. The proposed legislation allows a community to register ownership of an area of community land. The NLC administers the registration process.

5.4 International Guidance and Standards

The following international guidance, representing international best practices and standards, will be incorporated in all aspects of the ESIA. More specifically, the ESIA will comply with the IFC Performance Standards and EHS Guidelines.

- IFC (2012). Performance Standards for Environmental and Social Sustainability and accompanying Guidance Notes.

- **Performance Standard 1: Assessment and Management of Environmental and Social Risk and Impacts.** This standard aims to identify and evaluate all environmental and social risks of the Project and to promote improved environmental and social performance through effective use of management systems. The standard also promotes adequate engagement throughout the Project cycle.
- **Performance Standard 2: Labour and Working Conditions.** The objectives of Performance Standard 2 are to promote the fair treatment, non-discrimination and equal opportunity of workers in accordance with national laws and international conventions and instruments, specifically the core conventions of the International Labour Organisation and United Nations conventions related to rights of the child and migrant workers.
- **Performance Standard 3: Resource Efficiency and Pollution Prevention.** The objectives of Performance Standard 3 include avoiding or minimising pollution from project activities in order to avoid or minimise impacts on human health and the environment. This performance standard aims to promote the sustainable use of resources including energy and water and to reduce project-supplied GHG emissions.
- **Performance Standard 4: Community Health, Safety and Security.** The objectives of Performance Standard 4 include avoiding or minimising risks and impacts relating to the health and safety of the local community during the Project life cycle from both routine and non-routine circumstances. This performance standard aims to ensure that the safeguarding of people and property is conducted in a legitimate way which avoids or minimises risks to the community's safety and security.
- **Performance Standard 5: Land Acquisition and Involuntary Resettlement.** The objectives of Performance Standard 5 include the avoidance or minimisation of displacement and the avoidance of forced eviction. The responsible party should anticipate and avoid or minimise adverse social and economic impacts from land acquisition or restrictions on land use by providing compensation for loss of assets and ensuring resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected. The performance standard requires the improvement or restoration of the livelihoods and standards of living of the displaced persons. Living conditions among physically displaced persons should be improved through the provision of adequate housing with security of tenure at resettlement sites.
- **Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.** This standard aims to protect and conserve biodiversity. The standard promotes the utilisation of practices which integrate conservation needs and development priorities to promote the sustainable management and use of natural resources.
- **Performance Standard 7: Indigenous Peoples.** The objective of this Performance Standard is to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture and natural resource-based livelihoods of Indigenous Peoples.
- **Performance Standard 8: Cultural Heritage.** This standard aims to protect cultural heritage from adverse impacts of project activities and support its preservation; and also promotes the equitable sharing of benefits from the use of cultural heritage in business activities.

- IFC (2007a). EHS General Guidelines.
  - **EHS Guidelines: Wastewater and Ambient Water Quality.** These guidelines apply to projects that have either direct or indirect discharge of process wastewater, wastewater from utility operations or storm water to the environment, which may have implications for the Project's water treatment requirements. The guidelines are also applicable to industrial discharges to sanitary sewers that discharge to the environment without any treatment. The guidelines also state that if sewage from an industrial facility is to be discharged to surface water, treatment to meet

national or local standards for sanitary wastewater discharges is required. In their absence, indicative guideline values are provided by the IFC for sanitary wastewater discharges.

- **EHS Guideline: Air Emissions and Ambient Air Quality.** These guidelines apply to facilities or projects that generate emissions to air at any stage of the Project's life-cycle.
- **EHS Guideline: Occupational Health and Safety**. These guidelines apply to workers exposed to chemical and physical (i.e. noise) hazards whilst at work.
- **EHS Guideline: Noise**. These guidelines apply to projects that have noise impacts beyond the property boundary of the facilities. These guidelines establish noise standards that should not be exceeded, and also stipulates that noise levels should not result in a maximum increase in background levels of 3dB at the nearest receptor location offsite.
- **EHS Guidelines for Water and Sanitation.** These guidelines include information relevant to the operation and maintenance of potable water treatment and distribution systems, and collection of sewage in centralised systems, decentralised systems, and treatment of collected sewage at centralised facilities.
- **EHS Guidelines for Onshore Oil and Gas Development.** These guidelines include information on industry-specific impacts, management performance indicators, and monitoring related to seismic exploration, exploration and production drilling, development and production activities, transportation activities including pipelines, other facilities including pump stations, metering stations, pigging stations, compressor stations and storage facilities, ancillary and support operations, and decommissioning.
- **EHS Guidelines for Thermal Power Plants.** These guidelines may apply if the total power quantity generated at the CPF is greater than 50MWth.

Good Practice guidelines which will be referred to throughout the ESIA include but are not limited to the following:

- Business and Biodiversity Offsets Programme (2012). BBOP Standard on Biodiversity Offsets Guidance.
- IFC (2013). Good Practice Handbook: Cumulative Impact Assessment and Management – Guidance for the Private Sector in Emerging Markets.
- International Petroleum Industry Environmental Conservation Association (IPIECA) (2005).
- IPIECA (2007). An ecosystem approach to oil and gas industry biodiversity conservation.
- IPIECA (2010). Alien invasive species and the oil and gas industry Guidance for prevention and management.
- IPIECA (2014). Cross Sector Biodiversity Initiative Guidance.
- The Energy and Biodiversity Initiative (2006). Integrating Biodiversity into Environmental and Social Impact Assessment Processes and associated guidance.
- The Energy and Biodiversity Initiative (2006). Negative Secondary Impacts from Oil and Gas Development; www.theebi.org.
- The Energy and Biodiversity Initiative (2006). Biodiversity Indicators for Monitoring Impacts and Conservation Actions; www.theebi.org.
- The Energy and Biodiversity Initiative (2006). Opportunities for Benefiting Biodiversity Conservation; www.theebi.org.
- The Energy and Biodiversity Initiative (2006). Good Practice in the Prevention and Mitigation of Primary and Secondary Biodiversity Impacts; www.theebi.org.

- The Energy and Biodiversity Initiative (2006). Framework for Integrating Biodiversity into the Site Selection Process; www.theebi.org
- World Resources Institute (WRI) (Landsberg F, Treweek J, Stickler MM, Henninger N and Venn 0) (2013). Weaving ecosystem services into impact assessment: A Step-By-Step Method.
- WHO (2011). Drinking Water Quality Guidelines – 4th edition.
- WHO (2005). Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines.
- WHO (1999). Guidelines for Community Noise.

5.5 International Conventions

Relevant international agreements, treaties and conventions that have a social and/or environmental aspect to which Kenya is a signatory/acceded or ratified to are detailed in Table 5.4 below. Refer to Chapter 6.0 for applicability to each of the technical disciplines.

Table 5.4: International Conventions

Convention	Date Ratified/Acceded to
African Convention for the Conservation of Nature and Natural Resources (2003)	Ratified (12 May 1969)
Convention on Biological Diversity (1992)	Ratified (26 July 1994)
Vienna Convention for the Protection of the Ozone Layer (1985)	Acceded to (9 November 1988)
UNESCO Convention for the Protection of the World Cultural and Natural Heritage (1972)	Acceded to (1 May 1964)
Convention on the Conservation of Migratory Species of Wild Animals (1985) ■ The African-Eurasian Water-bird Agreement (AEWA). ■ The Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA).	Acceded to (26 February 1999)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)	Acceded to (13 December 1978)
Convention on Wetlands of International Importance (the Ramsar Convention 1971)	Only signatory
Convention on Persistent Organic Pollutants (2001)	Ratified (24 September 2004)
Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1995)	Acceded to (1 June 2000)
Bamako Convention on the Ban of the Import into Africa and the Control of Trans-boundary Movement and Management of Hazardous Wastes within Africa (1991)	Only signatory
Convention on Biological Diversity (2006)	Ratified (26 July 1994)

Convention	Date Ratified/Acceded to
Convention on Climatic Change and the Kyoto Protocol (1997)	Ratified (25 February 2005)
Lusaka Agreement on the Cooperative Enforcement Operations Directed against Illegal trade in Fauna (1994)	Ratified (17 January 1997)
Nile Basin Initiative (1999)	N/A

5.6 TKBV Policy

Tullow environmental and social internal policies and standards will also apply, including, but not limited to:

- EHS policy statement;
- Tullow Integrated Management System; and
- Tullow Oil Shared Prosperity Commitment.

5.7 Required Authorisations

Prior to project development, a number of permits and consents must be obtained from various government agencies. NEMA is one government agency with a key role in issuing such authorisations as projects with potential environmental impacts must be approved by NEMA in accordance with the EMCA (Amendment) 2015, and associated regulations.

One relevant environmental licence required by the Project proponent is an EIA Licence. An application for an EIA License is submitted to NEMA in the form of a Project Report. A project that NEMA considers should be subjected to an EIA study must first undergo a Scoping Study, followed by a full EIA study, which includes public and stakeholder consultation.

NEMA will review the EIA once submitted and will rely on technical advice from other government agencies and organisations when approving a new project. NEMA also receives guidance on local issues and advice from surrounding communities and stakeholders.

Other relevant key environmental, health and safety permits, licences and authorisations required include:

- Air emissions licence;
- Waste disposal licences;
- Water use, swamp drainage and discharge permits;
- Effluent discharge licence;
- Noise and/or vibrations licence;
- Temporary noise permit;
- Access to land;
- Consents for drain connection and water flow obstruction;
- Permit for movement of heritage items;
- National safety and security fund registration;
- Registration of workplace; and
- Work injuries and benefits registration.

6.0 TECHNICAL TOPICS

This chapter describes applicable standards, baseline conditions, the key data gaps, and the proposed assessment approach for each of the following technical topics:

- Biodiversity;
- Ecosystem Services;
- Soil, Terrain and Geomorphology;
- Water;
- Seismicity and Geology;
- Air and Climate;
- Noise and Vibration;
- Landscape and Visual;
- Cultural Heritage; and
- Social, which includes:
  - Administrative Divisions and Governance Structure
  - Demographics
  - Infrastructure and Services
  - Economics
  - Land Use and Ownership
  - Community Health and Safety
  - Education
  - Social Maladies
  - Social Capital and Conflict

Whilst waste is not included in the above list as a specific technical topic, the ESIA will assess potential impacts from the generation of hazardous and non-hazardous waste from the project under each technical topic, and describe the proposed treatment and disposal technologies that are to be used.

The ESIA will also assess potential impacts arising from commissioning under each technical topics, where relevant.

6.1 Biodiversity

6.1.1 Introduction

The elements and activities of the Upstream Project that are likely to affect biodiversity include:

- The land take required to accommodate and construct project facilities could lead to the direct loss of protected areas, land cover and/or habitats from clearing and site preparation;
- Direct effects resulting from project construction and operation activities include;
  - Air emissions and dust deposition;

- Sensory disturbance (light, noise, vibration, odour);
- Direct mortality of fauna (e.g. on roads, in open trenches), changes to surface water runoff and flood regimes;
- Spillages of contaminants due to catastrophic failure of project infrastructure;
- Discharge of unacceptable concentrations of contaminants;
- Population influx;
- Surface water and/or groundwater abstraction affecting water quality and quantity and any subsequent impacts on riparian habitat and species downstream of abstraction; and
- Barriers to movement.

- Indirect effects resulting from project construction and operation activities include:
  - Population influx;
  - Introduction of weed, pest and disease species during the construction, operation and decommissioning of the Project, which could affect vegetation communities and fauna and flora populations, resulting in changes to habitat quantity and quality; and
  - Increased access to areas of biodiversity value, via development of new roads.

6.1.2 Applicable standards and guidance

A detailed list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the biodiversity assessment in the ESIA.

National Policy and Legislation

The following national policy and legislation are considered relevant to be applicable to the ESIA:

- The Republic of Kenya. The Wildlife Conservation and Management Act, 2013;
- The Republic of Kenya. The Environmental Management and Co-ordination Act (Wetlands, River Banks, Lake Shore and Sea Shore Management) Regulations, 2009;
- The Republic of Kenya. The Environmental Management and Co-ordination Act (Conservation of Biological Diversity and Resources, Access to Genetic and Benefit Sharing) Regulations, 2006; and
- Ministry of Forestry and Wildlife. The National Wildlife Conservation and Management Policy, 2012.

International Guidance and Standards

The following Performance Standards and guidelines are specifically applicable to the assessment of biodiversity in the Upstream Area:

- International Finance Corporation. Performance Standard 6: 2012. Biodiversity Conservation and Sustainable Management of Living Natural Resources. IFC, 2012;
- International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers. A guide to developing biodiversity action plans for the oil and gas sector. IPIECA and OGP, 2005;
- International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers. An ecosystem approach to oil and gas industry biodiversity conservation. IPIECA and OGP, 2007;
- International Petroleum Industry Environmental Conservation Association (2007). An ecosystem approach to oil and gas industry biodiversity conservation. http://www.ipieca.org;

- International Petroleum Industry Environmental Conservation Association (2010). Alien invasive species and the oil and gas industry Guidance for prevention and management. http://www.ipieca.org.The Energy and Biodiversity Initiative (2006). Integrating Biodiversity into Environmental and Social Impact Assessment Processes; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Integrating Biodiversity into Environmental and Social Impact Assessment Processes; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Negative Secondary Impacts from Oil and Gas Development; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Biodiversity Indicators for Monitoring Impacts and Conservation Actions; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Opportunities for Benefiting Biodiversity Conservation; www.theebi.org;
- The Energy and Biodiversity Initiative (2006). Good Practice in the Prevention and Mitigation of Primary and Secondary Biodiversity Impacts; www.theebi.org; and
- The Energy and Biodiversity Initiative (2006). Framework for Integrating Biodiversity into the Site Selection Process; www.theebi.org.

International Conventions

The following conventions, to which Kenya is a signatory as well as a party to, relate to the protection of natural environment (i.e. ecosystems), and are considered to be applicable to the ESIA for the Upstream Area:

- The African Union. African Convention for the Conservation of Nature and Natural Resources. The African Union, 2003;
- United Nations. Convention on Biological Diversity. United Nations, 1992;
- Convention on the Conservation of Migratory Species of Wild Animals, 1985;
- Convention on International Trade in Endangered Species (CITES);
- The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) (1999);
- Convention on Wetlands of International Importance (the Ramsar Convention), 1971; and
- The World Heritage Convention, 1972.

6.1.3 Baseline

6.1.3.1 Available data

The following data/data sources were identified as available during the scoping stage:

- Integrated Biodiversity Assessment Tool (IBAT) data, including Red List species extents of occurrence and/or areas of occupancy, Key Biodiversity Areas (KBA), Endemic Bird Areas (EBA), Important Bird Areas (IBA), protected areas, wetland areas (IBAT, 2014);
- Regional vegetation communities and underlying geology of Northern Kenya (ILRI, 2011);
- Regional vegetation communities (White, 1983);
- Semi-supervised land-cover classification of Lokichar development area (ERA, 2014);
- Records of species presence and distribution held by the Global Biodiversity Information Facility (GBIF);
- Local records of species presence and distribution provided by National Museum of Kenya;

- Extensive literature library comprising information sourced for literature review component of critical habitat screening report;
- Ground truthing of desk top data including visual observations but no sampling, completed during a brief (less than one week) scoping visit in December 2014, attended by Golder representative Ruth Golombok and Bernard Agwanda of NMK; and
- Results of critical habitat screening exercise completed in March 2015.

6.1.3.2 Area of influence and study area

The biodiversity AOI will be similar to the AOI for the Upstream Project (Figure 1) because of the potential for the Project to affect biodiversity features in the wider area. Although it is subject to the outcome of the ongoing water abstraction and transport optioneering processes, the current biodiversity AOI will encompass the southern portion of Lake Turkana, the sub-counties of Loima, Turkana Central, Turkana South, Turkana East, as well as the potential pipeline route from the Turkwel Gorge Reservoir, and the A1 Lokichar to Kitale Highway. The current AOI covers the Kerio and Turkwel Rivers within whose river basins the Upstream Area lies.

The potential AOI currently includes the following protected areas:

- Lake Turkana National Parks World Heritage Site;
- South Turkana National Reserve;
- Nasalot National Reserve;
- Sekerr Forest Reseve;
- Kamatiri Forest Reserve;
- Lelan Forest Reserve; and
- Sogotio Forest Reserve.

The biodiversity Study Area will focus on the footprint of all the Upstream Project components and the oil fields. It will also encompass the potential pipeline route from the Turkwel Gorge Reservoir as well as the area of the potential abstraction point, and the Turkwel River downstream of the abstraction point.

6.1.3.3 Baseline conditions

Critical Habitat determination is a requirement under IFC Performance Standard 6 (PS6) to manage risk and avoid or mitigate and, where necessary, offset impacts to areas of high biodiversity value. A Critical Habitat Assessment Area (CHAA, refer to Figure 3) has been defined for the preliminary screening of potential triggers of critical habitat at the species, ecosystem and landscape level. Potential triggers are screened against both quantitative and qualitative criteria for the determination of critical habitat as identified in IFC PS6, and are listed below:

- Criterion 1 - Habitat of significant importance to critically endangered and/or endangered species.
- Criterion 2 - Habitat of significant importance to endemic and/or restricted-range species.
- Criterion 3 - Habitat supporting globally significant concentrations of migratory species and/or congregatory species.
- Criterion 4 - Highly threatened and/or unique ecosystems.
- Criterion 5 - Areas associated with key evolutionary processes.
- Criterion 6 - Areas required for seasonal refugia for critically endangered and/or endangered species.
- Criterion 7 - Ecosystems of known special significance to critically endangered or endangered species for climate adaptation purposes.

- Criterion 8: Concentrations of vulnerable species in cases where there is uncertainty regarding the listing, and the actual status of the species may be critically endangered or endangered.
- Criterion 9 - Areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity.
- Criterion 10 - Landscape and ecological processes (for example, water catchments, areas critical to erosion control, disturbance regimes) required for maintaining critical habitat.
- Criterion 11 - Habitat necessary for the survival of keystone species; that is, species that act as ecosystem engineers and drive ecosystem process an functions, for example, elephants in savannah woodlands and their foraging behaviours that maintain vegetation structure.
- Criterion 12 - Areas of high scientific value, such as those containing concentrations of species new and/or little known to science.
- Criterion 13 - An area of known high concentrations of natural resources exploited by local people.
- Criterion 14 - Areas that meet the criteria of the IUCN's Protected Area Management Categories Ia, Ib and II, although areas that meet criteria for Management Categories III-VI may also qualify depending on the biodiversity values inherent to those sites.
- Criterion 15 - KBAs, which encompass inter alia Ramsar Sites, IBAs, Important Plant Areas (IPA) and Alliance for Zero Extinction Sites.
- Criterion 16 - Areas determined to be irreplaceable or of high priority/significance based on systematic conservation planning techniques carried out at the landscape and/or regional scale by governmental bodies, recognized academic institutions and/or other relevant qualified organisations (including internationally-recognised NGOs).
- Criterion 17- High Conservation Value (HCV) areas, as defined by IFC PS6

The Critical Habitat screening identifies:

- 66 species of concern that could trigger critical habitat in the CHAA, including:
  - 2 insect species;
  - 1 macro-invertebrate species;
  - 17 fish species;
  - 2 amphibian species;
  - 1 reptile species;
  - 27 bird species, and
  - 16 mammal species.

Many plant and invertebrate species have not yet been assessed by the IUCN. Very few records exist for those species in the CHAA. Therefore, the screening of such species is not exhaustive and, hence, a potential exists for such species to occur in the CHAA.

- Four vegetation communities that could trigger critical habitat include:
  - Deciduous wooded annual grassland;
  - Evergreen and semi-deciduous bushland;
  - Evergreen and semi-deciduous woodland; and
  - Undifferentiated evergreen forest.

These potential triggers of critical habitat will be brought forward and fully assessed as part of the ESIA. They will form the basis of a more detailed assessment using expert opinion and targeted surveys. Furthermore, as mentioned, it is recognised that many plant and invertebrate species have not yet been assessed by the IUCN. Hence, the possible presence of triggers from these two groups should not be discounted. The ESIA will seek to confirm if such species exist in the CHAA.

Figure 4 (Sensitivity Map of CHAA) presents ecosystems of concern and available spatial records of species of concern (GBIF, 2014; NMK, 2015) within the CHAA, based on available information to date.

There are notably scarce records for plants and invertebrates - until dedicated field surveys are conducted during the baseline, there is little available data on what plant/invertebrate species may occur within the CHAA at this stage.

It can be expected that additional species records for plants and invertebrates will be added as further information becomes available during the ESIA.

6.1.3.4 Key data gaps

Primary data gathering in potentially affected areas is the key data gap, which will be addressed through an extensive suite of field survey planned for 2015/2016:

- Aquatic Ecosystems: quantitative and qualitative characterisation of riparian (lugga) systems in the vicinity of the proposed development and downstream of the proposed water abstraction point on the Turkwel River, and any temporary pools and wadis within the footprint of the Upstream Study Area.
- Wetland Ecosystems: characterisation of the boundaries of wetlands located downstream of proposed abstraction points. Other gaps include determining attributes relating to habitat condition, adjacent land use, and levels of disturbance.
- Vegetation and Flora: flora and habitat inventory for the Upstream Study Area.
- Birds, Herpetofauna and Invertebrates: Identification and characterisation of species in the Study Area, including distribution, relative abundance, populations, communities and habitat associations.
- Large and Small Mammals: Identification and characterisation of mammals in the study area, including distribution, relative abundance, populations, communities and habitat associations.

6.1.4 Identification of potentially significant effects

The following presents the environmental aspects that have been identified as potential effects that the Upstream Project could have on biodiversity features (ecosystems and species). The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Direct loss/conversion of natural ecosystems, features of biodiversity value (including critical habitat, species of concern) or habitat due to:
  - Clearing and earthmoving for construction, operation and closure of project infrastructure and pipelines – scoped in;
  - Project infrastructure located in legally protected areas including Mount Elgon Biosphere Reserve, Mount Kulal Biosphere reserve and Lake Turkana WHS – scoped out, since infrastructure avoids these areas although will be scoped in if Lake Turkana is the selected source of make-up water used for water injection;
  - Project infrastructure located in potential critical and/or important habitats or environmentally sensitive areas – scoped in;
  - Project infrastructure located in riparian vegetation – scoped in;

- Project infrastructure located in wetland areas - scoped out, since infrastructure avoids wetlands;
- Changes in surface water runoff and flooding regimes – scoped in;
- Groundwater abstraction – scoped in;
- Contamination from increased airborne/waterborne contaminants, noise, vibration, light and odour during construction and operation, and following closure of the Project – scoped in;
- Contamination from a catastrophic failure of project infrastructure– scoped out of biodiversity, but assessed in design of the Project and project hazards analysis;
- Water abstraction during construction and operations – scoped in; and
- Water abstraction following closure of the Project – scoped out, since water supply required only during operations and construction.

- Direct loss of palaeo-ecology – scoped out, since there is no evidence of palaeo-ecology observed during scoping site visit.
- Indirect loss/conversion of legally protected areas (including Outstanding Universal Value of Lake Turkana WHS) due to influx of opportunity seekers– scoped in.
- Indirect loss of areas of biodiversity value due to:
  - Harvesting of medicinal plants, bush meat, fishing, increased fuel wood harvest – scoped in;
  - Introduction of invasive species that could out-compete indigenous species – scoped in;
  - Changes to hydrological and sedimentation regimes – scoped in; and
  - Increased access, via development of new roads – scoped in.
- Loss of migration routes due to:
  - Barriers formed by power line – scoped in;
  - Barriers formed by pipelines once in place during operations – scoped in; and
  - Air-borne contamination and sensory disturbance, odour, noise, light – scoped in.

6.1.5 Summary of approach to the ESIA

A summary of the approach to the biodiversity component of the ESIA is provided in Table 6-1.

Table 6-1: Analysis of potential effects (Biodiversity)

Receptor	Potential Effect	Next Steps in the ESIA
Vegetation and flora	■ Direct loss of natural ecosystems and flora species (including species of concern) within the Upstream Area, due to Project construction, operation decommissioning activities. ■ Indirect/induced loss/conversion of natural habitat due to Project facilities.	*Baseline data gathering* – ■ Assessment of the extent, condition and quality of the vegetation communities within the Upstream Area. ■ Vegetation and flora studies of the vegetation communities within the proposed oil fields and CPFs. ■ Vegetation mapping of CHAA, including mapping of modified and natural habitat, to inform the

Receptor	Potential Effect	Next Steps in the ESIA
	■ Indirect/induced loss/conversion of natural habitat as a result of spontaneous settlement, agricultural conversion, and increased demand for ecosystem services (e.g. harvest of timber) associated with population influx. ■ Harvesting of medicinal plants, fibre and wood ■ Introduction of invasive species. ■ Direct/indirect losses of riparian vegetation. ■ Increased access, via development of new roads. ■ Fragmentation and edge effects. ■ Changes to hydrological regimes. ■ Increased erosion and sedimentation.	determination of modified, natural and critical habitats. *Impact Assessment –* ■ The vegetation and flora impact assessment analysis will be largely habitat-area based using GIS, focussing on select ecosystem or community-level indicators, as identified during the baseline habitat and vegetation mapping study.
Birds	■ Direct loss of nesting and foraging habitat within the Upstream Area. ■ Mortality of individuals and/or local populations. ■ Indirect/induced loss/conversion of preferred and/or critical habitat through sensory disturbance.	*Baseline data gathering –* ■ Three seasonally representative field surveys will be undertaken to identify bird species use of the Upstream Area, and establish distribution, relative abundance, populations, communities and habitat associations. *Impact Assessment –* ■ The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on bird species of concern identified during the baseline.
Herpetofauna	■ Direct loss of basking sites, refugia and foraging habitat, breeding habitats within the Upstream Area.	*Baseline data gathering –* ■ A survey of herpetofauna will be conducted within the Upstream Area and areas identified as being of high

Receptor	Potential Effect	Next Steps in the ESIA
	■ Mortality of individuals and/or local populations. ■ Sensory disturbance. ■ Introduced diseases.	potential to support species of concern. *Impact Assessment* – ■ The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on reptile and amphibian species of concern identified during the baseline that will be measurably affected by the Project.
Invertebrates	■ Direct loss of refugia and foraging habitat within the Upstream Area. ■ Mortality of individuals and/or local populations. ■ Sensory disturbance.	*Baseline data gathering* – ■ A survey of terrestrial invertebrates will be conducted within the Upstream Area and areas identified as being of high potential to support species of concern. *Impact Assessment* – ■ The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on invertebrate species of concern identified during the baseline that will be measurably affected by the Project.
Large mammals	■ Direct loss of refugia and foraging habitat within the Project infrastructure footprint. ■ Mortality of individuals and/or local populations. ■ Indirect/induced loss/conversion of preferred habitat. ■ Indirect/induced loss through increased bush meat hunting pressure from population influx. ■ Sensory disturbance. ■ Introduced diseases. ■ Barriers to movement.	*Baseline data gathering* – ■ Transect surveys will be conducted in the Upstream Area and selected control sites. ■ A remote camera trapping scheme will be deployed across the Upstream Area and selected sites. *Impact Assessment* – ■ The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on large mammal species of concern identified during the baseline that will be measurably affected by the Project.

Receptor	Potential Effect	Next Steps in the ESIA
Small mammals	■ Direct loss of nesting and foraging habitat within the Project infrastructure footprint. ■ Mortality of individuals and/or local populations. ■ Indirect/induced loss/conversion of preferred habitat. ■ Indirect/induced loss through increased bush meat hunting pressure from population influx. ■ Sensory disturbance. ■ Introduced diseases. ■ Barriers to movement.	*Baseline data gathering* – ■ A small mammal trapping scheme will be deployed across the different vegetation communities of the Upstream Area. ■ Bat species usage of the Upstream Area will be assessed through installation and rotation of passive acoustic monitors, and analysis of echolocating bat call signatures. *Impact Assessment* – ■ The impact assessment will be based on analysis of population effects and habitat-area based analysis using GIS, and will focus on small mammal species of concern identified during the baseline that will be measurably affected by the Project.
Aquatic and Wetland ecosystems	■ Direct loss/conversion of natural lugga and wetland ecosystems and habitat. ■ Indirect/induced loss/conversion of natural habitat. ■ Contamination from increased waterborne pollutants. ■ Change to hydrological regimes. ■ Introduced pests and diseases.	*Baseline data gathering* – ■ Fish and macro-invertebrates will be sampled at selected sites on the Turkwel River downstream of the proposed water abstraction point. Should sufficient flow occur in the Kalabata during the long wet season, sampling will also be conducted downstream of the Upstream Area. ■ Wetland ecosystems associated with the Turkwel River will be surveyed at selected sites. *Impact Assessment* – ■ The impact analysis will enable effects on aquatic flora and fauna to be assessed, through the examination of stressor indicators, habitat indicators, response indicators, and valued receptors (e.g. regionally/locally endemic fish species, Ramsar wetlands) and will focus on quantifying potential Project effects relative to baseline conditions.

6.1.6 References

ERA, 2014. Semi-supervised land cover classification – Lokichar development areas, Kenya. GIS dataset generated during scoping stage for the Project.

IBAT, 2014. GIS shapefiles including WDPA polygon boundaries for Kenya, Key Biodiversity Areas in Kenya including Important Bird Areas, Boundaries of Alliance for Zero Extinction sites, Regional biodiversity hotspot areas, endemic bird areas, and IUCN Red List species density grid.

ILRI, 2011. Vegetation types of Northern Kenya. International Livestock Research Institute (ILRI) spatial data.

White, F. 1983. *Vegetation of Africa - a descriptive memoir to accompany the UNESCO/AETFAT/UNSO vegetation map of Africa*. Natural Resources Research Report 20; U. N. Educational, Scientific and Cultural Organization; 7 Place de Fontenoy, 75700 Paris, France.

6.2 Ecosystem Services

6.2.1 Introduction

Ecosystem services consist of all the natural products and processes that contribute to human well-being, as well as the personal and social enjoyment derived from nature (Landsberg, Stickler, Henninger, Treweek, & Venn, 2013). They are the benefits that people, including businesses, derive from ecosystems. The broad categories of ecosystem services as defined by the *Millennium Ecosystem Assessment* (MA, 2005), their definition, and their context in terms of the Upstream Area is presented in Table 6-2.

Table 6-2: Defining Ecosystem Services in the Context of the Study Area

Broad category	Definition	Example in the Upstream Area
Regulating services	Ecosystem control of the natural environment, including air quality, climate, water flow timing, erosion control, and water purification.	Regulation of water timing and flows; for instance permeable soils like lugga sands facilitate fast aquifer recharge
Provisioning services	The goods or products obtained from ecosystems, such as medicinal plants and minerals, water sources, fishing grounds, fire wood	Wild foods such as the fruits of the duam palm, bushmeat (dikdik) and honey supplement the diet of pastoralist people of the region
Cultural services	Aesthetic, spiritual, recreational, and other cultural values supplied by ecosystems; such as sacred sites, recreation areas, sense of place	Certain trees (e.g. *Maytenus* sp.) are used by Turkana people as meeting places and forums. In many cases, these trees are considered sacred and may not be cut down
Supporting services	Natural processes essential to resilience, and functioning of ecosystems, that maintain the other ecosystem services	Primary production – growth of grass within the Upstream Area dictates the presence of pastoralists in the area

Ecosystem Services are therefore intrinsically linked with Biodiversity and the Social topics and as such its characterisation and assessment of impacts are highly dependent on biodiversity baseline data, as well as a strong understanding of the socio-economic context and cultural heritage linkages

6.2.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. Ecosystem services are largely addressed by IFC PS6; nevertheless the assessment of ecosystem services is spread throughout the environmental and social Performance Standards (PS) because the potential effects of a project on ecosystem services relates to all aspects of peoples' relationship with the environment, including health and safety risks,

land ownership or usage, and cultural heritage. The specific PS that contain provisions for ecosystem services assessment are PS1, PS3, PS4, PS5, PS7 and PS8.

In addition, the following generally accepted best practise guidance provides additional assessment approaches specific to ecosystem services assessment in the ESIA:

International Guidance and Standards

- International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers 2007. An ecosystem approach to oil and gas industry biodiversity conservation. IPIECA and OGP.
- International Petroleum Industry Environmental Conservation Association 2007. An ecosystem approach to oil and gas industry biodiversity conservation. http://www.ipieca.org.
- International Petroleum Industry Environmental Conservation Association (2010). Alien invasive species and the oil and gas industry Guidance for prevention and management. http://www.ipieca.org.
- International Petroleum Industry Environmental Conservation Association (2011). Ecosystem Services Guidance: Biodiversity and Ecosystem Services Guide and Checklists. http://www.ipieca.org.
- World Resources Institute (2013). Weaving ecosystem services into impact assessment: A Step-By-Step Method.

International Conventions

The following conventions relating to the protection of natural resources and cultural heritage are specifically applicable to the assessment of ecosystem services:

- The Convention for the Protection of the World's Cultural and Natural Heritage, 1972
- The Convention for the Safeguarding of the Intangible Cultural Heritage, 2003

6.2.3 Baseline

6.2.3.1 Available data

Available data for use in the preliminary assessment of ecosystem services supply within the Upstream Area includes the biodiversity data outlined in Section 6.1.3.1; available data on cultural services supplied by the ecosystems within the Upstream Area including NMK data holdings on locations of all archaeological, palaeontological and cultural sites; and some limited socio-economic information for the area (reports from Kenya National Bureau of Statistics).presents known data relevant to ecosystem services.

6.2.3.2 Area of influence and study area

The ecosystem services AOI will generally align with the AOI used for the socio-economic baseline assessment because of the potential for the project to affect ecosystem services in the wider area. It will encompass the three sub-county administrative units or Constituencies of Turkana East, Turkana South and Turkana Central, as well as the area extending to the border of Uganda and the town of Kitale.

6.2.3.3 Baseline conditions

Section 6.1.3 presents baseline conditions relevant to ecosystem services.

6.2.3.4 Key data gaps

Although the use of ecosystems by local people within the region is generally understood, little empirical information exists on the extent to which people use or rely upon ecosystem services supplied within the region. This lack of information will be addressed by the data baseline gathering for technical topics including Biodiversity, Soils, Water, Cultural Heritage and Social, which will be influenced by the Ecosystem Services specialists to ensure the correct information is gathered to inform the Ecosystems Services Assessment.

6.2.4 Identification of potentially significant effects

The following presents the potentially significant effects specific to ecosystem services. Ecosystem services may be affected by significant effects presented in Sections 6.1.4, 6.3.4, 6.4.4, 6.9.4and 6.10.4. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Influx of opportunity seekers during construction and operation whose activities and demands could affect processes, functioning and integrity of ecosystems, which could lead to a loss in the capacity to supply services – scoped in;
- Direct or indirect loss of ecosystem services through ecosystem alteration/loss due to construction and operation of the project – scoped in; and
- Indirect loss of ecosystem services through alteration of ecosystem processes, functioning and integrity, which could lead to a loss in the capacity to supply services – scoped in.

6.2.5 Summary of approach to the ESIA

The approach presented in Sections 6.1.5, 6.3.5, 6.4.5, 6.9.5, and 6.10.5 will inform the Ecosystem Services assessment, however

Table 6-3 presents a summary the approach which is specific to ecosystem services.

Table 6-3: Analysis of potential effects (Ecosystem Services)

Receptor	Potential Effect	Next Steps in the ESIA
Vegetation and flora	■ Direct loss of habitats and vegetation communities within the Upstream Area, due to Project construction, operation decommissioning activities affecting the systems' capacity to supply services. ■ Indirect/induced loss/conversion of natural habitat due to Project facilities affecting the systems' capacity to supply services. ■ Direct and/or indirect changes to ecosystem processes, functioning and integrity affecting the systems' capacity to supply services. ■ Population influx during construction and operation increasing the demand for ecosystem services. ■ Harvesting of medicinal plants, fibre and wood ■ Introduction of invasive species for use as medicinal plants, fibre and fire wood.	■ Baseline vegetation and flora study, including recording of plant species used as food resources, medicinal resources and for construction of traditional houses. ■ Stakeholder engagement to understand current demand for ecosystem services by local people, such as tree harvest for charcoal production, home building and kraal construction. ■ Inventorying, mapping and assessing the condition of vegetation communities in order to understand their capacity to

Receptor	Potential Effect	Next Steps in the ESIA
		supply ecosystem services
Wildlife (birds, herpetofauna, invertebrates, large and small mammals)	■ Indirect/induced loss through increased bush meat hunting pressure from population influx. ■ Direct and/or indirect changes to ecosystem processes, functioning and integrity affecting the systems' capacity to support populations of wildlife.	■ Baseline faunal biodiversity studies. ■ Stakeholder engagement to understand current demand for bush meat by local people. ■ Inventorying, mapping and assessing the condition of areas of ecosystem services supply
Water	■ Indirect and direct loss of water resources for livestock and human consumption due to groundwater abstraction. ■ Indirect and direct loss of water resources for project consumption due to groundwater abstraction and surface water abstraction. ■ Indirect losses of water supply for local livestock and wildlife due to altered hydrological regimes resulting from the construction, operation and decommissioning of the project. ■ Contamination of water by project activities. ■ Restriction of access to water resources by livestock and people due to construction, operation and decommissioning of the project. ■ Indirect and direct changes to the hydrological regimes resulting from the construction, operation and decommissioning of the project.	■ Review of baseline surface and groundwater data for the AOI ■ Community engagement (focus group or key informant) to understand current demand for water by local people, and important areas of supply. ■ Understanding the project's requirements for water supply. ■ Inventorying, mapping and assessing the condition of priority water supply areas /hydrocensus
Soil	■ Direct and induced loss of soil through construction, operation and decommissioning of the project. ■ Direct and/or indirect changes to soil processes, functioning and integrity affecting the systems' capacity to supply services.	■ Review of baseline soil and land use data for the AOI and understanding of its condition and potential to provide regulating and

Receptor	Potential Effect	Next Steps in the ESIA
	■ Restriction of access to arable areas by the local people.	supporting ecosystem services
Tangible and intangible cultural heritage	■ Direct and indirect loss of ecosystems linked to tangible cultural heritage. ■ Direct loss of access to areas linked to tangible and intangible cultural heritage. ■ Direct and indirect changes to the character of the landscape of the Upstream Area, through the construction, operation and decommissioning of the project, linked to intangible and tangible cultural heritage.	■ Collaboration with cultural heritage team and land use team to ensure that data pertaining to ecosystem service use is gathered during their baseline work ■ Community engagement (focus group or key informant) to understand current use of natural features for cultural services by local people. ■ Inventorying, mapping and assessing the condition of areas of cultural ecosystem services supply.

6.3 Soil, Terrain and Geomorphology

6.3.1 Introduction

The following elements of the Project may affect soil and terrain during construction and operations:

- The geographical extent of project facilities (e.g. well pads, CPF, water supply, feeder pipelines, transport infrastructure (roads, airstrip, helipad), integrated waste management facility and accommodation camps) that could lead vegetation clearing and the loss/conversion of terrain and soil;
- Leaks and spills resulting in soil contamination and compaction during construction and operations; and
- Influx of people to the region and associated changes in land use, agricultural practices and soil management.

6.3.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key guidance which will be applicable to and guide the soils assessment in the ESIA.

International Guidance and Standards

Field Soil survey methodology and data collected at individual soil inspection sites will follow internationally recognised pyogenic soil classification methods as described in FAO (2006), FAO (2007), USDA (1993) or USDA (1999).

6.3.3 Baseline

6.3.3.1 Available data

The following data/data sources have been identified as available during the scoping stage:

- Relationships between soils types and land uses practiced have been identified; and
- Soil chemistry and particle size results (specifically particle size analysis, pH and carbonate).

A geotechnical investigation for both the soil conditions and material investigation has been undertaken by Worley Parsons. This included drilling and test pitting in the Upstream Area including the field areas, CPF sites, and access roads. Samples of the soils have been taken and sent to a soils laboratory in Nairobi for testing.

6.3.3.2 Area of influence and study area.

The soil AOI and baseline Study Area for soil are the same. It is a smaller area than the project AOI for the Upstream Project shown in Figure 1, and will comprise the footprint of the project infrastructure with approximately a 2 km buffer around it. This is the area in which ground disturbance, earthmoving and stockpiling may occur.

6.3.3.3 Baseline conditions

From data gathered by Worley Parsons, it is understood that soil in the AOI for the Upstream Project are derived from tertiary volcanic and sedimentary materials, recent alluvial deposits and windblown sands. Soils are generally clay loam to loamy sand textured and include neutral, calcareous, saline and sodic soil reaction.

A low resolution soil map is included in Figure 5 (Soil Map). This map and data from the Worley Parsons work will be used to target Golder field studies for the ESIA baseline.

6.3.3.4 Key data gaps

The soils sampling described in Section 6.3.3.3 provides a high level understanding of the soil quality in the affected area. This data will be used to provide context to the ESIA baseline, however, the existing data describes particle size and soil chemistry in the upper 1.5 to 3.0 m, as opposed to the soil horizons in the upper 1 m to 1.5 m, which would feed into an ESIA baseline.

The gathering of primary data in the project affected areas is the key data gap for soils. The following briefly describes the survey work which will be completed to fill the key data gaps:

- Soil sampling and laboratory analysis, pedogenic description of representative soil profiles;
- Soil samples will be taken and laboratory analysis will likely include Particle size distribution, pH Cation exchange capacity (CEC); Exchangeable aluminum; Major cations and anions (Ca Mg K, Fe, NO3, PO4, SO4, Cl); and Organic matter (OM); and
- Soils, land use and erosion hazard map including:
  - Soil and surficial materials maps at a 1:30,000 to 1:50,000 scale; and
  - Agriculture suitability maps.

6.3.4 Identification of potentially significant effects

The following presents the environmental aspects have been identified as potential effects the Upstream Project could have on soil receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Erosion (water and wind based) from vegetation clearance – scoped in;
- Changes in soil salinity, sodicity, organic matter and structure due to disturbance of natural state – scoped in;
- Soil compaction from earthworks, structure placement and vehicular traffic during operations – scoped in;
- Contamination from increased airborne/waterborne contaminants during construction and operation – scoped in;
- Contamination from a failure to a pipeline or CPF, i.e. spill – scoped in, and addressed in the emergency response plan;
- Changes in distribution of agriculture type, due to influx, Socio-economic changes and/or land use– scoped in;
- Change in topography during construction and operations – scoped in;
- Loss of agricultural quality productivity on reinstatement of land where earthworks are required during construction – scoped in;
- Change in topography following decommissioning – scoped in, and covered in closure plan; and
- Contamination of soils used in burying pipelines – scoped out, covered by appropriate management practices in construction management plan.

6.3.5 Summary of approach to the ESIA

A summary of the approach to the soil assessment is provided in Table 6-4.

Table 6-4: Analysis of potential effects (Soils)

Receptor	Potential Effect	Next Steps in the ESIA
Terrain	■ Change in topographic assemblages. ■ Erosion of soils. ■ Compaction of soils.	*Baseline data gathering* – ■ Soil/terrain data collection will include descriptions of terrain types (topography, slope gradient, surface expression) and their associated characteristics. *Impact Assessment* – ■ The impact assessment will compare changes in terrain assemblages from baseline to development and will account for construction, operation and reclamation activities.
Soil quality	■ Change in soil quality (e.g. soil contamination,	*Baseline data gathering* –

Receptor	Potential Effect	Next Steps in the ESIA
	compaction, structure, infiltration, soil water storage, fertility, organic matter, sodicity and salinity).	■ Soil data collection will describe soil types and their characteristics. *Impact Assessment –* ■ The impact assessment will compare changes in soil quality from baseline to development and will account for direct and indirect changes to soil quality based on changes in soil types. The assessment will utilise both quantitative changes in soil type distribution and inferred changes based on literature.
Agricultural land suitability	■ Change in soil land suitability.	*Baseline data gathering –* ■ Collected soil data will be used to assess agricultural land suitability. *Impact Assessment –* ■ The impact assessment will compare changes in agriculture land suitability from baseline to development.

6.3.6 References

FAO. 2006. Soil Description Guidelines. 4th edition. Rome, Italy.

FAO. 2007. World Reference Base for Soil Resources. IUSS Working Group WRB. World Soil Resources Reports No. 103. FAO, Rome, Italy.

USDA. 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.

USDA. 1999. Soil Taxonomy A Basic System of Soil Classification for Making and Interpreting Soil Surveys. U.S. Department of Agriculture Handbook 436.

6.4 Water

6.4.1 Introduction

The operation of the Upstream Project has substantial water needs, particularly given the arid environment. Therefore the project has the potential to affect the water environment and local water users.

The following elements of the Upstream Project may affect surface water and groundwater:

- Project construction and operation activities which could affect water include:
  - Surface or groundwater abstraction;
  - Changes to surface water runoff and flood flows;
  - Spillages of contaminants due to catastrophic failure;
  - Discharge of unacceptable concentrations of contaminants; and
  - Population influx.
- The geographical extent of project facilities could lead to the direct loss of land cover and bare earth surfaces would increase erosion and sediment loads of surface water runoff; and
- Construction and operation of surface water abstraction facilities.

6.4.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the water assessment in the ESIA.

National Policy and Legislation

The following national policy and legislation are considered relevant to the Upstream Area:

- The Environmental Management and Coordination Act (Water Quality Regulation), 2006.
- The Republic of Kenya. The National Water Policy, 2012.
- The Republic of Kenya. The Water Bill, 2014 (in draft).

International Guidance and Standards

The following international guidance and standards are relevant to the Upstream Area:

- International Finance Corporation. EHS Guidelines for Wastewater and Ambient Water Quality. IFC, 2007.
- International Finance Corporation. EHS Guidelines for Water and Sanitation. IFC, 2007.
- International Finance Corporation. EHS Guidelines for Onshore Oil and Gas Development. IFC, 2007.
- International Finance Corporation. Performance Standard 3: 2012. Resource Efficiency and Pollution Prevention. IFC, 2012.
- World Health Organisation. Drinking Water Quality Guidelines – 4th edition. WHO, 2011.

International Conventions

The following international conventions are relevant to the Upstream Area:

- United Nations resolution of on the law of transboundary aquifers, 2008.
- United Nations Convention on the Law of the Non-navigational Uses of International Watercourses, 1997.
- Agreement on the Nile River Basin Cooperative Framework, 2010.
- Convention on Wetlands of International Importance (the Ramsar Convention 1971).

6.4.3 Baseline

6.4.3.1 Available data

Water quality data obtained during 2014 and 2015 from approximately 50 groundwater sampling points in proximity to the CPF and well pads, predominantly production wells, is available. Groundwater level data obtained during 2014 and 2015 from approximately ten wells is available. WRMA have an automated way of checking aquifer water levels at specified areas in the region.

A conceptual hydrogeological model is being developed as part of the water resources study, and will be available for use in the ESIA.

Tullow does not currently hold surface water flow or quality data from secondary sources. However data is available from the Water Resources Management Agency (WRMA) from 3 gauging stations: Lake Turkana (Kalokol), Turkwel River (Lodwar Bridge) and Kerio River (Lokori). For security reasons, the Kerio River data has not been captured for a long time. All information from these stations is available in soft copies from 2007. Previous data is still in hard copies.

A flood study on the Kapese catchment and a hydrological model has been completed by Worley Parsons to assess flooding in luggas for siting project infrastructure. The hydrological model used high resolution topographical data and processed rainfall data from Lodwar meteorological station to simulate flows in the luggas and understand flood lines. Data acquired from the Lodwar meteorological station will be used in the ESIA, along with data from two Tullow meteorological stations, which have been installed the project area and started gathering data in December 2015.

6.4.3.2 Area of influence and study area

The water AOI and Study Area for water are the same. It comprises the surface water catchments downstream of the Upstream Area up to and including Lake Turkana and the Upstream Areas of the catchment, including Turkwel Reservoir. Downstream the arid, relatively low lying environment features an extensive dendritic network of wide, shallow, ephemeral streams (luggas) in the vicinity of the Upstream Area, which coalesce within their respective catchments before discharging into Lake Turkana. Upstream of the AOI the ground levels rise to over 1,000 m above sea level, becomes mountainous and the extent of vegetation increases. The catchments have been delineated according to the topographic catchment divides.

The water AOI currently includes the water supply option at the Turkwel Dam, but is not yet informed by distant groundwater options.

6.4.3.3 Baseline conditions

Average annual rainfall is considered to be less than 250 mm, much of which falls during the Long Rains. Rainfall for the remainder of the year is typically low and the area is often at risk of serious drought conditions. In January 2014, according to the NDMA, no rainfall was recorded at Lodwar.

All precipitation over the Upstream Area either returns to the atmosphere via evapotranspiration, recharges to ground or drains to Lake Turkana. It is anticipated that the amount of current groundwater recharge is very low to minimal. The proportion of total inflow from the luggas and Kerio River to Lake Turkana is considered to be less than 5%; the Omo River, on which the Gibe III Dam is being constructed, provides much of the inflow to Lake Turkana (~90%). Turkwel River is significantly larger than the Kerio River.

Flow in the luggas is driven by short duration, intense seasonal rainfall which, given the lack of vegetation, likely leads to extensive erosion, high suspended solids content and rapid channel migration. The luggas within the Upstream Area are part of two separate catchments, both of which eventually discharge into Lake Turkana. The majority of luggas flow eastwards and coalesce, flowing parallel to Lokichar Loperot Road, before discharging into the Kerio River and subsequently to Lake Turkana. The remainder of the luggas flow northwards, coalescing before discharging into Lake Turkana. Riparian vegetation is more prominent for larger catchments, which see larger flows.

Lake Turkana water elevation was at its peak in 1896 at over 380 metres above sea level (masl). Water levels have steadily declined; since the 1920s the water level has typically ranged between 360 masl and 365 masl.

Lake Turkana is a closed lake, where outflow is dominated by evaporation; the annual loss through evaporation is estimated to be 2.4 m (UNEP, 2013). According to UNEP, Lake Turkana's water levels usually show seasonal fluctuations of 3-4 m.

Preliminary information from Tullow states large volumes of groundwater are known or expected to be present in some of the shallow formations in the Lokichar region however permeability is generally low such that borehole yields are poor. Groundwater sources in Kenya are known to have, among others, high fluoride, arsenic and boron concentrations.

6.4.3.4 Key data gaps

Local hydrological and hydro-geological conditions, and groundwater users and uses need to be characterised. Local primary data is the key data gap, which will be addressed through field studies and surveys in 2015/2016:

- Surface water gauging and water quality information in the local watercourses, the catchments for which will include the project infrastructure and activities;
- Groundwater level and groundwater quality data for at least one year concurrent with meteorological data, including data for proposed groundwater supply sources;
- Hydrocensus of the communities in the Project area (as part of socio-economic surveys); and
- Meteorological data in the locality of the Project for at least one year concurrent with hydrological data.

6.4.4 Identification of potentially significant effects

The following presents the environmental issues that have been identified as potential effects the Upstream Project could have on water receptors (assumes make-up water is obtained from The Turkwel River, Lake Turkana, local or distant groundwater sources. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Changes in fluvial flows and fluvial geomorphology (sediment erosion, transport and deposition) due to abstraction of surface water and/or diversion of luggas – scoped in;
- Changes in surface water run-off due to ground clearance, construction of bunds and areas of hard-standing – scoped in;
- Changes in surface water chemistry due to uncontrolled discharge, accidental spills and uncontained leaks from storage facilities – scoped in, and addressed in the emergency response plan;
- Contamination of water obtained from hand dug wells within bed sediments due to accidental spills and uncontained leaks from storage facilities – scoped in, and addressed in the emergency response plan;
- Changes in groundwater chemistry due to failure of the integrity of an injection well – scoped in;
- Changes in surface water chemistry due to known discharges to the environment – scoped in;
- Flood risk to project infrastructure – scoped in, and will be subject to flood management as part of the emergency response plan;
- Flood risk to communities downstream in the affected catchments – scoped in. and will be covered in the community health and safety plan;
- Changes in sediment load, due to changes in ground cover and erosion – scoped in;
- Changes to groundwater levels in local wells or to base flow in luggas due to abstraction from groundwater– scoped in;
- Increased groundwater salinity caused by water abstraction inducing flow from more saline aquifers – scoped in; and

- Contamination of groundwater due to accidental spills and leaks, inadequate well head construction and/or poor well completion resulting in leakage from production wells – scoped in, and addressed in the emergency response plan.

6.4.5 Summary of approach to the ESIA

A summary of the approach to the water component of the ESIA is provided in Table 6-5**.**

Table 6-5: Analysis of potential effects (water)

Receptor	Potential Effect	Next Steps in the ESIA
Rivers	■ Change in flow and water quality.	*Baseline data gathering* – ■ Surface water quality and flow monitoring and geomorphology. *Impact Assessment* – ■ Assessment of impact on quality and quantity in watercourses for a range of flows (high, medium, low), accounting for seasonality, and direct (abstraction/discharge) and indirect (catchment changes, surface water runoff) influences.
Aquifers	■ Change in flow and water quality.	*Baseline data gathering* – ■ Groundwater level and quality monitoring (ongoing). *Impact Assessment* – ■ Develop model for baseline conditions and adapt for proposed project, accounting for abstraction and injection water. Assessment of impact to level and quality
Local Water Users	■ Change in surface water and groundwater: flow; and quality.	*Baseline data gathering* – ■ Hydrocensus. *Impact Assessment* – ■ Spatial analysis of local water users and potential assessment of impacts to water environment.

6.4.6 References

NDMA, 2014. National Drought Management Authority. Turkana County, Drought Monitoring and Early Warning Bulletin – January 2014.

SWARA, 2014. What Future For Lake Turkana and Its Wildlife? Sean Avery. SWARA, January-March 2014.

UNEP, 2013. Balancing economic development and protecting the cradle of mankind – Lake Turkana basin. United Nations Environmental Programme, June 2013.

6.5 Seismicity (and Geology)

6.5.1 Introduction

The operations of the Upstream Project have the potential to be impacted by earthquakes potentially leading to disruption of operations and loss of containment.

Any elements of the Upstream Project which could affect local seismicity will not be covered in the ESIA, but in the engineering design.

6.5.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the seismicity assessment in the ESIA.

National Policy and Legislation

Ministry of Works, 1973. Code of practice for the design and construction of buildings and other structures in relation to earthquakes. Printed by the Kenya Building Centre.

International Guidance and Standards

US Department of Energy, 2012. Protocol for addressing induced seismicity associated with Enhanced Geothermal Systems. DOE/EE-0662.

6.5.3 Baseline

6.5.3.1 Available data

Data currently available is restricted to regional scale earthquake hazard mapping and regionally identified earthquake data help by the United States Geological Survey.

As part of the siting of infrastructure, Worley Parsons have accessed some high level information on fault lines in the Upstream Project footprint and additional information has been collected from geophysical surveys completed in 2015.

6.5.3.2 Area of influence and study area

The seismic AOI is that area in the immediate vicinity of the wells that may be impacted by induced seismicity including local communities and the CPFs, therefore does not differ from the AOI of the Upstream Project presented in Figure 1. The Study Area incorporates the region as a whole as a source of natural seismicity.

6.5.3.3 Baseline conditions

Turkana and Kenya as a whole is vulnerable to seismic activity associated with the presence of the East African Rift, which runs through the west of Kenya. The East African rift is prone to earthquakes and associated volcanicity. However, the frequency of earthquakes within the Turkana basin is relatively low

The overall hazard level is considered low (DFID, 2013). In the Study Area the natural earthquake hazard is rated by the WHO (2010) as low to medium with peak ground acceleration is the region of 0.2 m/s^2 -2.4 m/s^2 (Plates 6-1 to 6-3). It is however noted that relatively infrequent but significant events do occur with a maximum recorded magnitude event of 7 having an epicentre 300 km south of the development.

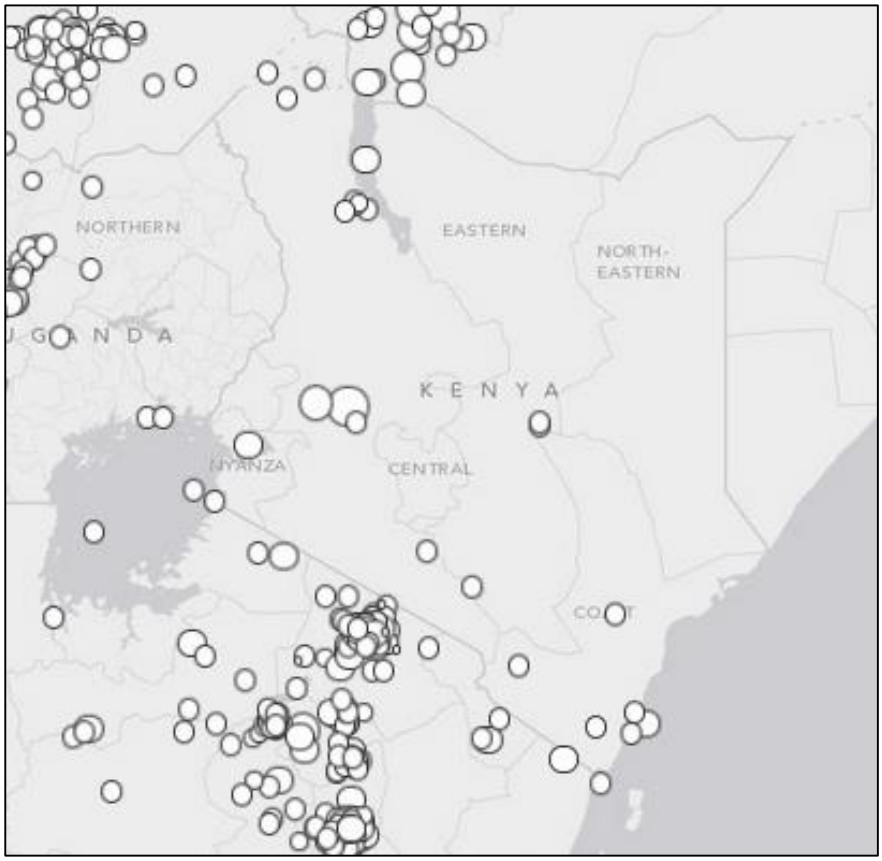

Plate 6-1 Earthquakes recorded in the last ~100 years (source USGS)

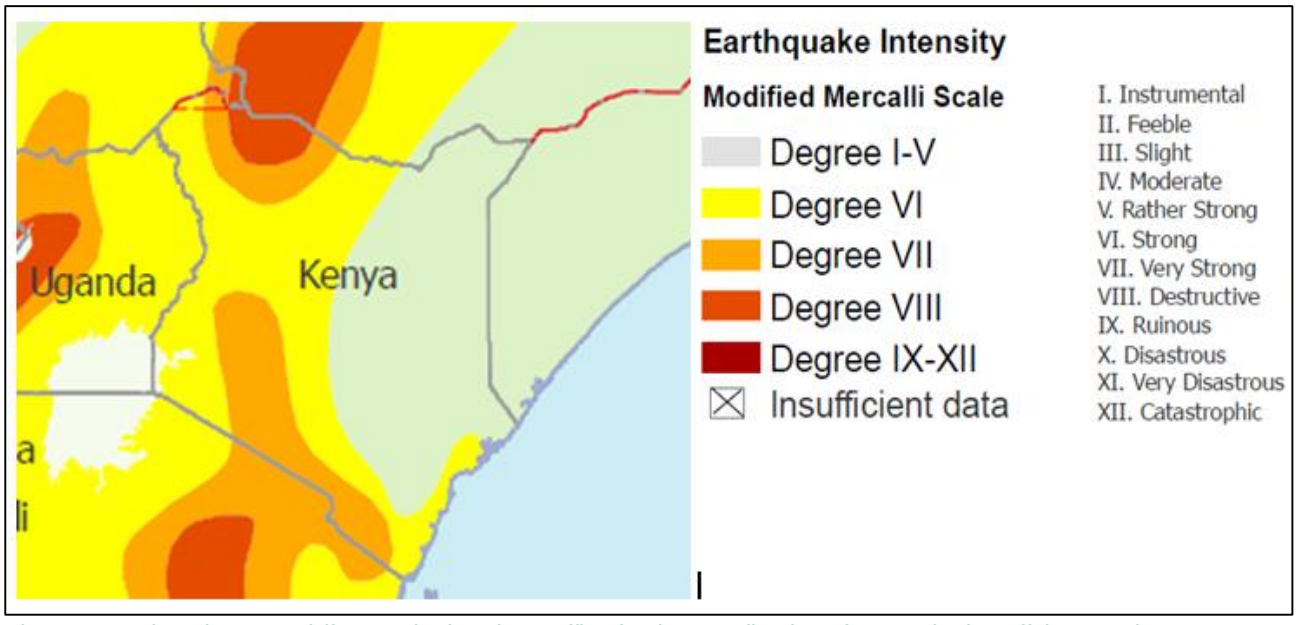

Plate 6-2 Earthquake Hazard (from United Nations Office for the coordination of Humanitarian affairs, 2007)

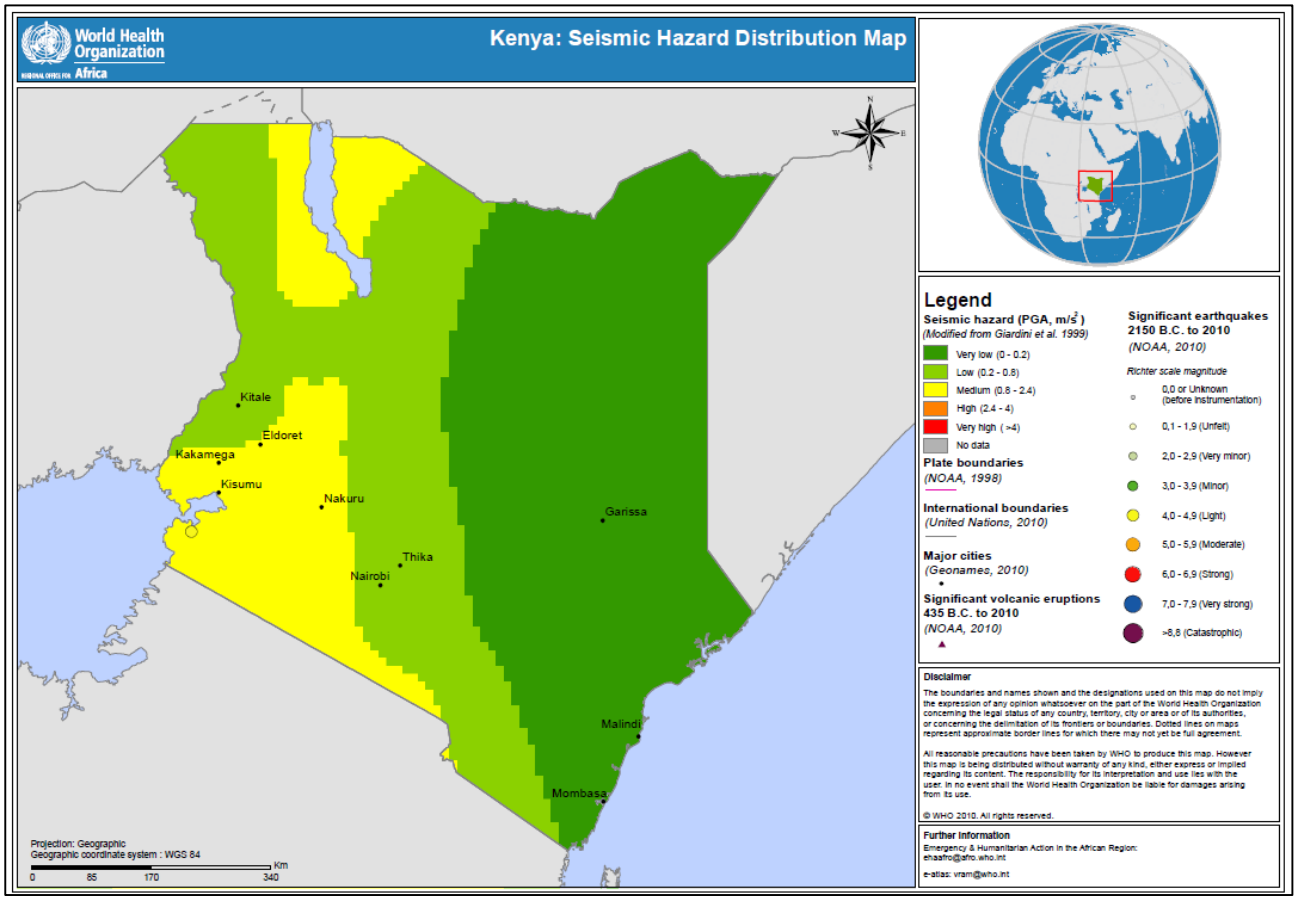

Plate 6-3 Seismic Hazard Distribution (WHO, 2010)

6.5.3.4 Key data gaps

Seismic hazard assessment will be desk based and completed as part of the design for the infrastructure of the Upstream Project. Further details of built structures will be required from aerial imagery analysis and ground truthing.

Gathered information on fault lines will also be accessed from Worley Parsons.

6.5.4 Identification of potentially significant effects

The following presents the environmental issues that have been identified as potential effects the Upstream Project could have on seismicity receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Impact of natural seismicity (earthquakes) on built structures which may lead to loss of containment (pollution via surface water or groundwater pathways), and on vibration sensitive built structures or equipment which may lead to operational failure – scoped in;
- Impacts from induced seismicity resulting in contamination from loss of containment due to failure of casing – scoped in; and
- Impacts from induced seismicity resulting ground vibration impacts on sensitive built structures or equipment which may lead to operational failures – scoped in.

6.5.5 Summary of approach to the ESIA

A summary of the approach to the seismicity component of the ESIA is provided in Table 6-6.

Table 6-6: Analysis of potential effects (Seismicity)

Receptor	Potential Effect	Next Steps in the ESIA
Built structures/water environment	■ Impact on built structures which may lead to loss of containment (pollution via surface water or groundwater pathways). ■ Impact on vibration sensitive built structures or equipment which may lead to operational failure.	*Baseline data gathering* – ■ Desk based review of regional earthquake hazard Impact Assessment – ■ Description of potential impacts and risks to be managed in an emergency preparedness plan
	■ Contamination resulting from loss of containment due to failure of casing. ■ Impact on built structures which may lead to loss of containment or operational failure.	*Baseline data gathering* – ■ Desk based review of potential for microseismicity from reservoir operations Impact Assessment – ■ Description of potential impacts and risks to be managed in an emergency preparedness plan

6.6 Air and Climate

6.6.1 Introduction

The construction and operations stages of the Upstream Project will generate emissions to atmosphere, which have the potential to affect local air quality and contribute to global greenhouse gas emissions.

The following elements of the Upstream Project may affect local air quality:

- Storage and transport of bulk materials, site stripping and excavation, power generation and, engine exhaust emissions from vehicles and construction plant, during construction;
- Direct emissions from combustion sources (such as diesel engines), flaring associated with non-routine and emergency events during operations (no routine flaring is envisaged), fugitive volatile organic compounds (VOCs) from drilling, pipework and storage tanks and waste management during operations;
- Indirect emissions through secondary formation of ozone, fine particulates and nitrogen dioxide (NO_2), during operations; and
- Fugitive release of odorous compounds during operations.

6.6.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the water assessment in the ESIA.

National Policy and Legislation

The following national policy and legislation are considered relevant to the Upstream Area:

- The Republic of Kenya. The Environmental Management and Coordination Act (Air Quality Standards) Regulations, 2008.

International Guidance and Standards

The following international guidance and standards are relevant to the Upstream Area:

- International Finance Corporation. EHS Guidelines: Environmental – Air Emissions and Ambient Air Quality. IFC, 2007.
- World Health Organisation. Air Quality Guidelines Global Updated. Germany: Druckpartner Moser, 2005.

International Conventions

- United Nations. Kyoto Protocol to the United Nations Framework Convention on Climate Change. United Nations, 1997.
- United Nations. Vienna Convention for the Protection of the Ozone Layer. United Nations, 1985.

6.6.3 Baseline

6.6.3.1 Available data

Digital terrain data has been obtained for air quality modelling which will be completed in the impact assessment.

Meteorological data for the region is available from Lodwar, the only meteorological site in the Turkana region. Meteorological parameters measured at Lodwar include rainfall, wind speed and direction.

A summary of the meteorological conditions, at Lodwar is presented in the *Lamu Marine oil export terminal Metocean and meteorological data study* (HR Wallingford, 2014). The report includes statistical analysis of wind speeds and directions (1957 to present), and rainfall and temperature (1994 – 2003). Data on solar insolation levels, based on modelled data from the Food and Agricultural Organization's CLIMWAT modelling,

is also presented in the report in the form of country-wide mapping data which incorporates the development site.

Further reference is made to rainfall and evaporation data for Lodwar from pre-1970 in the Hydrological Year Book 2012 (Water Resources Management Authority, 2013) (report indicates rainfall monitoring at Lodwar since before 1930).

Data acquired from the Lodwar meteorological station will be used in the ESIA, along with data from two Tullow meteorological stations, which have been installed the project area and started gathering data in December 2015.

6.6.3.2 Area of influence and study area

Dust emissions will typically deposit within 1 km of the emission source depending on the particle size. During particularly windy conditions dust may travel further from the site, but typically within 2 km of the point of release. Therefore, the Study Area and AOI for dust emissions will be within 2 km of project activities and therefore the point of release.

The AOI for vehicle emissions will typically have a localised effect occurring within a few hundred metres of sources. For stack emissions the typical AOI will be within 2-3 km of the source, however wider regional effects may occur particularly related to secondary pollutant formation. Therefore a Study Area and AOI of approximately 10 km by 10 km, centred on the site will be considered for point source air emissions.

Effects of emissions of greenhouse gases are calculated on a global basis, therefore emissions are considered from all project associated sources independent of a defined Study Area.

6.6.3.3 Baseline conditions

The National Drought Management Authority (NDMA) classifies the seasons as follows:

- January to March – Dry Season;
- April to June – Long Rains;
- July to September – Dry Cool Season; and
- October to December – Short Rains.

Meteorological data from the Lodwar measurement site indicates that the prevailing wind direction is easterly or north-easterly, with winds from these directions occurring for over 75% of the time. Wind speeds are typically light, with the majority being of less than 4 m/s on average. There is little seasonal variation on wind speeds or direction. A small diurnal variation in wind speeds is experienced in the site, with daytime wind speeds typically 1 m/s higher than night-time winds, on average.

Average rainfall levels are discussed further in Section 6.4, however it is noted that the majority of rainfall occurs during the April to June long rains season, with very low levels of rainfall occurring outside this period.

Temperatures within the study area are high, with minimum air temperatures in excess of 20^{o}C measured. Both air and ground temperatures will vary with the seasons, with the coolest temperatures experienced December to February and highest temperatures in March to May and September to November.

6.6.3.4 Key Data Gaps

Primary local data collection is the key data gap, which will be addressed through field studies and surveys in 2015/2016, include the following:

- Dust deposition and air quality data in the locality of the Upstream Area;
- Meteorological data gathered by project meteorological stations in the locality of the Upstream Area;
- Correlation of locally gathered meteorological data and historic records; and

- Mapping of settlement and other human activity and their nature.

6.6.4 Identification of potentially significant effects

The following presents the environmental issues that have been identified as potential effects the Upstream Project could have on air quality receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Impacts from dust resulting in soiling/nuisance effects (human receptors), deposition on plants/vegetation and increased sediment – scoped in;
- Direct adverse effects of heavy metals in dust on human or ecological receptors – scoped out - dust unlikely to contain significant concentrations of heavy metals;
- Direct adverse health effects from air emissions (human receptors) – scoped in;
- Indirect adverse health effects from air emissions (ground level ozone generation) (human receptors and ecological habitat) – scoped in - to be covered in the community health and safety health impact assessment;
- Direct and indirect acidification, eutrophication, toxicity – scoped in;
- Nuisance effects from odour (human receptors) – scoped in; and
- Impacts and contribution of Green House Gas (GHG) emissions to global warming – scoped in.

6.6.5 Summary of approach to the ESIA

A summary of the approach to the air and climate component of the ESIA is provided in Table 6-7.

Table 6-7: Analysis of potential effects (Air Quality)

Receptor	Potential Effect	Next Steps in the ESIA
Human receptors (villages, cultural sites and areas of regular human activity)	■ Change in air quality. Adverse effect on human health.	*Baseline data gathering* – ■ Air quality monitoring of key pollutants: fine particulates, NO_2 (combustion gas marker) and VOCs. *Impact Assessment* – ■ Evaluate impact to air quality of proposed construction and operation activities, through predictive air dispersion modelling, to determine additional pollutant burden.
Ecological habitat	■ Direct and indirect acidification, eutrophication, toxicity.	

Receptor	Potential Effect	Next Steps in the ESIA
Human receptors (villages and areas of regular human activity)	■ Fugitive dust deposition leading to soiling or smothering.	*Baseline data gathering* – ■ Monitoring of dust deposition rates. *Impact Assessment* – ■ Evaluate risk of additional dust deposition during proposed construction and operation activities to determine additional pollutant burden.
Human receptors (villages and areas of regular human activity)	■ Odour nuisance	*Impact Assessment* – ■ Evaluate risk of odour emissions and sources during proposed construction and operation activities. Determination of potential effects and required controls.
Global	■ Contribution to global emissions of greenhouse gases	*Impact Assessment* – ■ Quantification of greenhouse gas emissions associated with proposed construction and operation activities.

6.7 Noise and Vibration

6.7.1 Introduction

The construction and operations stages of the Project will generate noise and localised vibrations, which have the potential to affect local noise and vibration sensitive receptors.

The following elements of the Project may affect the local noise environment:

- Storage and transport of bulk materials, site stripping and excavation, piling, power generation and, vehicles, construction plant and human activity, including air transport during construction; and
- Drilling, traffic, operational plant and equipment site stripping and excavation, power generation and, human activity, including air transport during operations.

6.7.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the noise and vibration assessment in the ESIA.

National Policy and Legislation

The following national policy and legislation are considered relevant to the Upstream Area:

- The Republic of Kenya. The Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution) Control Regulations, 2009; and
- The Republic of Kenya. Act No. 15 of 2007. The Occupational Safety and Health Act (Chapter 89 and 90), 2007. Factories and Other Places of Work (Noise Prevention and Control) Rules (Chapter 13), 2005.

International Guidance and Standards

The following international guidance and standards are relevant to the Upstream Area:

- International Finance Corporation. EHS Guidelines: Environmental – Noise. IFC, 2007; and
- World Health Organisation. Guidelines for Community Noise. Geneva: WHO, 1999.

In the absence of national or international standards for vibration, reference will be made to alternative national standards, specifically:

- British Standard BS5228 *Code of practice for noise and vibration control on construction and open sites*. Vibration. British Standards Institute (BSI) December 2008; and
- British Standard BS6472 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting. BSI 2008.

6.7.3 Baseline

6.7.3.1 Available data

No data for the noise and vibration elements of the Upstream Project has been identified.

6.7.3.2 Area of Influence and study area

Noise effects typically occur locally to the source of noise, with the AOI typically within 2-3 km of source. The Study Area for assessment of noise effects will be consistent to the AOI and be set to a 3 km buffer around Upstream Area.

Vibration effects also occur close to source, typically within a few hundred metres, beyond which vibrations will dissipate. The AOI will therefore consider up to 1 km from activities which potentially generate vibrations. The Study Area will be consistent with the AOI.

6.7.3.3 Baseline conditions

There is no data for noise and vibration relating to the Upstream Project. Due to the lack of industry and sparse populations in the Upstream Area, sources of anthropogenic noise are minimal. In the absence of anthropogenic noise, natural noise sources such as wildlife noise, watercourses and wind induced noise through vegetation are typically the main noise sources. In the study area the absence of significant watercourses or vegetation, as well as prolific wildlife (birds or insects particularly) activity indicate that there are limited noise sources, and therefore the ambient noise level is likely to be quiet.

6.7.3.4 Key data gaps

Primary local data is the key data gap, which will be addressed through field studies and surveys in 2015/2016:

- Information on human receptor and faunal receptors (noise);
- Baseline noise data gathering to capture ambient noise levels at representative locations including diurnal variation; and
- Information on local built structures (vibration).

6.7.4 Identification of potentially significant effects

The following presents the environmental issues that have been identified potential effects the Upstream Project could have on noise and vibrations receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Impact from noise and vibrations resulting in loss of amenity/sleep disturbance (human receptors) – scoped in;
- Impact from noise resulting in disturbance or interference on communication, e.g. bird call, mammal communication over medium to long distances – scoped in, although will be scoped out if the absence of such species is confirmed;
- Impact of noise and vibration on Tullow labour force – scoped out, as this potential effect will be covered by occupational health policies and procedures. A separate occupational risk assessment will be undertaken to ensure that the labour force is protected from noise and vibration;
- Impact from vibrations resulting in disturbance (human, livestock and faunal receptors) – scoped in;
- Impact from vibrations resulting in structural damage (built structures) – scoped in; and
- The nuisance effects of noise and vibration on the appreciation of cultural sites (by human receptors) – scoped in.

6.7.5 Summary of approach to the ESIA

A summary of the approach to the noise and vibration component of the ESIA is provided in Table 6-8.

Table 6-8: Analysis of potential effects (Noise)

Receptor	Potential Effect	Next Steps in the ESIA
Human receptors (villages and areas of regular human activity/cultural importance)	■ Change in noise. Loss of amenity/sleep disturbance	*Baseline data gathering* – ■ Ambient noise levels at representative locations including diurnal variation. *Impact Assessment* – ■ Evaluate effects on noise environment of proposed construction and operation activities, through predictive modelling, to determine additional noise burden.
Ecological habitat and livestock	■ Disturbance, interference on communication (faunal receptors).	
Built structures	■ Structural damage.	*Impact Assessment* – ■ Identification of potential vibration sources and prediction of vibration levels to establish any adverse effects to built structures.

6.7.6 References

British Standards Institute, 2008. BS5228-1: 2009 Code of practice for noise and vibration control on construction and open sites. Vibration, December 2008.

British Standards Institute, 2008. BS6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting 2008.

6.8 Landscape and Visual

6.8.1 Introduction

The landscape and visual assessment will consider the effects the Upstream Project could have on the above ground features, which will be visible from the surrounding area, namely:

- Project activities generating dust (including clearing and earth moving);
- Construction works and the physical presence of the CPF, IWMF, electrical power lines;
- Airstrip; and
- Drilling sites (well pads and drilling rigs).

6.8.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the biodiversity assessment in the ESIA.

National Policy and Legislation

- Kenyan policy and legislation relating to landscape and visual impact assessment has not been identified.

International Guidance and Standards

The methodology proposed for the landscape and visual assessment has been developed by Golder Associates, based on current UK and USA guidance, namely:

- Landscape Institute with the Institute of Environmental Management and Assessment. Guidelines for Landscape and Visual Impact Assessment, Third Edition, 2013 (GLVIA 2013); and
- United States Department of the Interior, Bureau of Land Management. 1986a. Visual Resource Inventory. Bureau of Land Management Manual Handbook H-8410-1, Rel. 8-28. Washington, DC.

6.8.3 Baseline

6.8.3.1 Available data

The following data relating to the landscape and visual topic is available:

- Location of above ground project infrastructure; and
- Broad nature of land cover – vegetaion, built elements in the landscpe land uses and of topography terrain that determine landscape character as derived from satellite imgery, photographic records and a site visit;
- Broad types, nature and locations of potential of receptors for changes on visual amenity; and
- Topography from digital terrain data.

6.8.3.2 Area of influence and study area

The extent of the AOI for the landscape and visual assessment would be limited to those areas from which the project infrastructure will be visible. It would be defined by computer ‘viewshed’ modelling of the ‘above ground’

components of the project infrastucture, including the drilling sites in the Amosing, Ngamia, Ekales, Twiga, and Agete fields, along with the central processing facility.

Considering the relatively low height of a drilling rig (typically 35m from ground level) in relation to the topography it is proposed that the study area is limited to a maximum distance of 10 km from project infrastructure locations. Whilst components of the development may be theoretically visible beyond 10 km, it is unlikely they would be prominent features within a sparesely populated large sacle landscape and would be unlikely to give rise to significant adverse effects in ESIA terms.

6.8.3.3 Baseline conditions

The landscape and visual assessment will rely heavily on local data gathering in the baseline phase. No relevant site specific data is currently available.

6.8.3.4 Key data gaps

Key data gaps are all aspects of landscape and visual baseline, which will be addressed through desk studies and, if required, field studies in 2015/2016:

- Zone of Theoretical Visibility (ZTV) mapping and analysis;
- Confirmation of settlements within the study area; and
- Definition of landscape character of project areas.

6.8.4 Identification of potentially significant effects

The following presents the environmental issues that have been identified as potential effects the Upstream Project could have on views and the character of the landscape. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- Adverse effect on views and the visual amenity of local residents, travellers, visitors and workers within the study area due to construction of CPF and associated facilities – scoped in;
- Adverse effect on views and the visual amenity of local residents, travellers, visitors and workers within the study area during the operational period due to vertical structures, removal of vegetation and change in landform – scoped in;
- Adverse effect on views and the visual amenity of local residents, travellers, visitors and workers during the operational period due to light pollution – scoped in;
- Adverse effect on views and the visual amenity of water supply pipeline caused by linear features and the clearance of vegetation along them – scoped in;
- Adverse effect on views and the visual amenity of overhead transmission line along water supply pipeline route during construction, operation and closure – scoped in;
- Adverse effect on views and the visual amenity of the airstrip – scoped out due to lack of vertical structures and light pollution;
- Direct loss of landscape characteristics due to construction of project infrastructure – scoped in; and
- Direct loss of landscape characteristics during the operational period – scoped in.

6.8.5 Summary of approach to the ESIA

A summary of the approach to the landscape and visual component of the ESIA is provided in Table 6-9.

Table 6-9: Analysis of potential effects (Landscape and Visual)

Receptor	Potential Effect	Next Steps in the ESIA
Local population (including inhabitants, travellers, visitors, tourists and workers)	■ Changes to existing views and visual amenity of receptors.	*Baseline data gathering* – ■ Preparation of 3D computer model of the study area to enable: ■ Preparation of ZTV (Zone of Theoretical Visibility) to define the study area (based on preliminary scheme design). ■ Mapping the location and type of visual receptors, using aerial imagery and field observations. ■ Mapping type and extent of landscape character areas within the study area using mapping, results of baseline studies and field observations. ■ If required, photographic recording of receptors and key views during a site visit. *Impact Assessment* – ■ If required, the production of photomontages to illustrate the proposed development; ■ Updated ZTV's based on final scheme design;
Landscape character (Determined by a combination of: landform, land cover/use, pattern, colour, scale, vegetation, water, built-form, cultural associations, condition, rarity, tranquillity and condition)	■ Physical changes to the character and aesthetics of the existing landscape.	

6.8.6 References

Landscape Institute with the Institute of Environmental Management and Assessment. Guidelines for Landscape and Visual Impact Assessment, Third Edition, 2013 (GLVIA 2013); and

United States Department of the Interior, Bureau of Land Management (BLM). 1986a. Visual Resource Inventory. Bureau of Land Management Manual Handbook H-8410-1, Rel. 8-28. Washington, DC.

6.9 Cultural Heritage

6.9.1 Introduction

The Upstream Project has the potential to impact upon archaeological and paleontological remains, as well as historic, cultural, religious and sacred sites. The Upstream Project may also impact upon the intangible cultural heritage of the area, disrupting traditional practices and compromising traditional belief systems. The outputs from the cultural heritage impact analysis will inform elements of the socio economic impact assessment.

The following elements of the Upstream Project have the potential to impact upon cultural heritage; in particular activities involved breaking ground:

- Well pads;
- CPF;
- Personnel camps and accommodation;
- Air strip;
- Roads; and
- Pipelines (for both water abstraction and oil transportation).

6.9.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the cultural heritage assessment in the ESIA.

National Policy and Legislation

The following National policy and legislation are considered relevant to the Upstream Area:

- The Republic of Kenya. Act No. 6 of 2006. The National Museums and Heritage Act, 2006.

International Guidance and Standards

The following Performance Standards are considered to be applicable to the Upstream Area from a Cultural Heritage and Archaeological perspective:

- International Finance Corporation. Performance Standard 8: 2012. Cultural Heritage. IFC, 2012.

International Conventions

The following convention, to which Kenya ratified, is applicable to the Upstream Area:

- United Nations Educational, Scientific and Cultural Organisation. Convention Concerning the Protection of the World Cultural and Natural Heritage. UNESCO, 1972.

6.9.3 Baseline

6.9.3.1 Available data

The following data collection has been undertaken:

- Locations of designated areas, including World Heritage Sites;
- Locations of all archaeological, paleontological and cultural sites and remains recorded in the Study Area by the National Museums of Kenya (NMK) database;
- Literature review by the National Museums of Kenya (NMK);
- Locations of palaeo-surface water bodies (e.g. ancient river courses, lakeshores, luggas) as interpreted from aerial imagery;

- Locations of current and historic settlements and agricultural/pastoral enclosures as interpreted from aerial imagery;
- Topography of the Study Area as interpreted from satellite imagery;
- Surface soils and geology of Study Area; and
- Vegetation and current land cover/use of Study Area as interpreted from Remote Sensing data.

6.9.3.2 Area of influence and study area

For tangible and intangible cultural heritage the AOI is a smaller area than the AOI for the Upstream Area shown in Figure 1, and will comprise the footprint of the project infrastructure for the Upstream Project and the local communities. This is the area in which ground disturbance, earthmoving and stockpiling may occur and the local communities whom may be affected.

The Study Area for the ESIA comprises two elements – the area of the field walkover survey and the settlements where community consultations will be undertaken. The latter also includes any sites revealed during the consultation process (e.g. cemeteries, ritual sites). The field walkover survey will specifically focus on the development footprint where ground disturbance is anticipated and where tangible remains, or traditional land use and intangible cultural heritage, including pastoral farming and ritual practices, could occur.

6.9.3.3 Baseline conditions

Records of all known archaeological sites within the Upstream Area were obtained from the NMK database, as well as additional data from available literature. Aerial photo mapping was also undertaken to plot the location and density of traditional settlements and land use features, such as brushwood enclosures, within the study area. This information is presented in Figure 6 (Traditional Settlement and Land Use Features) and Figure 7 (Known Archaeological Finds, desktop based).

A brief summary of this information is presented in Table 6-10.

Table 6-10: Summary of Baseline Conditions

Site Type	Distribution within Upstream Area
Burial	Two distinct groups, although both are spread over relatively large areas. The northern group consists of a dense cluster to the west of Twiga and Agete, with slightly less dense clusters north of this. There are some burials recorded within Agete. Except for a small number of isolated examples, the rest of the burials are recorded in a southern grouping, spread across and around Amosing.
Pottery	Densely distributed across the entirety of the Upstream Area. Numerous examples of sites recorded within all prospects.
Lithic (relating to stone tools)	The vast majority are located to the north, with a very dense cluster north of Agete. Outside this cluster, lithic sites are widespread although only sparsely distributed. A slightly denser concentration is located at Amosing, with some lithic sites recorded within the prospect.
Faunal	Relatively sparse distribution, with majority to the north of Agete. Several examples recorded around Agete, Twiga and Ekales, with the reminder recorded south of Amosing.
Paleontological	Relatively sparse distribution. Majority are clustered to the west and south east of Amosing. Several other isolated examples, notably to the west of Agete.
Monument	Three monument sites are recorded north of Agete and one south of Amosing.
Jewellery	One jewellery site recorded to the far north.
Grindstone	One grindstone site is recorded to the west of Agete.

Traditional settlements and land use features were mapped during a brief walkover survey in December 2014. These were generally widespread and commonplace within the landscape, with a dense distribution throughout the entriety of the study area.

6.9.3.4 Key data gaps

Primary local data gathering is the key data gap, which will be addressed through the field survey planned for 2015/2016:

- Location, density and nature of surface archaeological and paleontological receptors within the development footprint;
- Information on tribal groups;
- Intangible cultural heritage in the area, including traditional cultural practices and beliefs; and
- Survey of existing/palaeo- surface water bodies, traditional settlements and enclosures.

6.9.4 Identification of Potentially Significant Effects

The following have been identified as potential effects the Upstream Project could have on cultural heritage receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- The loss or damage to surface or buried remains or the loss of previously unknown features and sites revealed in the area covered by the project infrastructure – scoped in;
- The loss or damage to surface or buried remains or the loss of previously unknown features and sites revealed in the area covered by the water supply pipe line and overhead transmission line – scoped in;
- The loss or damage to sacred or historic places and/or impacts on their setting – scoped in;
- The nuisance effects of noise, dust, and vibration, amongst other elements, on the appreciation of cultural sites (by human receptors) – scoped out of cultural heritage and into air quality and noise and vibration assessments; and
- Changes to culturally distinct patterns of life and traditional cultures – scoped in.

6.9.5 Summary of approach to the ESIA

A summary of the approach to the cultural heritage component of the ESIA is provided in Table 6-11.

Table 6-11: Analysis of potential effects (Cultural Heritage)

Receptor	Potential Effect	Next Steps in the ESIA
Archaeological, paleontological and palaeo-ecological sites and associated landscapes	■ Loss or damage to surface or buried remains and/or above-ground features. ■ Loss of previously unknown features and sites revealed during project related activities.	*Baseline data gathering* – ■ Field survey of development footprint is required to identify the location, density and nature of surface remains and to assess the potential for undiscovered remains, if present, to exist below ground. *Impact Assessment* –

Receptor	Potential Effect	Next Steps in the ESIA
		■ Once cultural heritage receptors and potential impacts have been identified the impact assessment methodology is to compare the intensity of the impact with the sensitivity of the receptor.
Cultural and historic sites	■ Loss or damage to sacred or historic places and/or impacts on their setting. ■ Nuisance effects of noise, dust, and vibration, amongst other elements, on the appreciation of cultural sites (by human receptors).	*Baseline data gathering* – ■ Field survey of development footprint and wider area, as well as consultations with local communities and leaders, is required to identify the location and nature of culturally or historically significant sites, as well as traditional practices and beliefs. *Impact Assessment* – ■ Once cultural heritage receptors and potential impacts have been identified the impact assessment methodology is to compare the intensity of the impact with the sensitivity of the receptor. The intangible impact analysis will inform the socio economic impact analysis.
Intangible cultural heritage practices	■ Changes to culturally distinct patterns of life and traditional cultures.	

6.10 Social

6.10.1 Introduction

The development of such a large scale and unprecedented project in Turkana holds significant potential for the entire country, yet it also presents immense challenges. Turkana County, the main area of interest during exploration, has the highest levels of poverty in the country at 87.5% and reaches 93.1% in Turkana East (KNBS and SID, 2013). The area has historically been marginalised from national political activities and now may be hosting the first oil development in the country. The Upstream Project will require significant infrastructure upgrades to allow the project development and transport oil to the proposed export terminal.

Land and water are the two primary resources that must be considered, as the use of these will place strains on areas already at risk of environmental challenges. These challenges were part of the long-standing inter-tribal conflict over natural resources prior to project initiation, but must be managed carefully, especially in light of the importance of natural resources to traditional pastoralist livelihoods. Land and water management are more complicated due to insufficient or unclear legislation that continues to be developed as part of the national process of devolution.

In addition to the physical challenges, the project also must manage extremely high expectations for employment, infrastructure development and other amenities. While local communities greatly desire employment and economic opportunities, the reality is that technical skills and experience needed for the Project will require substantial numbers of outsiders coming to the area, especially during construction.

The ESIA shall describe in the socio-economic baseline, the current status of human rights issues that are present within the AOI. The ESIA shall consider potential changes to these existing issues and identify any additional human rights issues. A separate Human Rights Impact Assessment will not be prepared and Tullow are committed to adhering to the Voluntary Principles on Security and Human Rights.

The main elements of the Project that may cause social impacts are:

- Direct and indirect impacts of substantial economic investment, and associated employment and procurement opportunities, in an area of high poverty and historical detachment from national politics;
- Indirect impacts of investment into an area of existing ethnic conflict, often linked to scarce resources;
- Loss of, or loss of access, to land and other natural resources as a result of infrastructure development;
- Introduction of security personnel to protect facilities and communities;
- Indirect impacts linked to environmental changes (e.g., water abstraction);
- Increased road traffic and associated changes with improved transportation infrastructure; and
- Management of outside workers needed for construction and other service provision, especially as outsiders mix with communities practicing traditional livelihoods.

6.10.2 Applicable standards and guidance

A full list of related legislation and guidance is presented in Chapter 5.0. The following provides the key legislation and guidance, which will be applicable to and guide the social assessment in the ESIA.

National Policy and Legislation

Table 6-12 presents national policy and legislation, which is considered relevant to the Upstream Study Area:

Table 6-12: Social issues covered by the Kenyan Constitution and National Laws

Issue	Kenyan Constitution	National Laws
■ Forced labour ■ Discrimination in workplace ■ Working hours ■ Fair labour conditions ■ Contract (including dismissal)	■ Article 30 ■ Article 40	■ Employment Act (2007)

Issue	Kenyan Constitution	National Laws
■ Leave entitlement ■ Work-related housing ■ Water use and consumption ■ Food consumption ■ Maternity and paternity leave ■ Medical attention		
■ Freedom of association ■ Collective bargaining ■ Recognition of trade union ■ All related trade union activities	■ Article 8 ■ Article 36 ■ Article 37	■ Labour Relations Act (2007)
■ Compensation for work-related injury or occupational diseases including medical treatment, appliances and travel	N/A	■ Work Injury Benefits Act (2007)
■ Safety, health and welfare at work ■ Protection of other individuals at workplace from risks arising from the activities of the employee at work ■ Special provisions for health and welfare of workers, machinery, chemical and safety		■ Occupational Safety and Health Act (2007)
■ Economic and social rights	Article 43	NA

Kenya has ratified seven out of the eight ILO Core Labour Conventions. Kenya has not ratified No. 87 on Freedom of Association and Protection of the Right to Organise, however, this right is protected by Article 36 of the Kenyan Constitution.

Other important legislation related to rights include:

- The Republic of Kenya. Act No. 56 of 2012. Prevention, Protection and Assistance to Internal Displaced Persons and Affected Community Acts, 2012;
- International Convention on the Elimination of All Forms of Racial Discrimination,1969;
- International Covenant on Civil and Political Rights,1976;
- International Covenant on Economic, Social and Cultural Rights,1976;
- Convention on the Elimination of All Forms of Discrimination against Women,1981;
- Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment,1987;
- Convention on the Rights of the Child,1990;
- Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict, 2002; and
- Convention on the Rights of Persons with Disabilities, 2008.

International Guidance and Standards

The following Performance Standards are considered to be applicable to the Project:

- International Finance Corporation. Performance Standard 1: 2012. Assessment and Management of Environmental and Social Risk and Impacts. IFC, 2012;
- International Finance Corporation. Performance Standard 2: 2012. Labour and Working Conditions. IFC, 2012;
- International Finance Corporation. Performance Standard 4: 2012. Community Health, Safety and Security. IFC, 2012;
- International Finance Corporation. Performance Standard 5: 2012. Land Acquisition and Involuntary Resettlement. IFC, 2012; and
- International Finance Corporation. Performance Standard 7: 2012. Indigenous People. IFC, 2012.

6.10.3 Baseline

6.10.3.1 Available data

Based on the literature and reports reviewed to date, much of the existing socio-economic information will need to be updated and narrowed to focus on the specific study area. Information reviewed to date includes:

- Reports from the Kenya National Bureau of Statistics;
- EIA and socio economic baselines for a number of the exploration phases of the project;
- Community Perception on Conflict, Conflict Mitigation and Security in Turkana and Pokot Regions; and
- Numerous national reports on socio economics, human development, pastoralism, health and development plans from various sources.

The data provided to date, while providing context, does not provide sufficient information that can be transferred easily into the ESIA socio-economic baseline.

6.10.3.2 Area of Influence and Study Area

The Upstream Study Area is located in Turkana, which is defined as the regional AOI for the social impact assessment. The extent of the local AOI would however be limited to the three sub-county administrative units or Constituencies of Turkana East, Turkana South and Turkana Central, which will house various components of the project infrastructure. These three administrative units will therefore also constitute the Study Area.

6.10.3.3 Baseline conditions

6.10.3.3.1 Administrative divisions and governance structure

Within the County, there are six sub-counties as shown in Figure 9 (Administrative Divisions for Turkana County).

Each sub-county is further divided into Divisions, Locations and Sub-locations. All administrative units are outlined in Table 6.13 to Table 6.16. Sub-counties or Constituencies are represented by one Member of Parliament (MP) per county, each sitting in the National Assembly. Within the County, each Constituency is divided into electoral Wards, each being represented by a Member of County Assembly (MCA) in the County Assembly. In addition to the 30 MCAs listed per Constituency, there are an additional ten MCAs nominated by political parties, making a total of 40 MCAs.

Table 6.13: Wards per Constituency in Turkana County

Constituency	*Number of Wards*
Turkana South	5
Turkana East	3
Turkana Central	5
Loima	4
Turkana West	7
Turkana North	6
Total Number of Wards	30

Table 6.14: Sub-county Administrative Units: Turkana South

Turkana South			
Division	***Location***	***Sub-location***	***Ward***
Lokichar	Lokichar	Lokichar	Lokichar
		Kapese	
	Lochwangi Kamatak	Lochwangi Kamatak (Lochwangimatak)	
		Naposumuru (Napusimoru)	
	Kalapata	Kalapata	Kalapata
		Loperot	
		Nakalale (Nakaalei)	
Kainuk	Kainuk	Kainuk	Lobokat
		Kakongu (Kakong)	
		Loyapat	
	Kaputir	Kalomwae	Kaputir
		Nakwamoru	
		Lorogon	
Katilu	Katilu	Katilu	Katilu
		Lokapel	
		Kalemgorok (Kalemgorok)	
		Kanaodon (Kanaodon)	

Table 6.15: Sub-county Administrative Units: Turkana East

Turkana East			
Division	***Location***	***Sub-location***	***Ward***
Lomelo	Lomelo	Lomelo	Kapedo/Napeitom
		Katir	
	Napeitom	Napeitom	
	Nadome	Nadome	
		Ekipor	
	Kamuge	Kamuga (Kamuge)	
		Ngilukia	
	Kapedo	Kapedo	
		Silale	
Lokori	Lokori	Lokori	Lokori/Kochodin
		Kangitit (Kang'itit)	
		Lotubae	
	Kochodin	Lochodin (Kochodin)	
		Lopii	
	Lochakula	Lochakula	
		Kakulit	
		Lokwamosing	
	Katilia	Katilia	Katilia
		Elelea	
		Parkati (Paragati)	

Table 6.16: Sub-county Administrative Units: Turkana Central

Turkana Central			
Division	***Location***	***Sub-location***	***Ward***
Kerio	Kerio	Kerio	Kerio Delta
		Nakurio	
		Nadoto	
	Kangirisaye	Kangirisaye	
		Nakoret	
	Lorengelup	Lorengelup	
		Kangagetei	
		Kakimat	
Kalokol	Kalokol	Kalokol	Kalokol
		Kapua	
		Namadak	
	Namukuse	Namukuse	Kang'ototha
		Locher Ekeny	
	Kangatotha	Eliye (Ille)	
		Naworos (Naoros)	
		Lomopus	
Central	Lodwar Township	Lodwar Township	Lodwar Township
		Nakwamekwi	
		Napetet	
	Kanamkemer	Kanamkemer	Kanamkemer
		Nawoitorong	

Reorganisation associated with changes from the 2010 constitution has caused some challenges in understanding role and responsibilities among various levels of government authorities.

6.10.3.3.2 Demographics

The most recent census data from the Kenya Population and Housing Census (KPHC) in 2009 counted a total population of 855,399. This figure was expected to be over 1 million in 2012, but additional official statistics have not been identified (Turkana County, 2013).

The three Constituencies in the AOI made up approximately 360,000 people with Turkana Central being the most densely populated (Turkana County, 2013). However, Turkana County is often described as having unreliable data given the movement of pastoralist communities, making it difficult to count and track population figures.

Lodwar town, Kakuma and Lokichggio are the three main urban centres in Turkana County. Lodwar town had the largest population of the urban centres with a total of 35,897 people according to the 2009 census. Kakuma is unique in that it hosts a refugee camp sheltering people fleeing from Sudan, Ethiopia, Uganda, Somalia and Burundi (Turkana County, 2013).

The County is characterised by clustered settlements. Rural areas are settled with the nomadic pastoral communities on a temporary basis because of their movement in search of water and pasture for their livestock.

The majority of the people in the county come from the Turkana community, with a few other tribes from different parts of the country. Precise numbers of other ethnic groups are as yet unknown.

There is little existing information on classification of vulnerable and marginalised group, which will be studied further. The Kenyan Constitution, Part 3 – 56, has requirements related to “minorities and marginalised groups” that will need to be considered in the context of project impacts and mitigations.

At this stage, insufficient information is available regarding the appropriateness of referring to any group as “indigenous”, which would trigger further analysis in line with IFC Performance Standard 7 on Indigenous Peoples. Golder will conduct an applicability assessment as part of the baseline analysis and consultation work. Key steps in that assessment include:

- Initial Review of Previous PS7/Indigenous Peoples Applicability;
- Initial Baseline Data Review; and
- PS7 Evaluation of Distinct Social & Cultural Groups in the Project Area

6.10.3.3.3 Infrastructure and services

Socio-economic mapping has been conducted as part of the establishment of exploration wells. This will be expanded to capture infrastructure and services data relating to the Upstream Project.

6.10.3.3.4 Economics

Wage earners constitute only 6% of the population in Turkana County. Unemployment levels are estimated at 70% in contrast to national figures of 42% (Turkana County, 2013).

The majority of Turkana County depends on nomadic pastoralism; fishing and weaving are also common sources of livelihood. Fishing is practiced in Lake Turkana. Goats, donkeys, camels and cattle are the most common livestock and the Kerio River and Turkwel Dam are key sources of water to support animal husbandry (Turkana County, 2013).

Turkana has some of the highest levels of poverty in the country. Such figures need to be considered in context. One way of assessing context may be to assess how far a community is from its water source, although, such questions are more complex among communities travelling with animals and following patterns of seasonal resources.

6.10.3.3.5 Land use and ownership

All land associated with the Project is unregistered community land in Turkana. In accordance with the Constitution, all unregistered community land is held in trust by the County Government (County Council of Turkana) on behalf of the community. Research by USAID has indicated that approximately 70% of land in Kenya is classified as community land (USAID, 2011).

Land rights relate to ownership, access and use and the security of this ownership, access and use. Land formed the basis for the independence movement in Kenya and has symbolic, cultural and historical importance. There are complex political, community, commercial, legislative and contractual factors that influence the preferred mechanisms and consequences for how the Project seeks to secure access to unregistered community land.

To date, exploration and appraisal activities have involved accessing relatively limited areas of land on a temporary basis. This has involved obtaining temporary land leases issued by Turkana County Government, together with provision of community benefits for communities proximate to required sites. To develop the discovered oil resources the development and production phases will require longer-term access for at least 25 years to larger areas of land in upstream oil fields.

The overall approach proposed for securing land for the Project will be done with the government, including the National Land Commission, Turkana County Government and other stakeholders. Tullow works closely with the Ministry of Energy and Petroleum's Land Working Group, who expect to agree on the approach and details of implementation in early 2016. As with all aspects of the Project, the approach will need to meet national requirements, as well as comply with the IFC Performance Standards.

Tullow has initiated baseline data gathering within known land required for the project to assess land ownership, land use, land users and structures and assets. This will inform the ESIA on baseline and potential impacts and be used to change project design to minimise impact associated with land acquisition. This data, as well as other socio-economic research, will be used to develop appropriate a Resettlement Action Plan or Livelihood Restoration Plan, which will form part of the overall Environmental and Social Management Plan.

Beyond the clear indication that local residents use land for pastoralism, there is limited data and information that can be used to analyse land use in the local AOI. Preliminary findings from Tullow's on-going baseline data gathering confirm that all land is community land and there are no indications of land staking within the field areas visited. Regional insecurity has influenced the way land is being used near some areas. This dynamic will be assessed for all fields and baseline information will be collected for wet and dry season variations.

Land is one of the most important aspects of the socio-economic baseline and will be studied in greater detail during baseline data collection.

6.10.3.3.6 Community health and safety

TKBV have mapped some health facilities in the AOI, but little information or data on health trends has been collected.

Turkana County documents report that access to health is low compared to the size of the territory and population. Official information also indicated that health personnel are not sufficient with one doctor for every 70,000 people and one nurse for every 5,200 people (Turkana County, 2013).

The two most common diseases are said to be malaria and respiratory infections. Many areas are favourable environments for mosquitoes and dust is said to contribute to the respiratory ailments (Turkana County, 2013).

Kenya is considered one of six "high burden" countries in Africa in relation to HIV with an estimated 1.6 million people living with the disease in 2011. The most affected population for new infections are married couples, which accounted for 44% of 91,000 new infections in 2009 (UNAIDS, 2012).

More recent statistics and additional qualitative information are expected from key informant interviews.

6.10.3.3.7 Education

In total, there are only 315 primary schools and 32 secondary schools in all of Turkana County. There are polytechnic institutes in Kakuma and Lodwar; two colleges, one focus on health and the second on teacher training. The only campus university sites are in Lodwar and Lokichoggio and a Technical Training Institute is being built in Lodwar (Turkana County, 2013).

Socio-economic mapping has sought to identify only what educational infrastructure is located in villages close to exploration wells. There is limited information on educational achievement, literacy and other aspects that can be compared across the AOI or to understand how these areas compare with similar places within Turkana County and throughout Kenya.

TKBV have planned an industrial baseline survey, which will seek to get further information on local and regional educational capacity and facilities. When complete, the findings from this study will be incorporated into the socio-economic baseline.

6.10.3.3.8 Social maladies

Social maladies have not yet been investigated. These include aspects of alcohol or drug use, crime, commercial sex work, child and forced labour and other work/occupational inequities. While limited data can be expected on these topics, the topics will be investigated through key informant interviews and focus groups.

6.10.3.3.9 Social capital, security and conflict

TBKV has engaged Wasafiri Consulting to conduct conflict analysis of some communities in the local AOI. The group has done preliminary site visits to three villages, two of which (Nakukulas and Loperot) have had contact with Tullow, and one that has had relatively limited contact, Nakabosan.

Preliminary findings include an atmosphere of increasing tension between communities, different ethnic groups, especially the Pokot to the southwest, and with Tullow itself. The findings also indicate that there is increasing tension between traditional community governance structures and elected leaders. This is reportedly linked to disagreements about who represents local communities.

In addition, secondary and primary research has been conducted by Small Arms Survey. Their report on community perceptions of conflict indicates shifts and intensification of armed conflict. Over the past 10 years, a gradual shift has occurred in patterns of livestock raiding and attacks. While raids continue to serve as a means to distribute wealth within a community through the acquisition of assets, particularly animals, the commercialization of livestock theft – in which individuals, and not communities, benefit from raiding – has emerged. Politicians, businessmen and other elites are alleged to be supporting and profiting from commercialized raiding, something that is believed to be eroding elders' authority (Mkutu, 2010; Kaimba, 2011; Griener, 2013; Triche, 2014).

Further baseline research will aim to better understand the general dynamic.

6.10.3.4 Key data gaps

The following are the key data gaps, which will be addressed during baseline data collection:

- Description of roles and responsibilities of administrative units;
- Information on populations of potentially affected communities;
- Information on migration trends, vulnerable groups;
- Information on the business environment (i.e., type of businesses and number of businesses), income, poverty and inequality, livelihoods and occupations, inflation and departmental or sector-specific economic issues;
- Industrial baseline survey;
- Information on community health and safety, such as communicable/non-communicable diseases, health information systems, water and sanitation;

- Data on infrastructure and services;
- Data and information on land ownership and land use;
- Information education, such as literacy and educational achievements, skills sets available;
- Information on social maladies; and
- Information on social capital, security provision and community/conflict dynamics.

6.10.4 Identification of potentially significant effects

The following social issues have been identified as potential effects the Upstream Project could have on socio-economic receptors. The text presents where effects are to be scoped in to the ESIA or whether they do not require further consideration and will be scoped out of the ESIA:

- In-flux and migration: Changes in demographics, mixture of local residents with outsiders and changes to culture and intangible cultural heritage (with inputs from intangible cultural heritage impact assessment). In-flux can also be linked to many indirect changes in social maladies, security and community health – scoped in;
- Taxes and other payments: Changes in government resources – scoped in;
- Direct employment for skilled and non-skilled labour: Employment may be a positive impact. However, the allocation of jobs can also lead to accusations of nepotism, which in turn can lead to opposition to the Project and conflict among residents – scoped in;
- Contractor (indirect) employment for skilled and non-skilled labour: Contractor or "non-employee" workers are considered differently than workers hired directly by TKBV. Workers hired by third parties present different risks – scoped in;
- Business opportunities/local content: As with employment, this can be a positive dynamic, but the perception of fair process is essential to avoid tensions between different groups – scoped in;
- Inflation: Changes in prices for goods, services and labour – scoped in;
- Resettlement and economic displacement: Land is an issue itself, as well as being linked to numerous in-direct issues such as communal land use (i.e., grazing and fishing) and migration and movement of people. The issue is further complicated by an overall lack of legal framework underpinning the access to community land. Devolution from national to county governments has politicised the issue, making it difficult to balance communication with national, county and sub-county stakeholders – scoped in;
- Indigenous peoples: While no final conclusion has been made on determining whether local residents meet the criteria of Indigenous Peoples, further analysis will be required – scoped in;
- Vulnerable and marginalised groups: Vulnerable groups are a key issue touching gender, ethnicity, elderly and the dynamic between various socio-economic levels – scoped in;
- Infrastructure: Changes in infrastructure, including roads, power, water and waste management – scoped in;
- Community health and safety – scoped in;
- Changes in social capital, security provision and conflict – scoped in;
- Education: Changes in the provision of education – scoped in;
- Indirect impacts linked to environmental changes (e.g., water abstraction) – scoped in; and

- Stakeholder expectations: High expectations are linked to all social and many environmental issues. This is overarching for all issues listed above. It is especially relevant to the expectation for "shared benefits" or discretionary social investment – scoped in.

6.10.5 Summary of approach to the ESIA

A summary of the approach to the social component of the ESIA is provided in Table 6.17.

Table 6.17: Analysis of potential effects (Social)

Receptor	Potential Effect	Next Steps in the ESIA
Project Affected People (including individual residents as well as non-organised groups with particular areas of interest or that may be vulnerable (e.g. elderly, people with disabilities, ethnic minorities)	■ Influx and migration. ■ Changes in taxes, profit sharing and other payments. ■ Direct employment for skilled and non-skilled labour. ■ Contractor (indirect) employment for skilled and non-skilled labour. ■ Business opportunities/local content. ■ Inflation, and hence changes in prices for goods, services and labour. ■ Resettlement and economic displacement ■ Impacts on indigenous peoples, and vulnerable groups. ■ Changes in infrastructure. ■ Changes in health and safety ■ Changes in social capital, security provision and conflict. ■ Changes in the provision of education.	*Baseline data gathering* - ■ Review information gathered during stakeholder engagement to inform approach to socio economic baseline data gathering, concerns and questions. ■ Collect more detailed data and information on existing baseline conditions through focus group, key informant interviews at the community and non-community levels and secondary literature research; ■ Collect local and regional health data through database research by medical practitioners and focused key local informant interviews Impact Assessment ■ Using baseline information and stakeholder inputs and more detailed project description, conduct detailed analysis of how the potential effects listed above will impact the main receptor, project-affected people; and ■ Develop reasonable and appropriate mitigation measures to

Receptor	Potential Effect	Next Steps in the ESIA
		reduced negative impacts and maximise potentially positive impacts.

6.10.6 References

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7.0 EMERGENCY PREPAREDNESS AND RESPONSE TO UNPLANNED EVENTS

The ESIA will consider risks that may occur from unplanned events. This is necessary both to meet national EIA requirements and comply with international standards (notably IFC PS 1 and 4, which specify that the environmental and social management measures emerging from the assessment process should incorporate measures for *"emergency preparedness and response"*).

Tullow's Emergency Preparedness Standard (2015) also requires the company to undertake an exercise which involves the Identification and Assessment of credible risks and states that "*credible emergency scenarios*" shall be documented, based on the business unit and operational risk registers/assessments and include an evaluation of the potential likelihood, severity and operational impact of:

1) Medical emergencies (Illness, Injury, Fatality)
2) Road transport incidents
3) Aviation or marine transport incidents
4) Natural disasters
5) Fire and/or explosion

6) Hazardous release to the environment (including well control)

7) Community protest or targeted demonstrations

8) Security incidents (crime, civil disorder, terrorism, kidnap, piracy, war

Management of unplanned events which require an element of environmental or social risk management will be incorporated into the ESIA and its associated Management Plans. The Management Plans will include an Emergency Response and Preparedness Plan, and will:

- Identify and quantify both the likelihood of the occurrence of unplanned events and their environmental and social consequences (i.e. level of hazard should the event occur); and
- Specify both measures for avoiding/minimising risks of occurrence through design, training and allocation of resources and operational procedures, as well as responses to be implemented in the event of an occurrence.

The above approach will meet the requirements of national legislation and international good practice as well commitments within the Tullow polices and provide clear guidelines on the avoidance, response to and management of high consequence, low probability unplanned events. Such events and their consequences are likely to include but not be limited to those outlined below:

- Natural seismicity (earthquakes) on built structures which may lead to loss of containment (pollution via surface water or groundwater pathways), and on vibration sensitive built structures or equipment which may lead to operational failure;
- Induced seismicity (due to oil production/water injection) resulting in risk as per above including loss of containment due to failure of casing;
- Flood or other extreme weather event events putting infrastructure risks with potential for operational failure an possible impacts on communities close to project infrastructure notably the CPF;
- Uncontrolled leaks and spills including from structural or mechanical failure, vehicle/plant collision or other human error;
- Waste handling, storage and transport including drilling muds;
- Run off discharges from systems that are normally isolated (e.g. around drill rig, central part of CPF) during high rainfall or uncontrolled conditions causing potential risks of pollution/contamination;
- Discharges of firefighting foam;
- Well blow out during drilling and workover interventions;
- Well casing/grout integrity failure and down hole collisions during drilling interventions and production;
- Pipeline failure;
- Emergency crude release from CPF;
- Blow out, explosion or integrity failure resulting in emergency releases of gas from wells, the pipeline or CPF;
- Emergency releases from relief systems for control of tank pressure;
- Flaring from emergency and non-routine events; and
- Community protest or targeted demonstrations relating to environmental and/or social issues.

Report Signature Page

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FIGURES

Figure 1: Likely Area of Influence for the Upstream Project

South Lokichar Development,

ESIA Project Report

570000 770000 970000

340000 140000

South Sudan
Kenya

Ethiopia
Kenya

South Sudan
Uganda

Kenya
Uganda

LOKICHAR

KITALE

Turkwel Dam

EASTERN

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Key

- Potential Export Pipeline
- Potential Power Line - 132KV
- Potential Source Water Pipeline
- A1 Lokichar to Kitale Highway
- Potential Area of Influence of the Upstream Component
- Upstream Area
- Surface Waterbody
- International Border

N

Scale (at A3): 1:1,550,000

Kilometres

0 10 20 30 40

Data sources:
Data sourced from client

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

TULLOW OIL PLC

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Figure 2: Water Supply Options

South Lokichar Development, ESIA Project Report

Key

- Upstream Area
- International Border

South Sudan
Kenya

Ethiopia
Somalia

Ethiopia
Kenya

Kenya
Uganda

Kenya
Somalia

Uganda
Tanzania

Kenya
Tanz

Option 3: Lake Turkana

LOKICHAR

Option 4: Local Ground Water

Option 2: Turkwel Dam

Option 1: River Nile / Lake Kyoga

Option 6: Distant Ground Water

Option 7: Lake Victoria

Option 5: Indian Ocean

N

Scale (at A3): 1:3,500,000

Kilometres

0 40 80 120 160

570000 770000 970000 1170000 1370000 1570000

740000 540000 340000 140000 -60000

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Data sources:
Data sourced from client

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

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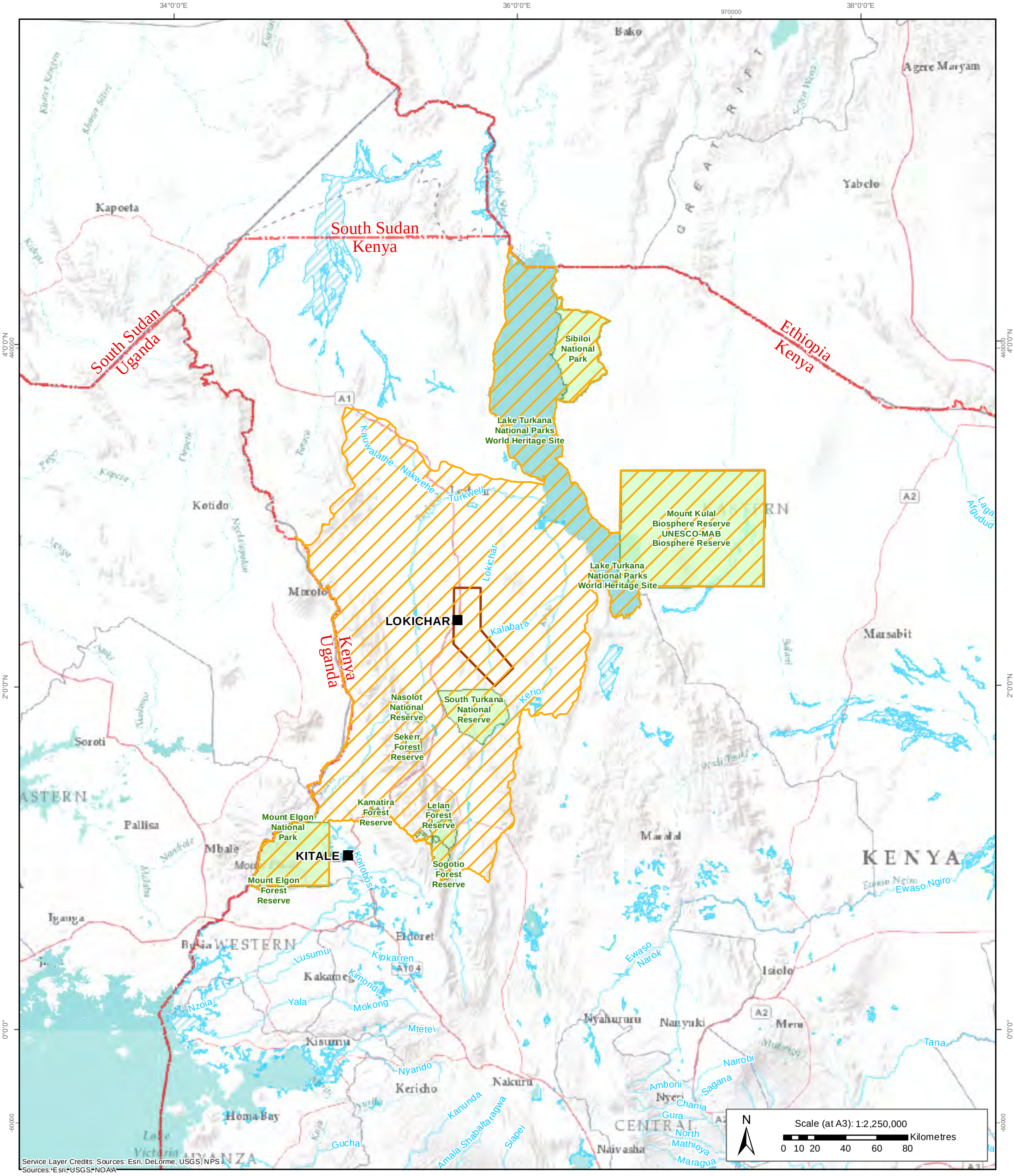

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Key

- Watercourse
- International Border
- Critical Habitat Area of Analysis (CHAA)
- WDPA Global Protected Areas (2012)
- Upstream Component
- Wetlands

Data sources: WDPA (2012)

Figure 3: Critical Habitat Area of Analysis (CHAA)

South Lokichar Development, ESIA Project Report

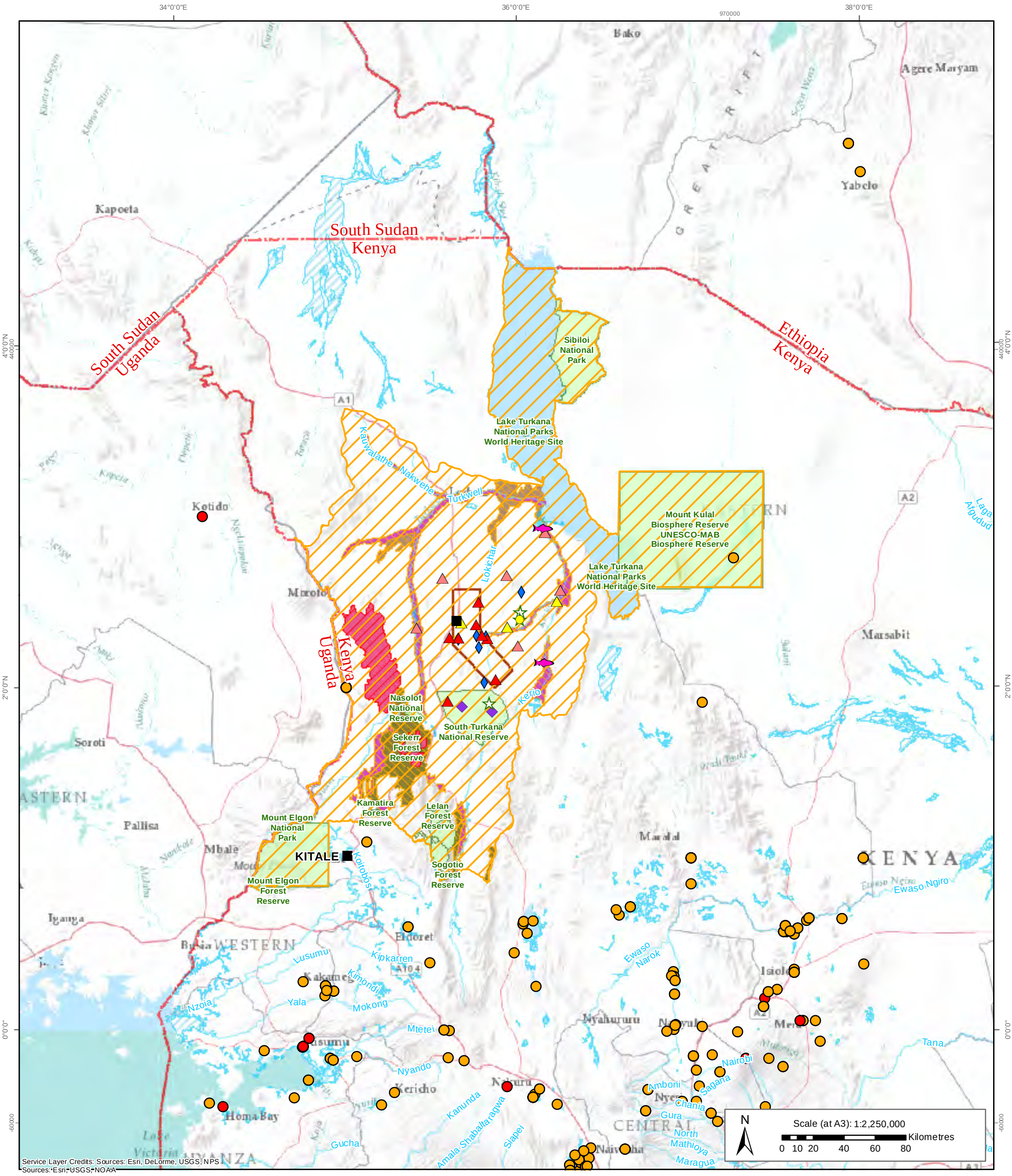
Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

TULLOW OIL plc

Golder Associates

1 Alie Street. London, E1 8DE UK



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Key

NMK Records of Species

- Olive Baboon
- African Elephant
- Hildegarde's tomb bat
- Jackal (species unknown)
- Leopard
- Migratory birds
- Birds species of concern

- Fish species of concern

GBIF Red List Species

- Critically endangered
- Endangered

- Critical Habitat Area of Analysis (CHAA)
- International Border
- Upstream

- WDPA Global Protected Areas (2012)
- Watercourse
- Wetlands
- Detailed_Water

Potential critical habitat triggers

- Deciduous wooded annual grassland (EN)
- Evergreen and semi-deciduous bushland (EN)
- Evergreen and semi-deciduous woodland (EN)
- Undifferentiated evergreen forest (CR)

Figure 4: Sensitivity Map of the CHAA

South Lokichar Development, ESIA Project Report

Coordinate System: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

Data sources: Biodiversity data sourced from NMK,WDPA and GBIF

1 Alie Street. London, E1 8DE UK

770000
820000
870000
290000
240000
190000

Lake Turkana

LOKICHAR

N

Scale (at A3): 1:500,000

0 6 12 18 24 Kilometres

Figure 5: Soil Map

South Lokichar Development, ESIA Project Report

Key

Upstream Area

Soil Type

- Clayey
- Loamy
- Sandy
- Very clayey

Well Field

- Agete
- Amosing
- Ekales
- Ngamia
- Twiga

Data sources:
Kenya Soils (2002); International Livestock Research Institute

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref: 14514160360	Prepared by: LDoyle 21/12/2015	Reviewed by: JMorgan 10/12/2015	Approved by: AMorsley 10/12/2015

Map path: \\RDC1-V-GISUK01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\14514160360\1451460360_516_Scoping_report\02_PRODUCTION\MXD\A_2\1451460360-516-OG-0088-A.2-F005.mxd

Company Details: 1 Alie Street London E1 8DE, UK

Figure 6: Traditional Settlements and Land Use Features

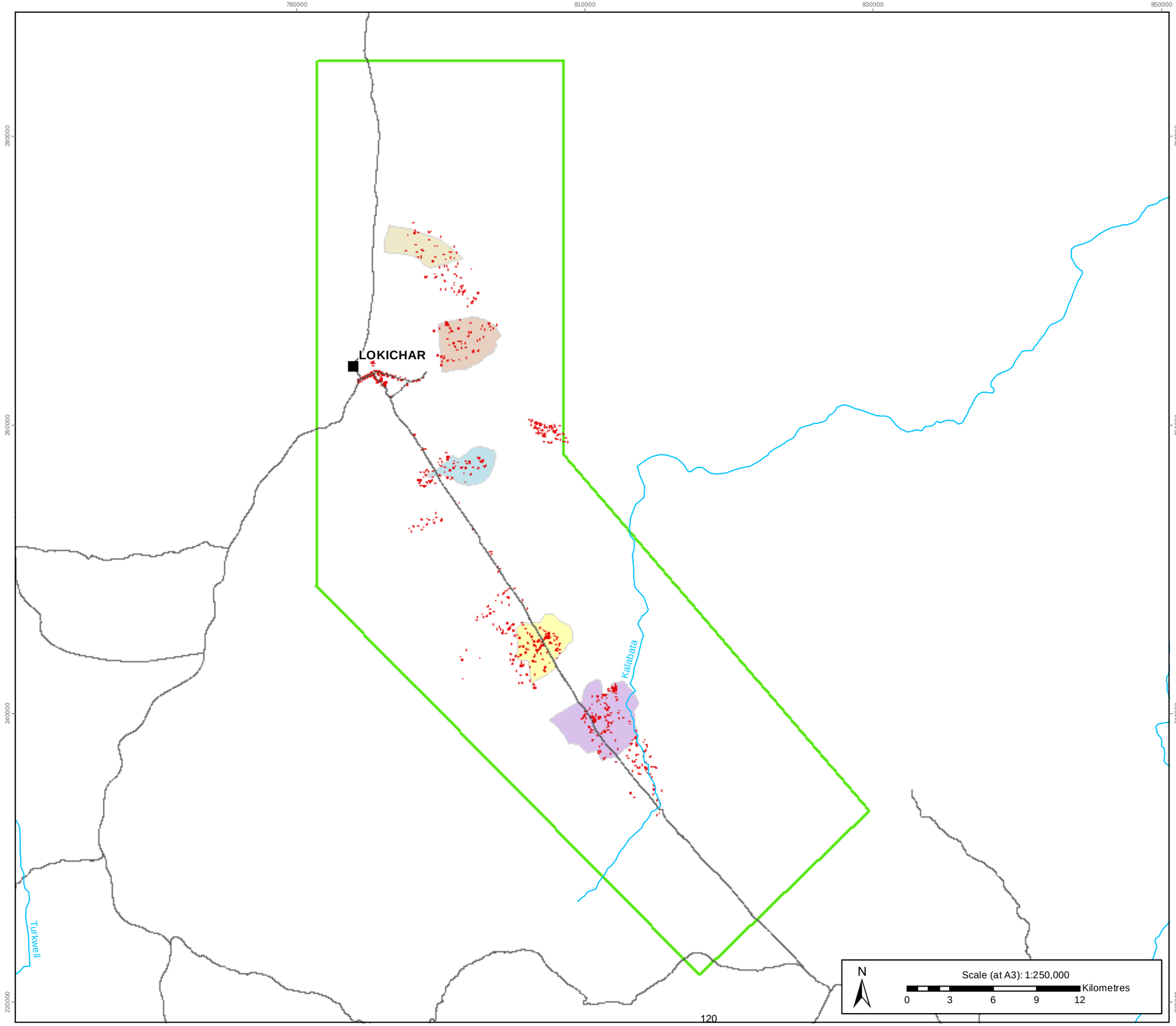
South Lokichar Development, ESIA Project Report

Key

- Existing Road
- Upstream Area
- Surface Water Course
- Traditional Settlement & Land Use Feature

Well Field

- Agete
- Amosing
- Ekales
- Ngamia
- Twiga



Data sources:
Basedata sourced from client

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

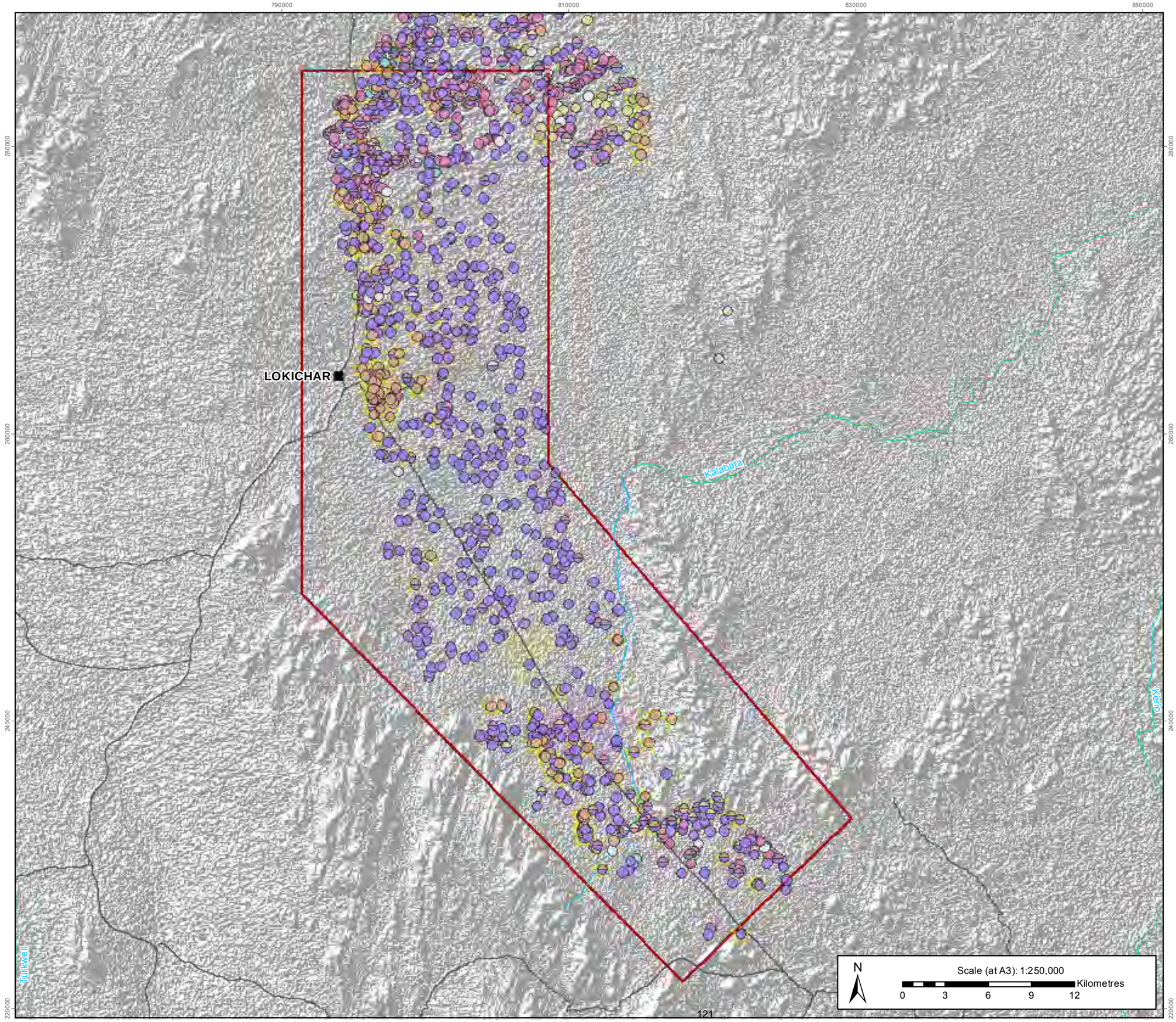
Map path: \\RDC1-V-GISUK01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\14514160360\1451460360_516_Scoping_report\02_PRODUCTION\MXD\A_2\1451460360-516-OG-0089-A.2-F006.mxd

Company Details: 1 Alie Street London E1 8DE, UK

Figure 7: Known Archaeological Finds (from desktop study)

South Lokichar Development,

ESIA Project Report



Key

- Desk study indicates potential constraint high value – to be investigated further
- Site with multiple archaeological finds
- Burial
- Faunal
- Grindstone
- Jewellery
- Lithic
- Monument
- Palaeontological
- Pottery
- Existing Road
- Watercourse
- Upstream Area

Well Field

- Agete
- Amosing
- Ekales
- Ngamia
- Twiga

Data sources:
Basedata sourced from client

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 21/12/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

Company Details: 1 Alie Street London E1 8DE, UK

Map path: \\RDC1-V-GISUK01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\14514160360\1451460360_516_Scoping_report\02_PRODUCTION\MXD\A_2\1451460360-516-OG-0090-A.2-F007.mxd

Figure 8: Administrative Divisions for Turkana County

South Lokichar Development, ESIA Project Report

Key

- Upstream Area

Divisions

- Loima
- Turkana Central
- Turkana East
- Turkana North
- Turkana South
- Turkana West
- International Border
- Surface Waterbody

570000 720000 870000 1020000

390000 240000

South Sudan
Kenya

Ethiopia
Kenya

South Sudan
Uganda

Kenya
Uganda

Turkana North

Turkana West

Lake Turkana

Loima

Turkana Central

Turkana South

LOKICHAR

Turkana East

Turkwel Dam

KITALE

N

Scale (at A3): 1:1,550,000

Kilometres

0 10 20 30 40

122

Data sources:
German Agency for Technical Cooperation (GTZ), Department of Resource Surveys and Remote Sensing (DRSRS) and International Livestock Research Institute (ILRI)

Coordinate system: WGS 1984 UTM Zone 36N

Project Ref:	Prepared by:	Reviewed by:	Approved by:
14514160360	LDoyle 15/04/2015	JMorgan 10/12/2015	AMorsley 10/12/2015

Tullow Oil plc

Golder Associates

Company Details: 1 Alie Street London E1 8DE, UK

Map path: \\RDC1-V-GISUK01\Data\Tullow_Oil\Lokichar\Kenya_Upstream_ESIA\99_PROJECTS\14514160360\1451460360_516_Scoping_report\02_PRODUCTION\MXD\A_2\1451460360-516-OG-0091-A.2-F008.mxd

APPENDIX B

Scoping Consultation PowerPoint slides, Nov 2015

South Lokichar Development Project (Phase I)

November 2015

Initial welcome

- Welcome and initial safety moment
- Agenda:
  - Introductions and expected outcomes
  - Objectives of the meeting
  - Overview of the oil and gas life cycle
  - Description of the Development Project
  - Handover to the Upstream ESIA Contractor (Golder and EMC Associates)

Introductions and objectives

- Introductions:
  - Tullow Kenya B.V. and Africa Oil Corp (AOC)
  - Golder Associates
  - EMC Associates
  - ESIA Stakeholders present today

- Objectives:
  - To provide information associated with the Development Project
  - To introduce the Upstream ESIA Contractor
  - Describe the Environmental & Social Impact Assessment (ESIA) process
  - To provide stakeholders with an opportunity to provide feedback on the project and indicate the key issues that should be addressed as part of the ESIA process

Expected outcomes from the meeting

- Stakeholder questions after Tullow's presentation on the project description

- Stakeholder views and opinions on key environmental and social issues that will need to be addressed in the ESIA process

Project Venture Partners

- Global independent oil and gas company
- Publicly listed on the London, Irish and Ghana Stock Exchanges
- The Group has interests in 123 exploration and production licences in 22 countries globally
- Tullow Kenya BV: wholly owned subsidiary pursuing exploration and development in Kenya

- Canadian oil and gas company with assets in Kenya and Ethiopia
- East African holdings cover total gross land package in excess of 250,000 square kilometres
- Publicly listed on the Toronto and Stockholm stock exchanges

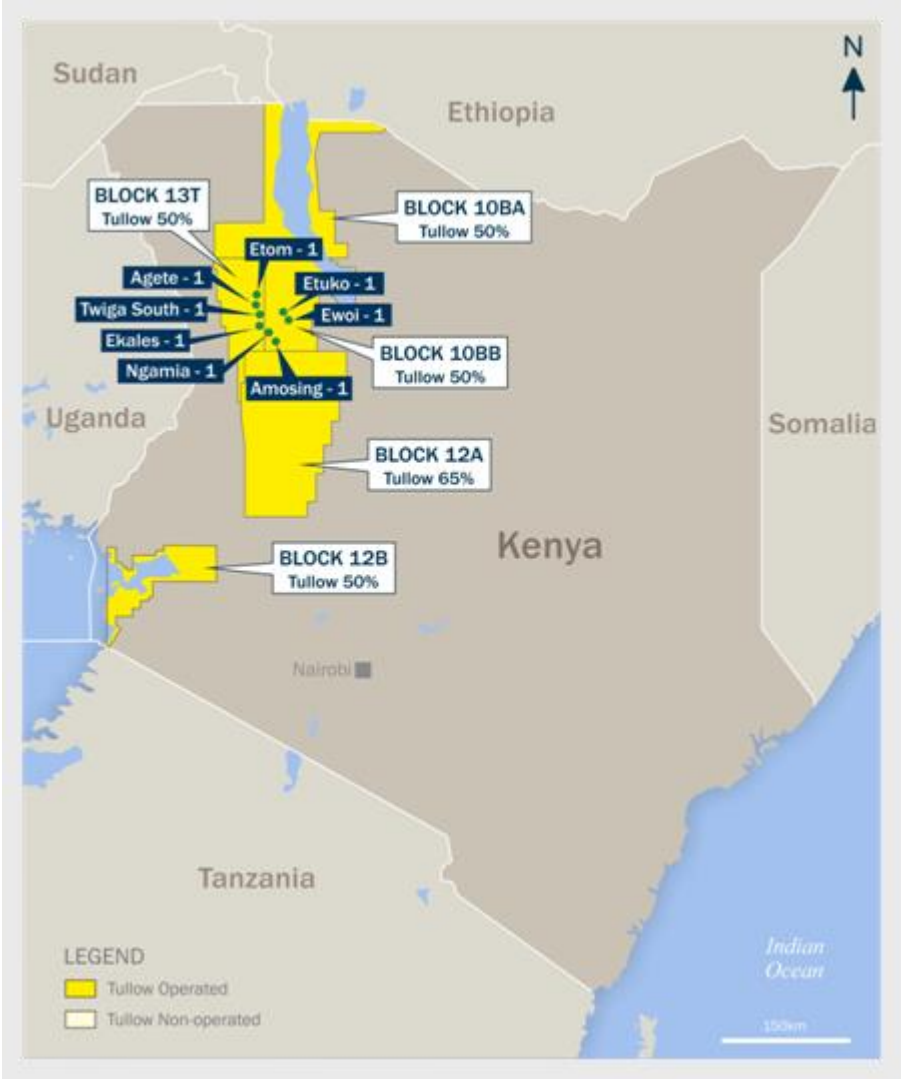
Oil & Gas Life Cycle

Exploration & Appraisal | Development & Construction | Commissioning & Production | Decommissioning

Seismic Activity	Exploration Drilling & Testing	Central Processing Facility	Crude Oil Pipeline	Marine Terminal	Oil Production	End of Project
						
5 – 10 years		5 – 10 years		20 – 50 years		5 years

Introduction to the Development Project

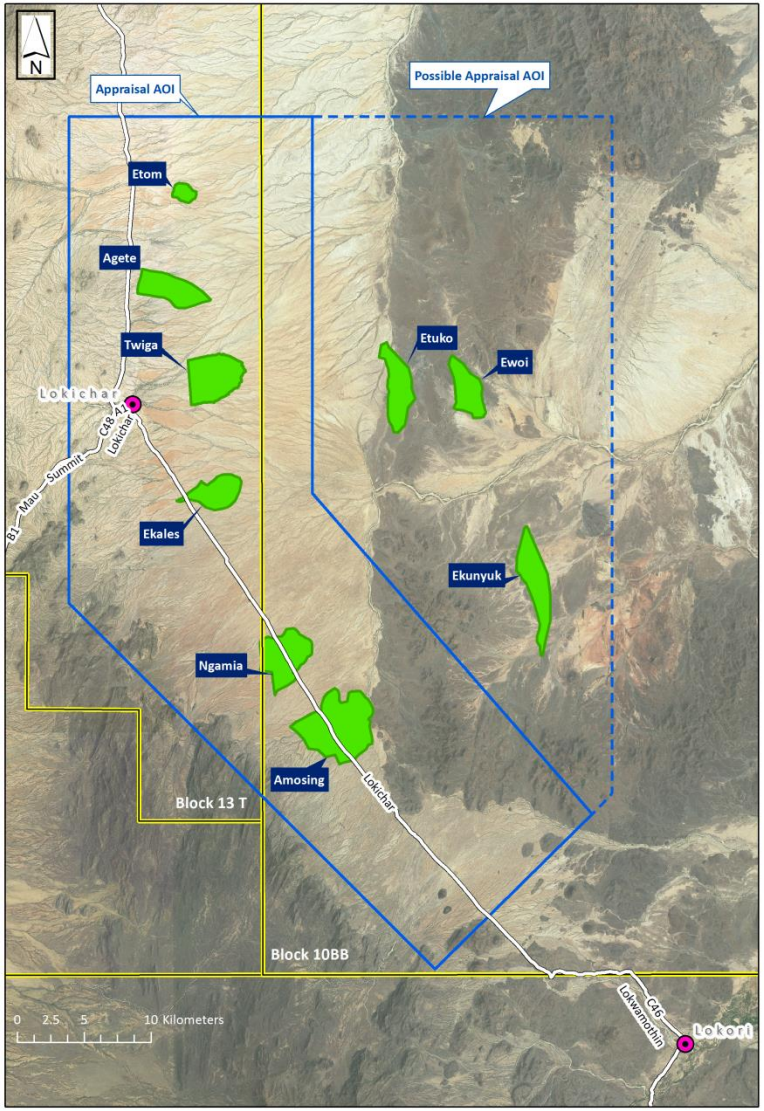
- Enough oil has been found in Kenya to start planning for a Development Project
- Exploration & Appraisal in a number of fields since 2012
- Upstream Field Development Project
- Project comprises up to 5 fields:
  - Agete
  - Twiga
  - Ekales
  - Ngamia
  - Amosing
- Project location – Turkana, North West Kenya



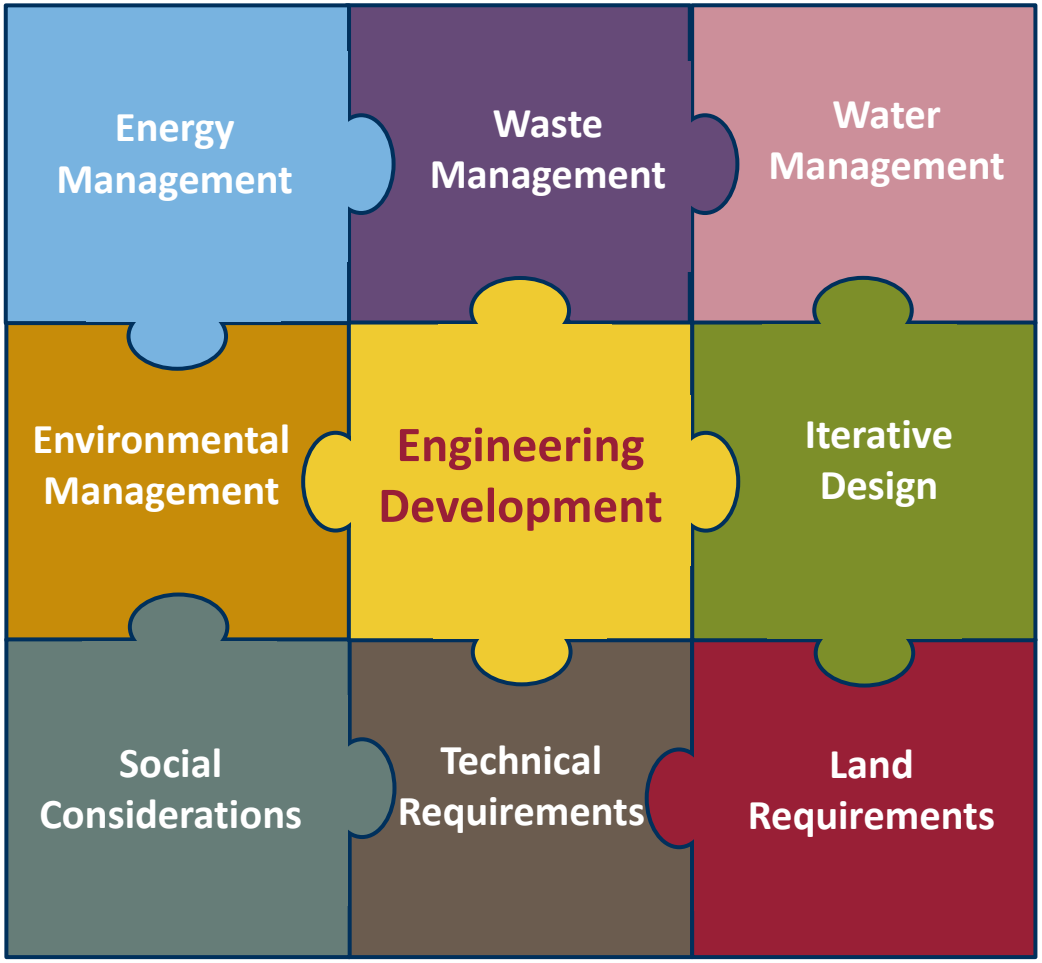
Introduction to the Development Project

- Range of technical studies underway to optimise design:
  - Which oil fields to start with
  - Location of Central Processing Facility (CPF)/well pads
  - How many wells, how many per pad
  - Location of interconnecting flowlines
  - Source(s) of water
  - How oil is transported to international markets
  - Workforce requirements and timing

- Current schedule – Upstream:
  - Concept + Front End Engineering Design (FEED): **FEED expected to start in 2016**
  - Permitting & ESIA: **2015 - 2016**
  - Field Development Plan submission & Final Investment Decision (FID): **2016/2017**
  - Construction start following FID



Project Development Key Considerations



Environmental & Social Impact Assessment (ESIA)

- Compliance with applicable Kenyan legislation and to meet the International Finance Corporation (IFC) Environmental & Social Sustainability Performance Standards (PSs)
- Framework for the future management of environmental and social performance
- Condition of external finance from international lenders

Historical approach:

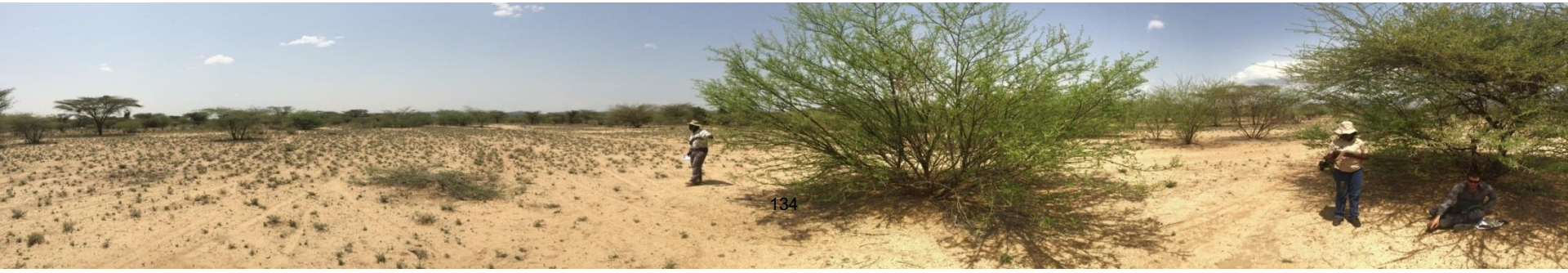
- Block-wide Environmental Impact Assessments
- Site-Specific Assessments

Approach to the ESIA for the Development Project:

- Upstream component (Central Processing Facility (CPF), well pads, flowlines, etc.) – ***focus of this meeting***
- Midstream component (pipeline and terminal) – awaiting agreement on pipeline
- Partnerships between Kenyan experts and international ESIA contractors:
  - Maximum use of Kenyan knowledge and expertise
  - Use of Kenyan experts to assist baseline data gathering activities

Land access approach for development

- Ministry of Energy & Petroleum (as the responsible ministry) has convened a Government Working Group on land matters specifically for the Development Project
- Tullow Kenya is working with the Working Group to define the Development Phase land access approach, initially focusing on upstream areas
- It will need to meet applicable national land laws and International Finance Corporation (IFC) requirements - notably IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement
- The land access approach needs to be identified by early 2016 and presented in a Land Acquisition Framework (LAF)

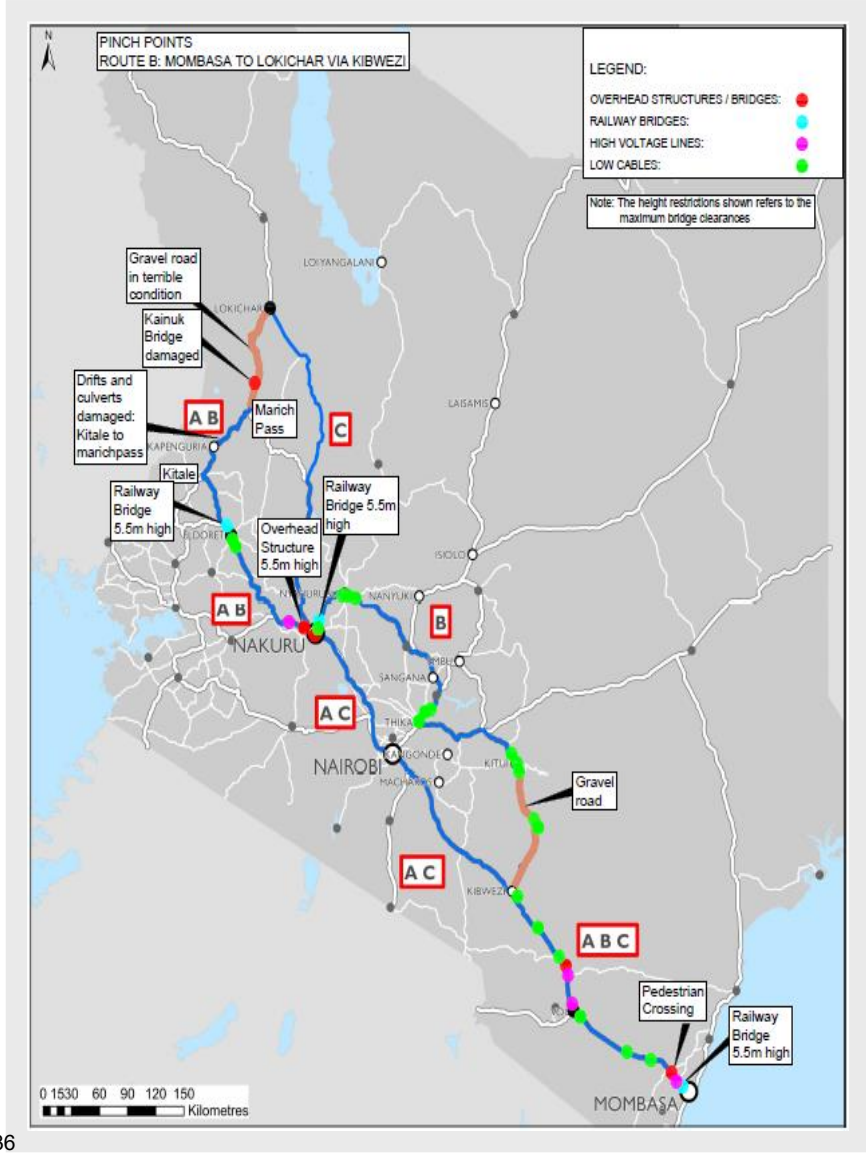


Water required for the Development Project

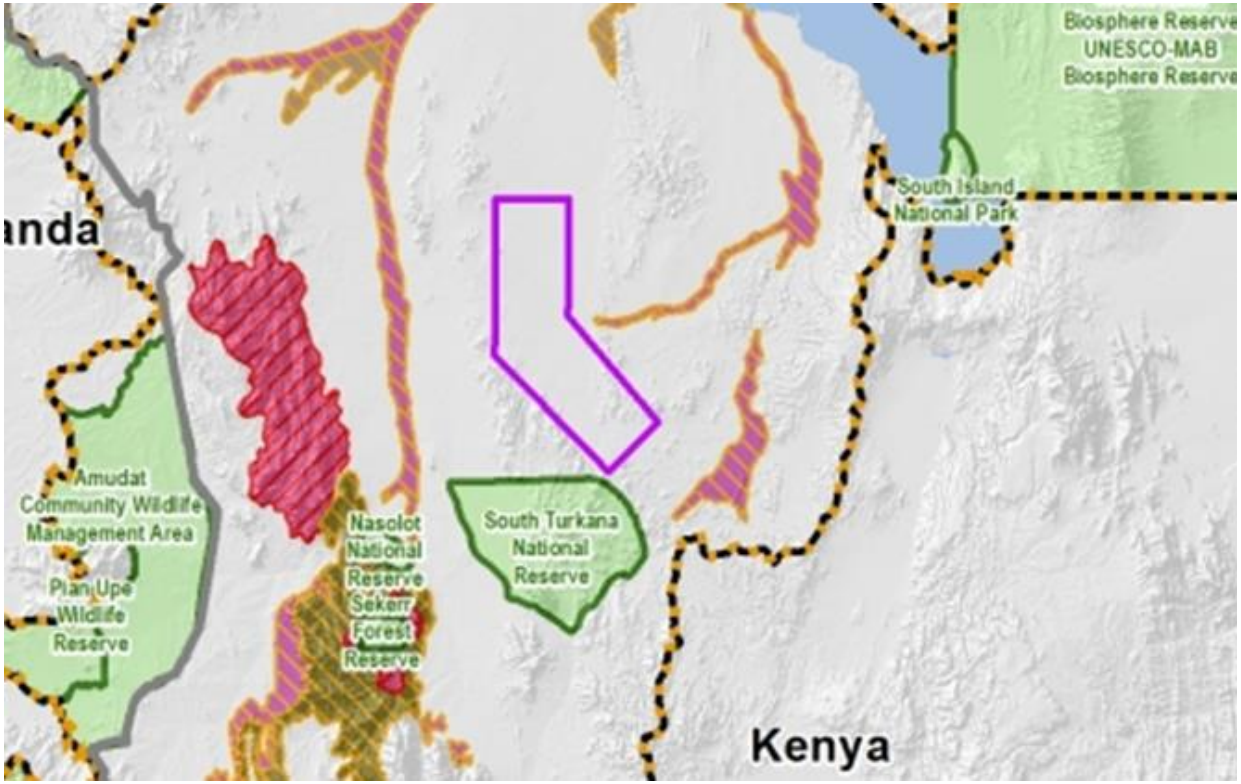
- Water is required for both the construction and production phase
- Construction phase water expected to be derived from groundwater boreholes
- Production phase water demand is higher and a range of sources are currently being considered.
- Various options have been identified and short-listed (groundwater and surface water sources).
- A variety of technical hydrological and hydrogeological studies are ongoing to identify the optimum source(s) of production phase water.

Road and Rail Logistics Study

- Aim was to determine the optimum transportation solution(s) to transport approximately 2 million tonnes of equipment and materials, a Road/Rail logistics study was conducted.
- The main logistics corridor runs from Mombasa to Lokichar via Eldoret.
- Two road routes may be used, Route A for in gauge loads and Route B for out of gauge loads.
- Rail transportation will be used from Mombasa to Eldoret.
- Air transportation will be from Nairobi and/or Eldoret to and airfield in the South Lokichar Basin.
- Government logistics upgrades are required to support the development.



Stakeholder Questions on the Development Project



SOUTH LOKICHAR DEVELOPMENT PROJECT (PHASE 1) **SCOPING CONSULTATION**

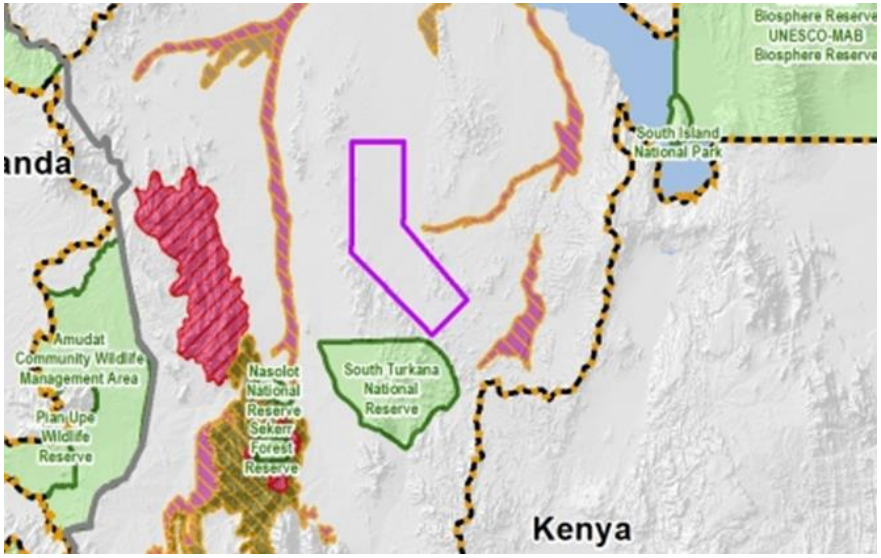
November 2015

EMC Consultants
ENVIRONMENTAL KNOWLEDGE IN PRACTISE

Golder Associates

Objectives of the presentation / meeting

- Introductions – Golder and EMC
- Describe the Environmental and Social Impact Assessment (ESIA) process
- Listen to and record any opinions and questions from stakeholders
- Solicit feedback on future stakeholder engagement



Introductions

Golder Associates

A global environmental organisation providing consulting, design, and construction services since 1960.

Specialised in Environmental and Social Impact Assessments (ESIA) for the extractive industry to international and national guidelines/standards to lender and regulator requirements.

Golder's project team is based in the UK with technical support from Kenyan specialists (EMC).

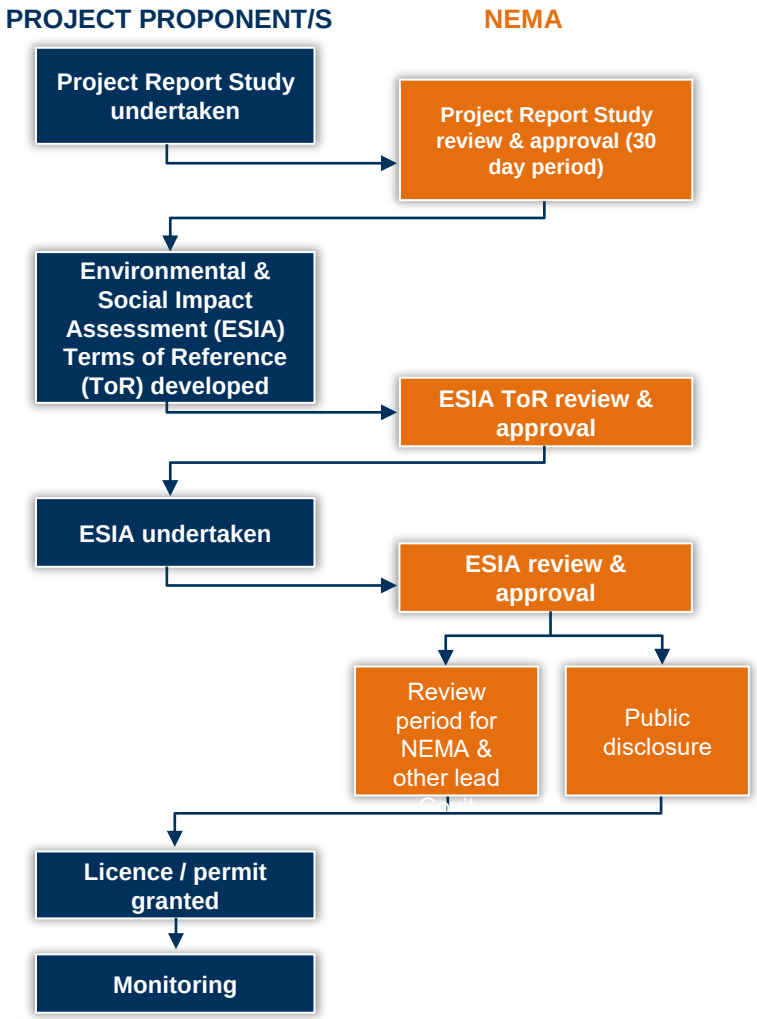
EMC Consultants
ENVIRONMENTAL KNOWLEDGE IN PRACTISE

EMC Consultants is a Kenyan consulting firm, based in Nairobi, specializing in environmental engineering, social analysis and environmental management services.

EMC is made up of specialist consultants from diverse environmental and social disciplines with extensive experience delivering to Kenyan legislation and IFC standards.

Environmental & Social Impact Assessment

- ESIA Approach
  - Scoping (Stage 1)
  - Baseline studies (Stage 2)
  - Impact assessment (Stage 3)
  - Impact mitigation and benefit enhancement (Stage 3)
  - Cumulative impact analysis (Stage 3)
  - Monitoring and management



ESIA Legislation and Guidelines

- Compliance with Kenyan Constitution and relevant legislation
- Tullow corporate policies
- Compliance with International Finance Corporation (IFC) Performance Standards on environmental and social sustainability
- IFC Environmental, Health and Safety Guidelines
- Investor driven to meet Kenyan legislation and IFC

nema
mazingira yetu | uhai wetu | wajibu wetu

WATER RESOURCES MANAGEMENT AUTHORITY

IFC International Finance Corporation
World Bank Group

Golder Associates

IFC Performance Standards

- PS 1: Social and Environmental Assessment and Management System
- PS 2: Labour and working conditions
- PS 3: Pollution prevention and abatement
- PS 4: Community health, safety and security
- PS 5: Land acquisition and involuntary resettlement
- PS 6: Biodiversity conservation and sustainable natural resources management
- PS 7: Indigenous peoples
- PS 8: Cultural heritage

IFC International Finance Corporation
World Bank Group

Golder Associates

ESIA Stage 1 - Scoping

Deliverables:

- Scoping Report
  - Project description
  - Project need and alternatives
  - Policy, legal and institutional framework
  - Approach to the ESIA
  - Potential effects of the project
- Stakeholder Engagement Plan
- Terms of Reference
  - Approach to the ESIA
  - Table of contents of ESIA

Golder Associates

ESIA Stage 2 and 3

- Stage 2 - Baseline Studies
  - Socio-economics
  - Land
  - Community health and safety
  - Cultural heritage
  - Biodiversity
  - Ecosystem Services
  - Soil
  - Geology and seismicity
  - Water
  - Air Quality and climate
  - Noise and vibration
  - Landscape and visual
- Stage 3 - Impact Assessment
  - GIS and computer prediction software
  - Professional judgement + past experience
  - Receptor identification
  - Design of mitigation measures
  - Design of an impact monitoring framework
  - Management Plans
  - Environmental and Social Management System (ESMS)

Golder Associates

Expected Upstream Basin ESIA Schedule

- Stage 1 - Scoping phase – to be completed Dec 2015
- Stage 2 - Baseline studies – Q4 2015 to end of 2016
- Stage 3 - Impact analysis and mitigation – late 2016
  - Environmental and social management plans prior to ESIA submission

Key focus areas for the ESIA

- Key areas where robust data gathering and impact assessment will be required:
  - Land use and ownership
  - Livelihoods and quality of life
  - Education and employment
  - Demographics and population
  - Community health, safety and security
  - Cultural heritage (including archaeology)
  - Water resources (including community water supplies and aquatic resources)
  - Biodiversity and habitats
  - Ecosystem Services (reliance on natural resources)
  - Air quality, dust and noise

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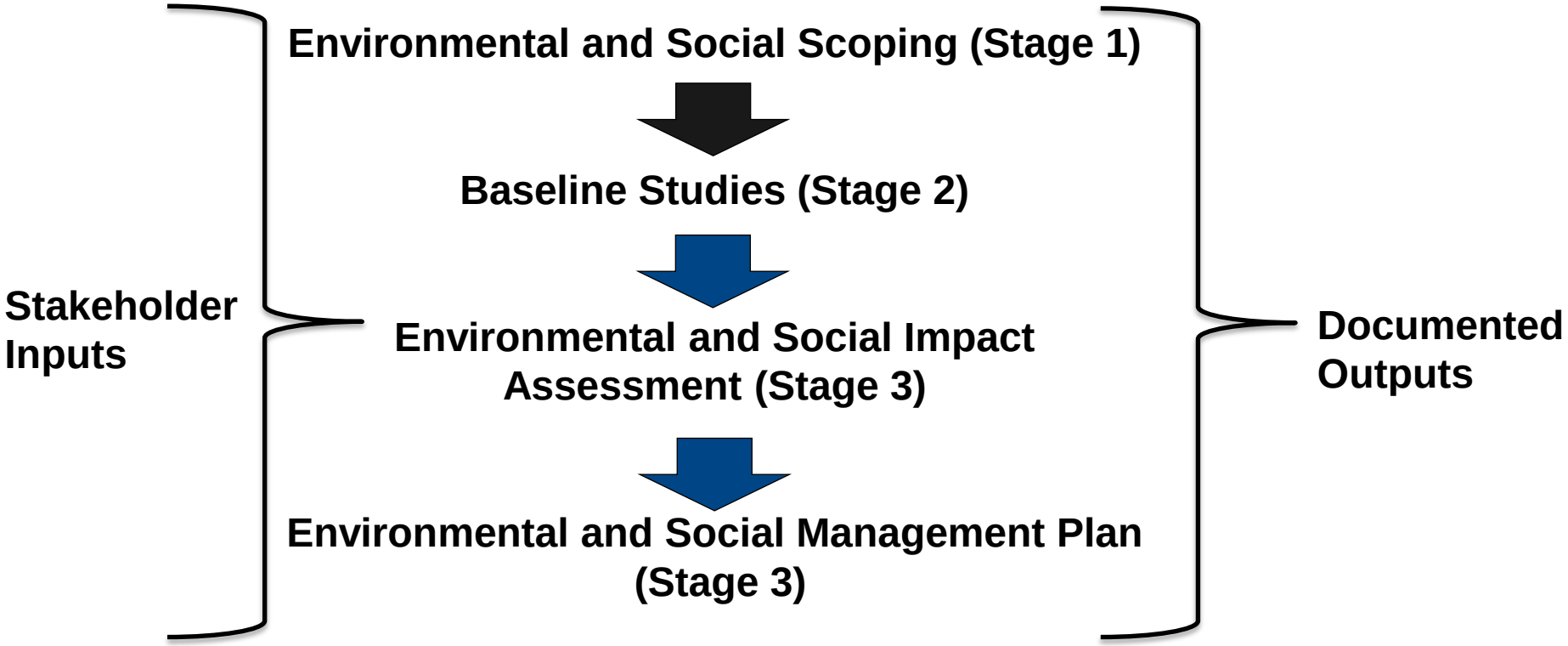
Stakeholder input to ESIA



ESIA Stakeholder Engagement

- Describe the Project and the ESIA process
- Solicit feedback to inform ESIA
- Build on stakeholder engagement undertaken during exploration and appraisal activities
- Upstream basin scoping stage will involve consultation to county (MCA) level (Stage 1)
- Produce a Stakeholder Engagement Plan (SEP) for the ESIA
- Engagement planned in future stages with County & community level affected and interested stakeholders as well as national and international stakeholders
- Commitment to informed consultation & participation and meeting Kenya ESIA requirements

Grievance Mechanism

- On-going management tool
- Free to use, widely available
- Policy of “non-retaliation” (nobody punished for submission of a grievance)
- Overseen by Grievance Management Committee
- Results track in a management system with monthly reporting

Golder Associates

Questions?

- Do you have any questions about:
  - South Lokichar Project
  - ESIA process
  - Stakeholder engagement process

Contact Information

- infokenya@tullowoil.com
- Community Resource Offices (Lodwar, Lokichar and Lokori)
- Development Project Team

  Tullow Kenya BV

  P.O. Box 63298-00619

  Nairobi, Kenya

  +254 (0)20 428 6000

Golder Associates

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UK
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ANNEX I

A

ESIA ToR and Scoping Report

A3 NEMA Acknowledgement and Approval of ESIA Terms of Reference

nema
mazingira yetu | uhai wetu | wajibu wetu

NEMA/TOR/5/2/.....15,154..... *Date*.....15/3/2016.....

.....TULLOW KENYA B.V.....

.....P.O BOX 63298 – 00619.....

.....NAIROBI.....

.....

RE: ACKNOWLEDGEMENT AND APPROVAL OF TERMS OF REFERENCE (TOR) FOR THE ENVIRONMENTAL IMPACT ASSESSMENT

We acknowledge the receipt of the TOR for the above subject.

Pursuant to the Environmental Management and Coordination Act, 1999 the second schedule and the Environmental (Impact Assessment and Audit) Regulations 31 and 35, your terms of reference for the Environmental Impact Assessment (EIA) for the proposed.....SOUTH LOKICHAR UPSTREAM DEVELOPMENT PROJECT SOUTH LOKICHAR, NORTH EAST TURKANA COUNTY.....
.....
.....
.....
.....
..... have been approved.

You shall submit five (5) copies and one electronic copy of your report prepared by a registered expert to the Authority. EIA licence fee 0.1% of the total project cost) shall be paid to **NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY REVENUE ACCOUNT – AC NO: 1102298158, KCB KICC BRANCH** on submission of the report.

FRANCIS CHWANYA
EIA SECTION HEAD

ANNEX I

B

Project Standards

B1 Project Standards

REPORT

Project Oil Kenya - Upstream

Project Standards

Submitted to:

Tullow Kenya B.V.

Submitted by:

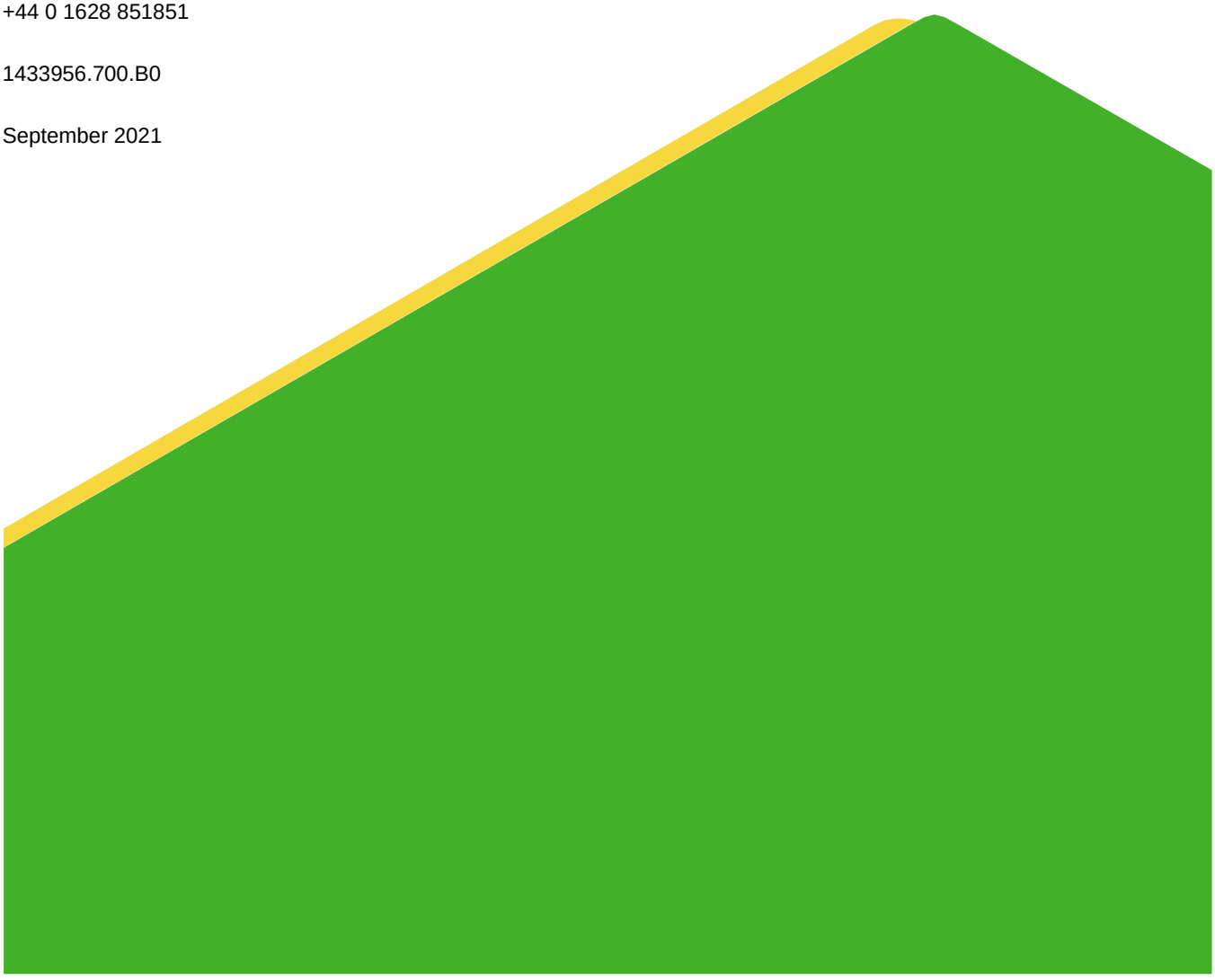
Golder Associates (UK) Ltd

Cavendish House, Bourne End Business Park, Cores End Road,
Bourne End, Buckinghamshire, SL8 5AS, UK

+44 0 1628 851851

1433956.700.B0

September 2021



Distribution List

Tullow Kenya B.V. - 1 copy pdf

Golder Associates (UK) Ltd - 1 copy pdf

Table of Contents

TABLES

1.0 INTRODUCTION

This section of the Project Oil Kenya – Upstream ("the Project") ESIA presents the proposed Project Standards. These are used for the preparation of the baseline reports and are included as part of the impact assessment criteria of the ESIA.

The ESIA project standards were selected by reviewing international and national guideline values. The international standards refer to the institutions and guidelines produced by the lead international agencies and worldwide institutions such as IFC, WBG, WHO, USEPA, and UK Environment Agency (EA) guidelines.

A list of national and international guidelines that are relevant to the ESIA have been provided as part of the Legal and Institutional Framework section, this subsection makes reference to the values provided in those guidelines. Where National standards are absent or are not appropriate, Golder's approach has been to refer to other internationally recognised guidelines for reference.

2.0 AIR QUALITY

2.1 Ambient Air Quality

Ambient air quality should meet national or local standards. Where these are absent or international guidelines are more stringent, alternative indicative guideline values are considered appropriate.

Table 1: Ambient Air Quality

Parameter	Average	Applicable International Standard [a)]	Kenyan Standard [b]		Project Standard
			At boundary	Off-Site (rural)	
Sulphur Dioxide (SO_2)	Annual mean	-	50 µg/m³ [(c)]	50 µg/m³ [(c)]	50 µg/m³ [(c)]
	24-hour mean	20 µg/m³	125 µg/m³ [(c)]	80 µg/m³ [(c)]	20 µg/m³
	10-minute mean	500 µg/m³	-		500 µg/m³
Nitrogen Dioxide (NO_2)	Annual mean	40 µg/m³	-	0.05 ppm (94 µg/m³)	40 µg/m³
	24-hour mean	-	-	0.1 ppm (188 µg/m³)	0.1 ppm (188 µg/m³)
	1-hour mean	200 µg/m³	-	0.2 ppm (376 µg/m³)	200 µg/m³
Nitrogen Oxides (NO_x)	Annual mean	-	80 µg/m³	60 µg/m³	60 µg/m³
	24-hour mean	-	150 µg/m³	80 µg/m³	80 µg/m³
Total Particulate Matter (TPM)	Annual mean	-	-	140 µg/m³	140 µg/m³
	24-hour mean	-	-	200 µg/m³	200 µg/m³
Particulate Matter (PM_{10})	Annual mean	20 µg/m³ (guideline) 70 µg/m³ Interim Target 1[(d)] 50 µg/m³ Interim Target 2[(d)]	50 µg/m³	50 µg/m³	20 µg/m³

Parameter	Average	Applicable International Standard [a)]	Kenyan Standard [b]		Project Standard
			At boundary	Off-Site (rural)	
		30 µg/m³ Interim Target 3[(d)]			
	24-hour mean	50 µg/m³ (guideline) 150 µg/m³ Interim Target 1[(d)] 100 µg/m³ Interim Target 2[(d)] 75 µg/m³ Interim Target 3[(d)]	70 µg/m³	100 µg/m³	50 µg/m³
Particulate Matter ($PM_{2.5}$)	Annual mean	10 µg/m³ (guideline) 35 µg/m³ Interim Target 1(d) 25 µg/m³ Interim Target 2(d) 15 µg/m³ Interim Target 3(d)	35 µg/m³		10 µg/m³
	24-hour mean	25 µg/m³ (guideline) 75 µg/m³ Interim Target 1(d) 50 µg/m³ Interim Target 2(d) 37.5 µg/m³ Interim Target 3(d)	75 µg/m³		25 µg/m³
Ozone (O_3)	8-hour mean	100 µg/m³	120 µg/m³	1.25 ppm (2,450 µg/m³, instant peak)	100 µg/m³
	1-hour mean	-	200 µg/m³	0.12 ppm (235 µg/m³)	0.12 ppm (235 µg/m³)
Carbon monoxide (CO)/Carbon Dioxide (CO_2)	8-hour mean	-	5 mg/m³	2.0 mg/m³	2.0 mg/m³
	1-hour mean	-	10 mg/m³	4.0 mg/m³	4.0 mg/m³
Lead (Pb)	Annual mean	-	0.5- 2.0 µg/m³	0.75 µg/m³	0.75 µg/m³
	24-hour mean	-	0.5- 2.0 µg/m³	1.00 µg/m³	1.00 µg/m3

a) IFC (2007). WBG EHS Guideline: Air Emissions and Ambient Air Quality / WHO, 2005. Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines.

b) Kenyan Government, 2014. The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

c) Standards for Sulphur Oxides (SOx) but will be considered as SO_2.

d) IFC WBG Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

2.2 Emissions to Air

Emissions sources should meet national or local standards. Where these are absent or international guidelines are more stringent, alternative indicative guideline values are considered appropriate.

Table 2: Emissions to Air from Small Combustion Facilities (Engine 3 to 50 MWth with Liquid Fuels)

Parameter	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Particulate Matter (PM_{10})	50 mg/Nm^3 or up to 100 if justified by environmental assessment	50 mg/Nm^3	50 mg/Nm^3
Sulphur Dioxide (SO_2)	1.5% to 3% Sulphur if justified by project specific considerations	1.5% - 3% Sulphur fuel. Only justified by project considerations, otherwise add secondary treatment to meet 1.5% Sulphur	1.5% Sulphur
Nitrogen Oxides (NO_x)	Bore size diameter (mm) <400: 1,460 mg/Nm^3 (or up to 1,600 if justified to maintain high energy efficiency) Bore size diameter (mm) >400: 1,850 mg/Nm^3	Bore size diameter (mm) <400: 1,460 mg/Nm^3 (or up to 1,600 if justified to maintain high energy efficiency) Bore size diameter (mm) >400: 1,850 mg/Nm^3	1,600 mg/Nm^3
Dry Gas, Excess O_2 Content (%)	15%	-	15%

a) IFC (2007). WBG EHS Guideline: Air Emissions and Ambient Air Quality / WHO, 2005. Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines.

b) Kenyan Government (2014). The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

Table 3: Emissions to Air from Small Combustion Facilities (Turbine 15 to 50 MWth with Natural Gas)

Parameter	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Particulate Matter (PM_{10})	N/A	N/A	N/A
Sulphur Dioxide (SO_2)	N/A	N/A	N/A
Nitrogen Oxides (NO_x)	25 ppm	25 ppm	25 ppm
Dry Gas, Excess O_2 Content (%)	15%		15%

a) IFC (2007). WBG EHS Guideline: Air Emissions and Ambient Air Quality / WHO, 2005. Air Quality Guidelines Global. Guidelines on the standards that should be achieved for air, in the absence of national guidelines.

b) Kenyan Government (2014). The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

c) Emissions Guidelines for a Non- Degraded Airshed

Table 4: Emissions Guidelines for Combustion Turbines (Natural Gas >50 MWth)

Parameter	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Particulate Matter (PM_{10})	N/A	N/A	50 mg/Nm^3
Sulphur Dioxide (SO_2)	N/A	N/A	1.5% Sulphur
Nitrogen Oxides (NO_x)	51 ppm[(c)]	51 ppm[(c)]	1,600 mg/Nm^3
Dry Gas, Excess O_2 Content (%)	15%	15%	15%

a) IFC (2007). WBG EHS Guideline: Thermal Power Plants.
b) Kenyan Government (2014). The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.
c) Emissions Guidelines for a Non- Degraded Airshed.

Table 5: Emissions Guidelines for Incinerators (Municipal Solid Waste)

Parameter	Applicable International Standard	Kenyan Standard [a]	Project Standard
Particulate Matter (PM_{10})	-	100 mg/Nm^3	100 mg/Nm^3
Sulphur Dioxide (SO_2)	N/A	N/A	NA
Nitrogen Oxides (NO_x)	N/A	300 mg/Nm^3	300 mg/Nm^3
Dry Gas, Excess O_2 Content (%)	N/A	Not specified	15%

a) Kenyan Government, 2014. The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

Table 6: Emissions Guidelines for Incinerators (Medical Waste)

Parameter	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Particulate Matter ($PM_{2.5}$)	N/A	20 mg/Nm^3	20 mg/Nm^3
Sulphur Dioxide (SO_2)	N/A	500 mg/Nm^3	500 mg/Nm^3
Nitrogen Oxides (NO_x)	N/A	300 mg/Nm^3	300 mg/Nm^3
Dry Gas, Excess O_2 Content (%)	15%	Not specified	15%

a) IFC (2007). WBG EHS Guideline: Air Emissions and Ambient Air Quality.
b) Kenyan Government, 2014. The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

2.3 References

- Kenyan Government, 2014. The Environmental Management and Co-ordination (Air Quality) Regulations, 2014.
- International Finance Corporation (IFC). 2007. World Bank Group (WBG) General EHS Guidelines. 2007. Environmental, Health and Safety (EHS) Guidelines - Air Emissions and Ambient Air Quality
- WHO (World Health Organization). 2005. Air Quality Guidelines – Global Update 2005.

3.0 NOISE AND VIBRATION

3.1 Noise

Golder carried out a review of the IFC Noise Guideline and Kenya Noise Regulations, recommending the use of the IFC Noise Guideline for Project operation (Golder technical memo 1654017.511 included in Annex I). This was subsequently confirmed with NEMA in a minuted meeting that the IFC Noise Guideline could be used as Project standards for the Upstream EOPS Phase II ESIA and has been adopted for this ESIA also. The IFC Noise Guideline does not provide construction noise level limits and therefore the approach is to use construction limits provided in the Kenya Noise Regulations.

Table 7: Noise Standards Relevant to the ESIA

Receptor Classification	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Residential, Institutional and Educational Receptors	■ Daytime (7:00 to 22:00): ▪ 55 dBA $L_{eq,1hr}$ ■ Night-time (22:00 to 7:00): ▪ 45 dBA $L_{eq,1hr}$ Noise impacts should not exceed the levels presented above or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.	■ Residential (indoor): ▪ Daytime (06:00 to 20:00): – 45 dBA L_{eq},14hr ▪ Nighttime (20:00 to 06:00): – 35 dBA L_{eq},10hr ■ Residential (outdoor): ▪ Daytime (06:00 to 20:00): – 50 dBA L_{eq},14hr ▪ Nighttime (20:00 to 06:00): – 35 dBA L_{eq},10hr	■ Residential (outdoor): ▪ Daytime (07:00 to 22:00): – 55 dBA L_{eq},1hr ■ Residential (outdoor): ▪ Nighttime (22:00 to 07:00): – 45 dBA L_{eq},1hr ▪ Nighttime (20:00 to 06:00): – 35 dBA L_{eq},10hr ■ OR exceed 3 dB increase over background levels at nearest receptor location off-site

Receptor Classification	Applicable International Standard [a]	Kenyan Standard [b]	Project Standard
Construction Sites – Residential	-	■ Daytime (06:00 to 18:00): ▪ 60 dBA L_{eq},12hr ■ Nighttime (18:00 to 06:00): ▪ 35 dBA L_{eq},12hr	■ Daytime (06:00 to 18:00): ▪ 60 dBA $L_{eq,}$ 12hr ■ Nighttime (18:00 to 06:00): ▪ 35 dBA L_{eq},12hr
Construction Sites – Other	-	■ Daytime (06:00 to 18:00): ▪ 75 dBA L_{eq},12hr ■ Nighttime (18:00 to 06:00): ▪ 65 dBA L_{eq},12hr	■ Daytime (06:00 to 18:00): ▪ 75 dBA L_{eq},12hr ■ Nighttime (18:00 to 06:00): ▪ 65 dBA L_{eq},12hr

a) WBG (2007). WBG EHS Guidelines: Environmental – Noise.

b) Kenyan Government (2009). The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control), Regulations.

3.2 Vibrations

In the absence of detailed Kenyan standards for vibration an alternative international equivalent has been chosen and presented in Table 7.

Table 8: Vibration Standards

<table>
<tr><th>Receptor Classification</th><th colspan="4">Applicable International Standard [a] [b]</th><th>Kenyan Standard [c]</th><th colspan="2">Project Standard</th></tr>
<tr><td>Unreinforced or light- framed structures</td><td colspan="4">British Standard BS5228-2:2009
PPV in frequency range of predominant pulse – transient vibration guide values for cosmetic damage.</td><td rowspan="2">5 mm/s beyond any source property boundary</td><td colspan="2">PPV in frequency range of predominant pulse.</td></tr>
<tr><td>Residential or light commercial buildings</td><td colspan="2">4 Hz to 15 Hz
15 mm/s at 4 Hz and above, increasing to 20 mm/s at 15 Hz.</td><td colspan="2">15 Hz and above
20 mm/s at 15 Hz, increasing to 50 mm/s at 40 Hz and above.</td><td>4 Hz to 15 Hz
15 mm/s at 4 Hz and above, increasing to 20 mm/s at 15 Hz.</td><td>15 Hz and above 20 mm/s at 15 Hz
increasing to 50 mm/s at 40 Hz and above.</td></tr>
<tr><td rowspan="4">Continuous ground-borne vibration; people in residential buildings</td><td colspan="4">BS.6472:2008 Evaluation of human exposure to vibration in buildings [1 Hz to 80 Hz].
Vibration dose values [m/s$^{1.75}$] above which various degrees of adverse comment may be expected in residential buildings.</td><td rowspan="4">-</td><td colspan="2" rowspan="2">Daytime (06:00 – 22:00) 0.6 m/s$^{1.75}$</td></tr>
<tr><td>Period</td><td>Low probability of adverse comment</td><td>Adverse comment possible</td><td>Adverse comment probable</td></tr>
<tr><td>Daytime, 16hr</td><td>0.2 – 0.4</td><td>0.4 – 0.8</td><td>0.8 – 1.6</td><td colspan="2">Night-time (22:00 – 06:00) 0.3 m/s$^{1.75}$</td></tr>
<tr><td>Night-time, 8hr</td><td>0.1 – 0.2</td><td>0.2 – 0.4</td><td>0.4 – 0.8</td><td colspan="2"></td></tr>
</table>

a) British Standards Institution, 2008. BS 5228-2:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites. Vibration Noise. 2014 revision. London, United Kingdom

b) British Standards Institution, 2008. BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting London, United Kingdom

c) NEMA (2009). Noise and Excessive Vibration Pollution (Control)

3.3 References

- British Standards Institution, 1993. BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from ground-borne vibration London, United Kingdom.
- British Standards Institution, 2008. BS 5228-2:2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites. Vibration Noise. 2014 revision. London, United Kingdom.
- British Standards Institution, 2008. BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting London, United Kingdom.
- Health and Safety Executive, 2005. Control of Vibration at Work Regulations 2005 United Kingdom.
- IFC, 2007. WBG EHS Guidelines: Environmental – Noise.
- Kenyan Government, 2009. The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control), Regulations.
- IFC. 2007. WBG EHS Guidelines Occupational Health and Safety.

4.0 DISCHARGES/ABSTRACTIONS FROM WATER

4.1 Effluent Discharge Standards to Surface Water

Sewage from an industrial facility should only be discharged to surface water if it meets national or local standards for sanitary wastewater discharges. Where national or local standards are absent or are not appropriate, alternative indicative guideline values provided in Table 9 are considered applicable to sanitary wastewater discharges.

Table 9: Effluent Discharge Standards to the Environment

Parameter	Applicable International Standard [a b]	Kenyan Standard [c]	Project Standard
1,1,1-trichloroethane	-	3 mg/l	3 mg/l
1,1,2-trichloethane	-	0.06 mg/l	0.06 mg/l
1,1-dichloroethylene	-	0.2 mg/l	0.2 mg/l
1,2-dichloroethane	-	0.04 mg/l	0.04 mg/l
1,3-dichloropropene	-	0.02 mg/l	0.02 mg/l
Alkyl Mercury compounds	-	Not Detectible	Not Detectible
Ammonia, ammonium compounds, NO_3 compounds and NO_2 compounds (Sum total of ammonia-N times 4 plus nitrate-N & Nitrite-N)	-	100 mg/l	100 mg/l
Arsenic	-	0.02 mg/l	0.02 mg/l
Arsenic and its compounds	-	0.1 mg/l	0.1 mg/l
Benzene	-	0.1 mg/l	0.1 mg/l
Biochemical Oxygen Demand (BOD_5)	25 mg/l [b]	30 mg/l	25 mg/l
Boron	-	1.0 mg/l	1.0 mg/l
Boron and its compounds – non marine	-	10 mg/l	10 mg/l
Boron and its compounds – marine	-	30 mg/l	30 mg/l
Cadmium	-	0.01 mg/l	0.01 mg/l
Cadmium and its compounds	-	0.1 mg/l	0.1 mg/l
Carbon tetrachloride	-	0.02 mg/l	0.02 mg/l

Parameter	Applicable International Standard [a b]	Kenyan Standard [c]	Project Standard
Chemical Oxygen Demand (COD)	125 mg/l [a]	50 mg/l	50 mg/l
Chromium VI	-	0.05 mg/l	0.05 mg/l
Chloride	-	250 mg/l	250 mg/l
Chlorine free residue	-	0.10 mg/l	0.10 mg/l
Chromium total	-	2 mg/l	2 mg/l
Cis-1,2- dichloroethylene	-	0.4 mg/l	0.4 mg/l
Copper	-	1.0 mg/l	1.0 mg/l
Dichloromethane	-	0.2 mg/l	0.2 mg/l
Dissolved iron	-	10 mg/l	10 mg/l
Dissolved Manganese	-	10 mg/l	10 mg/l
E.coli	-	Nil Counts / 100 ml	Nil Counts / 100 ml
Fluoride	-	1.5 mg/l	1.5 mg/l
Fluoride and its compounds (marine and non-marine)	-	8 mg/l	8 mg/l
Lead	-	0.01 mg/l	0.01 mg/l
Lead and its compounds	-	0.1 mg/l	0.1 mg/l
n-Hexane extracts (animal and vegetable fats)	-	30 mg/l	30 mg/l
n-Hexane extracts (mineral oil)	-	5 mg/l	5 mg/l
Oil and grease	10 mg/l [a]	Nil	Nil

Parameter	Applicable International Standard [a b]	Kenyan Standard [c]	Project Standard
Organo-Phosphorus compounds (parathion, methyl parathion, methyl demeton and Ethyl parantrophenyl phenylphosphorothroate, EPN only)	-	1.0 mg/l	1.0 mg/l
Polychlorinated biphenyls, PCBs	-	0.003 mg/l	0.003 mg/l
pH (Hydrogen ion activity----marine)	6 – 9 (general) [a]	5.0-9.0	5.0-9.0
pH (Hydrogen ion activity--non marine)	6 – 9 (general) [a]	6.5-8.5	6.5-8.5
Phenols	-	0.001 mg/l	0.001 mg/l
Selenium	-	0.01 mg/l	0.01 mg/l
Selenium and its compounds	-	0.1 mg/l	0.1 mg/l
Hexavalent Chromium VI compounds	-	0.5 mg/l	0.5 mg/l
Sulphide	-	0.1 mg/l	0.1 mg/l
Simazine	-	0.03 mg/l	0.03 mg/l
Total Suspended Solids	35 mg/l [b]	30 mg/l	30 mg/l
Tetrachloroethylene	-	0.1 mg/l	0.1 mg/l
Thiobencarb	-	0.1 mg/l	0.1 mg/l
Temperature (in degrees Celsius) based on ambient temperature	-	± 3 degrees Celsius	± 3 degrees Celsius
Thiram	-	0.06 mg/l	0.06 mg/l
Total coliforms	400 (MPN per 100 ml) [a]	30 counts /100 ml	30 counts /100 ml
Total Cyanogen	-	ND	ND

Parameter	Applicable International Standard [a b]	Kenyan Standard [c]	Project Standard
Total Nickel	-	0.3 mg/l	0.3 mg/l
Total Dissolved solids	-	1200 mg/l	1200 mg/l
Colour in Hazen Units	-	15 HU	15 HU
Detergents	-	Nil	Nil
Total mercury	-	0.005 mg/l	0.005 mg/l
Trichloroethylene	-	0.3 mg/l	0.3 mg/l
Zinc	-	0.5 mg/l	0.5 mg/l
Total Phosphorus	2 mg/l [a]	2 mg/l (Guideline value)	2 mg/l
Total Nitrogen	10 mg/l [a]	2 mg/l (Guideline value)	2 mg/l

a) IFC. WBG EHS Guidelines: Environmental 2007

b) IFC WBG EHS Guidelines for Onshore Oil and Gas Developments 2017.

c) Kenyan Government, 2006. The EMCA (Water Quality) Regulations (2006) Schedule 3: Standards for Effluent Discharge into the Environment.

4.2 Drinking Water Quality

Drinking or potable water should meet national or local standards. Where these are absent or are not appropriate, alternative indicative guideline values provided in Table 10 are considered applicable.

Table 10: Drinking Water Quality Standards

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Units (unless otherwise stated)	**µg/l**	**mg/l**	**mg/l**	
Acrylamide	0.5	-	-	0.5 µg/l
Alachlor	20	-	-	20 µg/l
Aldicarb	10	-	-	10 µg/l
Aldrin and dieldrin	0.03	-	0.00003	0.00003 mg/l
Aluminium	-	-	0.2	0.2 mg/l
Antimony	20	-	-	20 µg/l
Arsenic	10 (A,T)	0.01	0.01	0.01 mg/l
Atrazine and its chloro- striazine metabolites	100	-	-	100 µg/l
Barium	700	-	0.7	0.7 mg/l
Benzene	10	-	0.01	0.01 mg/l
Benzo[a]pyrene	0.7	-	-	0.7 µg/l
Boron	2400	-	2.4	2.4400 mg/l
Bromate	10 (A,T)	-	0.01	0.01 mg/l
Bromodichloromethane	60	-	-	60 µg/l
Bromoform	100	-	-	100 µg/l
Cadmium	3	0.01	0.003	0.003 mg/l
Carbofuran	7	-	-	7 µg/l
Carbon tetrachloride	4	-	0.002	0.002 mg/l
Chlorate	700 (D)	-	-	700 µg/l (D)
Chlordane	0.2	-	0.0003	0.0003 mg/l
Chlorine	5000 (C)	-	-	5000 µg/l (C)
Residual Chlorine	-	-	Absent	Absent

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Chlorite	700 (D)	-	-	700 µg/l (D)
Chloroform	300	-	0.03	0.03 mg/l
Chlorotoluron	30	-	-	30 µg/l
Chlorpyrifos	30	-	-	30 µg/l
Chromium (total)	50 (P)	-	0.05	0.05 mg/l
Copper	2000	0.05	1	0.05 mg/l
Cyanazine	0.6	-	-	0.6 µg/l
Cyanide	-	-	0.01	0.01 mg/l
2,4-D	30	-	-	30 µg/l
2,4-DB	90	-	-	90 µg/l
DDT and metabolites	1	-	0.001	0.001 mg/l
Dibromoacetonitrile	70	-	-	70 µg/l
Dibromochloromethane	100	-	-	100 µg/l
1,2-Dibromo-3- chloropropane	1	-	-	1 µg/l
1,2-Dibromoethane	0.4 (P)	-	-	0.4 µg/l (P)
Dichloroacetate	50 (D)	-	-	50 µg/l (D)
Dichloroacetonitrile	20 (P)	-	-	20 µg/l (P)
1,2-Dichlorobenzene	1000 (C)	-	-	1000 µg/l (C)
1,4-Dichlorobenzene	300 (C)	-	-	300 µg/l (C)
1,2-Dichloroethane	30	-	0.03	0.03 mg/l
1,1-Dichloroethene	-	-	0.03	0.03 mg/l
1,2-Dichloroethene	50	-	-	50 µg/l
1,1-Dichloroethylene	-	-	0.0003	0.0003 mg/l
Dichloromethane	20	-	-	20 µg/l
2,4-Dichlorophenoxyacetic acid	-	-	0.03	0.03 mg/l
1,2-Dichloropropane	40 (P)	-	-	40 µg/l (P)

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
1,3-Dichloropropene	20	-	-	20 µg/l
Dichlorprop	100	-	-	100 µg/l
Di(2-ethylhexyl) phthalate	8	-	-	8 µg/l
Dimethoate	6	-	-	6 µg/l
1,4-Dioxane	50	-	-	50 µg/l
Edetic acid	600	-	-	600 µg/l
Endrin	0.6	-	-	0.6 µg/l
Epichlorohydrin	0.4 (P)	-	-	0.4 µg/l (P)
Ethylbenzene	300 (C)	-	-	300 µg/l (C)
Fenoprop	9	-	-	9 µg/l
Fluoride	1500	1.5	1.5	1.5 mg/l
Heptachlor and Heptachlor Epoxide	-	-	0.00003	0.00003 mg/l
Hexachlorobenzene	-	-	0.001	0.001 mg/l
Hexachlorobutadiene	0.6	-	-	0.6 µg/l
Hydroxyatrazine	200	-	-	200 µg/l
Isoproturon	9	-	-	9 µg/l
Lead	10 (A,T)	0.05	0.01	0.01 mg/l
Lindane	2	-	0.002	0.002 mg/l
MCPA	2	-	-	2 µg/l
Mecoprop	10	-	-	10 µg/l
Mercury (total)	6	-	0.001	0.001 mg/l
Methoxychlor	20	-	0.02	0.02 mg/l
Metolachlor	10	-	-	10 µg/l
Microcystin-LR	1 (P)	-	-	1 µg/l (P)
Molinate	6	-	-	6 µg/l
Molybdenum	-	-	0.07	0.07 mg/l

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Monochloramine	3000	-	-	3000 µg/l
Monochloroacetate	20	-	-	20 µg/l
Nickel	70	-	0.02	0.02 mg/l
Nitrate as NO_3	50000	10	45	10 mg/l
Nitrilotriacetic acid	200	-	-	200 µg/l
Nitrite	3000	3	0.9	0.9 mg/l
N-Nitrosodimethylamine	0.1	-	-	0.1 µg/l
Pendimethalin	20	-	-	20 µg/l
Pentachlorophenol	9 (P)	-	-	9 µg/l (P)
Phenols	-	-	0.002	0.002 mg/l
Phosphates (as PO_4)	-	-	2.2	2.2 mg/l
Selenium	40 (P)	0.01	0.01	0.01 mg/l
Simazine	2	-	-	2 µg/l
Sodium	-	-	200	200 mg/l
Sodium dichloroisocyanurate	50000	-	-	50000µg/l
Styrene	20 (C)	-	-	20 µg/l(C)
2,4,5-T	9	-	-	9 µg/l
Terbuthylazine	7	-	-	7 µg/l
Tetrachloroethene	40	-	0.04	0.04 mg/l
Toluene	700 (C)	-	0.7	0.7 mg/l
Trichloroacetate	200	-	-	200 µg/l
Trichloroethene	20 (P)	-	-	20 µg/l (P)
2,4,6-Trichlorophenol	200 (C)	-	0.2	0.2 mg/l
Trifluralin	20	-	-	20 µg/l

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Trihalomethanes	The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1	-	-	The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1
Uranium	30 (P)	-	0.03	0.03 mg/l
Vinyl chloride	0.3	-	-	0.3 µg/l
Xylenes	500 (C)	-	0.5	0.5 mg/l
Polynuclear Aromatic Hydrocarbons	-	-	0.0007	0.0007 mg/l
Turbidity	-	-	25 NTU	25 NTU
Taste	-	-	Not objectionable	Not objectionable
Odour	-	-	Not objectionable	Not objectionable
Colour	-	-	50 true colour units max.	50 true colour units max.
pH	-	6.5-8.5	5.5-9.5	6.5-8.5
Electrical Conductivity	-	-	2500 µS/cm	2500 µS/cm
Total filterable residue	-	-	-	-
Total hardness as $CaCO_3$	-	-	600	600 mg/l
Calcium	-	-	150	150 mg/l
Magnesium	-	-	100	100 mg/l
Magnesium and Sodium	-	-	-	-
Potassium			50	50 mg/l
Sulphate (SO_4)	-	-	400	400 mg/l
Chloride	-	-	250	250 mg/l
Iron (total)	-	-	0.3	0.3 mg/l
Manganese	-	-	0.1	0.1 mg/l

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Zinc	-	1.5	5	1.5 mg/l
BOD_5	-	-	-	-
Absorbed Oxygen (as $KMnO_4$)	-	-	-	-
Ammonia NH_3	-	0.5	0.5	0.5 mg/l
Total Nitrogen (excluding NO_3)	-	-	-	
Surfactants (Alkyl Benzyl Sulphonates)	-	-	-	-
Surfactants (reacting with methylene blue)	-	-	0.2	0.2 mg/l
Total viable counts at 37°C per ml	-	-	50 counts	50 counts at 37°C per ml
Total viable counts at 22°C per ml			100 counts	100 counts at 22°C per ml
Total Coliforms (CFU/100 ml)	-	-	Nil	Nil
E.coli (CFU/100 ml)	-	Nil/100	Nil	Nil/100
Pseudomonas aeruginosa fluorescence (CFU/100 ml)	-	-	Nil	Nil
Salmonella (per 100 ml)	-	-	Nil	Nil
Shigella (per 100 ml)	-	-	Nil	Nil
Giardia (per 100 ml)			Nil	Nil
Cryptosporidium (per 100 ml)			Nil	Nil
Staphylococcus aureus (CFU/100 ml)	-	-	Nil	Nil
Streptococcus faecalis (CFU/100 ml)	-	-	Nil	Nil
Sulphate reducing anaerobes (CFU/100 ml)	-	-	Nil	Nil
Phenolic substances (as Phenol)	-	Nil	-	Nil
Gross alpha activity	-	-	0.5	0.5 Bq/L
Gross beta activity	-	-	1	1 Bq/L

Parameter	Applicable International Standard [a] [b]	Kenyan Standard [c]	Kenya Standard for potable water - natural [d]	Project Standard
Suspended Solids	-	30	Nil	Nil
Total dissolved solids	-	1200	1500	1500 mg/l
Organic matter	-	-	0.003	0.003 mg/l
Alkyl benzyl sulphonates	-	0.5	-	0.5 mg/l
Permangenate (PV)	-	1	-	1 mg/l

a) World Health Organization (WHO), 2011. Drinking Water Quality Guidelines – 4th edition.

b) P = provisional guideline value, as there is evidence of a hazard, but the available information on health effects is limited. T = provisional guideline value because calculated guideline value is below the level that can be achieved through practical treatment methods, source protection, etc. A = provisional guideline value because calculated guideline value is below the achievable quantification level. D = provisional guideline value because disinfection is likely to result in the guideline value being exceeded. C = concentrations of the substance at or below the health-based guideline value may affect the appearance, taste or odour of the water, leading to consumer complaints.

c) Kenyan Government, 2006. Environmental Management and Coordination Act (Water Quality) Regulations Schedule 1: Quality Standards for Sources of Domestic Water.

d) Kenya Bureau of Standards (KEBS), 2018. Kenya Standard KS EAS 12:2018 (ISC 13.060.20). Potable Water – Specification. Second Edition. The standard for natural potable water has been included for the purposes of screening natural baseline groundwater and surface water quality.

e) Kenya standard for boric acid (H3BO3). WHO standard for boron selected for comparison to water quality results for boron.

f) Under conditions of epidemic diseases, it may be necessary to increase the residual chlorine temporarily.

4.3 References

- Kenya Bureau of Standards (KEBS), 2018. Kenya Standard KS EAS 12:2018 (ISC 13.060.20). Drinking Potable Water – Specification. Third Second Edition
- Kenyan Government, 2006. Environmental Management and Coordination Act (Water Quality Regulation) Schedule 1: Quality Standards for Sources of Domestic Water.
- Kenyan Government, 2006. The EMCA (Water Quality) Regulations (2006) Schedule 3: Standards for Effluent Discharge into the Environment.
- World Health Organization (WHO), 2017. Drinking Water Quality Guidelines – 4th edition.

5.0 SOILS

There are no specific guidelines that are expected to be followed to conduct these evaluations of the soil and terrain properties; therefore, Golder best practice, based on pedologic principles and research literature, will be adopted.

To classify the soils for the ESIA, the FAO of the UN soil classification system will be used, which is a common classification system for describing natural soils in Africa (FAO, 2006; FAO, 2007; FAO, 2014) and the United States Department of Agriculture Soil Taxonomy Classification System (USDA, 1993; USDA, 1999). The soil field survey will follow the Guidelines for Soil Survey and Land Evaluation in Ecological Research (Breimer et al, 1986).

5.1 References

- Breimer, R.F., A.J. van Kekem and H van Reuler, 1986. Guidelines for Soil Survey and land Evaluation in Ecological Research, MAB Technical Note 17, Prepared in Co-operation with the International Soil Reference and Information Centre (ISRIC), Published by the United Nations Educational, Scientific and Cultural Organization (UNESCO), ISBN 92-3-3102366-7.
- FAO, 1976. A Framework for Land Evaluation, FAO Soils Bulletin #32, Food and Agriculture Organization of the UN, Rome, Italy.
- FAO, 1983. Soil resources development and conservation service "Guidelines: land evaluation for rainfed agriculture". FAO Soils Bulletin 52, FAO, Rome.
- FAO, 1984. Land evaluation for forestry FAO Forestry Paper 48, FAO, Rome.
- FAO, 1991. Soil resources development and conservation service "*Guidelines: land evaluation for extensive grazing*". FAO Soils Bulletin 58, FAO, Rome. Specific guidelines for evaluating land for extensive grazing, based on the FAO framework.
- FAO, 2006. Soil Description Guidelines. 4th edition. Rome, Italy.
- FAO, 2007. World Reference Base for Soil Resources. IUSS Working Group WRB. World Soil Resources Reports No. 103. FAO, Rome, Italy.
- FAO, 2014. World Reference Base for Soil Resources. IUSS Working Group WRB. World Soil Resources Reports No. 106. FAO, Rome, Italy. (Update 2015).
- USDA, 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.
- USDA, 1999. Soil Taxonomy A Basic System of Soil Classification for Making and Interpreting Soil Surveys.
- U.S. Department of Agriculture Handbook 436.

6.0 BIODIVERSITY AND ECOSYSTEM SERVICES

Table 11: Biodiversity Requirements

Aspect	Applicable International Standard	Kenyan Standard	Project Standard
Protected Areas	IFC PS6 – delineation of critical habitats	Prohibition of disturbance or harming flora and fauna in National Park[(a).]	Project should aim to avoid any direct impacts on protected areas.
Wildlife and ecosystems	IFC PS6 – delineation of critical habitats	Wildlife Conservation and Management Act (2013) - strong emphasis on protection of wildlife both within and outside protected areas.	Wildlife Conservation and Management Act (2013) - strong emphasis on protection of wildlife both within and outside protected areas.
Conflicts between people and wildlife		Wildlife Conservation and Management Act (2013) Part IX deals with human-wildlife conflict, including problem animals and unlawful wounding of animals.	Project must endeavour to ensure that no animals are unlawfully wounded or killed as a result of construction and operation activities.
Ecosystem Services	Standards include: Landsberg et al (2013); IPIECA (2005; 2007; 2010); IPIECA (2016); and Secretariat of the Convention on Biological Diversity (2012). IFC PS6 – sustainable management of living natural resources	Kenya NBSAP (produced as an obligation to commitments under the CBD) key objectives include provisions for sustainable utilisation of biodiversity resources. The County Wildlife Conservation and Compensation committees instituted by the Kenya Wildlife Conservation and Management Act (2013) ensure that benefits derived from the use of wildlife resources are distributed in accordance with the provisions of the Act.	No residual significant impacts on land cover types/vegetation communities that provide priority Ecosystem services to local beneficiaries should be sustained as a result of Project impact. Management of biodiversity and ecosystem services (BES) impacts, dependencies, risks and identification of opportunities in the oil and gas sector.
Wetlands	Convention on Wetlands of International Importance (the Ramsar Convention 1971). CSBI (2015). Secretariat of the Convention on Biological Diversity (2006).	According to The EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management Plan) Regulations (2009) in non-specifically protected wetlands, Environmental impact assessment and environmental audits as required under the Act shall be mandatory for all activities likely to have an	Any potential effects on wetlands must be covered by the environmental impact assessment.

Aspect	Applicable International Standard	Kenyan Standard	Project Standard
		adverse impact on the wetland. The Wetlands Policy (2013) seeks to regulate, protect, manage and conserve all wetlands including those within public, private and community land in line with the Constitution.	

a) The Republic of Kenya, 2013. The Wildlife Conservation and Management Act.

6.1 References

- Agreement on the Conservation of African-Eurasian Migratory Water birds (AEWA), 1992. Convention on Biological Diversity.
- Convention on International Trade in Endangered Species (CITES).
- Gullison, R.E., J. Hardner, S. Anstee, M. Meyer, 2015. Good Practices for the Collection of Biodiversity Baseline Data. Prepared for the Multilateral Financing Institutions Biodiversity Working Group & Cross-Sector Biodiversity Initiative.
- International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers, 2005. A guide to developing biodiversity action plans for the oil and gas sector. IPIECA and OGP.
- International Petroleum Industry Environmental Conservation Association and the International Association of Oil and Gas Producers, 2007. An ecosystem approach to oil and gas industry biodiversity conservation.
- IPIECA and IOGP International Petroleum Industry Environmental Conservation Association, 2010. Alien invasive species and the oil and gas industry Guidance for prevention and management.
- International Petroleum Industry Environmental Conservation Association, 2016. Biodiversity and ecosystem services fundamentals. Guidance document for the oil and gas industry. prepared by the BES Fundamentals Task Force, under the auspices of the IPIECA-IOGP Biodiversity and Ecosystem Services Working Group, with assistance from Edward Pollard and The Biodiversity Consultancy.
- Kenyan Government, 2000. The Kenya National Biodiversity Strategy and Action Plan (NBSAP). Landsberg, et al, 2013. Weaving Ecosystem Services into Impact Assessment, World Resources Institute. Ramsar, 1971. Convention on Wetlands of International Importance especially as Waterfowl Habitat.
- Secretariat of the Convention on Biological Diversity, Netherlands Commission for Environmental Assessment, 2006. Biodiversity in Impact Assessment, Background Document to CBD Decision VIII/28: Voluntary Guidelines on Biodiversity-Inclusive Impact Assessment, Montreal, Canada.
- Secretariat of the Convention on Biological Diversity and the United Nations Environment Programme-World Conservation Monitoring Centre, 2012. Best policy guidance for the integration of biodiversity and ecosystem services in standards. Montreal, Technical Series No. 73, 52 pages.

- The Republic of Kenya, 2009. The Environmental Management and Co-ordination Act (Wetlands, River Banks, Lake Shore and Sea Shore Management) Regulations.
- The Republic of Kenya, 2013. The Wildlife Conservation and Management Act. The Republic of Kenya, 2013. The Wetland Policy.
- The Energy and Biodiversity Initiative, 2007. Good practice in the prevention and mitigation of Primary and Secondary Biodiversity Impacts.
- The Energy and Biodiversity Initiative, 2006. Biodiversity indicators for monitoring impacts and conservation actions.

7.0 CULTURAL HERITAGE

For Cultural heritage, the National Museums and Heritage Act (2006) represents the national standard. The Protection of Traditional Knowledge and Cultural Expressions Act (2016) is also relevant and has been given due consideration.

The Cultural Heritage assessment also complies with IFC PS 8: Cultural Heritage (2012a) (including accompanying guidance – Guidance Note 8: Cultural Heritage (2012b)).

7.1 References

- IFC (International Finance Corporation). 2012. Performance Standard 8: Cultural Heritage. Washington, D.C. Available at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/ps8 .
- The Republic of Kenya, 2006.The National Museums and Heritage. Act.
- The Republic of Kenya, 2016. The Protection of Traditional Knowledge and Cultural Expressions Act.

Signature Page

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ANNEX I

C

Baseline Supporting Information

Weather and Climate

C1

1 Weather data

Table 1: Kapese

Month	Average Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Average Relative Humidity (%)	Maximum Relative Humidity (%)	Minimum Relative Humidity (%)	Average Total Precipitation (mm)	Minimum Total Precipitation (mm)	Maximum Total Precipitation (mm)	Average Wind Speed (m/s)	Minimum Wind Speed (m/s)	Maximum Wind Speed (m/s)
January	29.5	20.2	37.0	33.7	84.5	12.9	5.3	0.8	9.8	2.5	0.5	8.4
February	31.0	22.0	38.5	30.5	84.5	9.6	0.9	0.0	1.8	3.1	0.5	7.7
March	29.3	19.9	39.2	48.9	98.7	12.8	50.9	2.2	99.6	2.8	0.5	8.5
April	28.1	20.4	37.0	58.8	98.1	21.7	50.2	26.0	74.4	2.5	0.5	8.7
May	27.5	20.2	34.7	59.9	98.5	23.0	90.4	62.2	118.6	2.0	0.5	6.1
June	27.5	19.7	35.2	52.5	99.4	21.8	50.3	1.4	99.2	2.1	0.5	6.8
July	27.9	21.0	34.3	44.2	86.2	25.6	2.1	0.2	4.0	2.3	0.5	7.4
August	28.4	20.0	35.8	43.0	95.1	21.8	11.7	0.8	32.8	2.5	0.5	7.9
September	28.9	20.4	36.1	40.8	97.7	20.3	18.7	0.0	56.0	2.5	0.5	6.7
October	29.4	20.6	36.7	42.4	95.3	14.9	26.7	4.2	54.0	2.8	0.5	7.4
November	28.8	20.0	36.0	44.7	98.2	16.4	29.1	1.4	56.6	2.9	0.5	7.8
December	29.0	19.7	36.1	40.0	94.0	13.0	2.5	0.0	6.6	2.7	0.5	7.3

Table 2: Ngamia

Month	Average Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Average Relative Humidity (%)	Maximum Relative Humidity (%)	Minimum Relative Humidity (%)	Average Total Precipitation (mm)	Minimum Total Precipitation (mm)	Maximum Total Precipitation (mm)	Average Wind Speed (m/s)	Minimum Wind Speed (m/s)	Maximum Wind Speed (m/s)
January	29.6	19.7	37.6	29.1	81.7	9.5	5.9	0.2	11.6	2.6	0.5	6.5
February	31.0	21.4	38.8	33.1	88.0	10.3	13.8	0.2	20.6	2.9	0.5	6.7
March	30.8	20.4	40.1	40.9	96.2	11.2	28.9	0.2	83.6	2.7	0.5	7.4
April	28.8	15.7	37.7	57.5	97.5	23.2	106.0	70.0	142.0	2.3	0.5	6.6
May	28.1	21.2	35.7	59.8	98.4	23.9	110.6	n/a	n/a	1.8	0.5	5.8
June	28.2	20.3	35.9	48.9	96.9	22.8	47.2	n/a	n/a	2.0	0.5	4.9
July	28.3	19.9	34.8	46.2	91.2	25.0	8.0	n/a	n/a	2.0	0.5	6.5
August	28.2	20.5	36.1	44.5	97.3	21.5	14.0	n/a	n/a	2.2	0.5	7.0
September	29.3	20.7	36.5	38.0	83.4	21.6	4.0	n/a	n/a	2.5	0.5	5.9
October	30.1	21.1	37.0	41.5	95.5	17.3	21.7	0.6	40.8	2.8	0.5	6.5
November	29.3	19.8	36.3	45.1	98.8	16.0	36.0	2.4	92.8	2.8	0.5	6.3
December	29.8	20.5	36.5	35.3	96.3	14.2	18.7	2.0	49.0	2.9	0.5	6.9

Table 3: Lodwar

Month	Average Temperature (°C)	Minimum Temperature (°C)	Maximum Temperature (°C)	Average Relative Humidity (%)	Maximum Relative Humidity (%)	Minimum Relative Humidity (%)	Average Total Precipitation (mm)	Minimum Total Precipitation (mm)	Maximum Total Precipitation (mm)	Average Wind Speed (m/s)	Minimum Wind Speed (m/s)	Maximum Wind Speed (m/s)
January	n/a	16.5	38.8	n/a	n/a	n/a	9.2	0.0	124.0	4.9	1.0	13.0
February	n/a	16.9	39.9	n/a	n/a	n/a	5.8	0.0	30.2	5.2	2.0	13.0
March	n/a	17.9	39.5	n/a	n/a	n/a	21.5	0.0	96.4	5.3	2.0	12.0
April	n/a	20.2	38.9	n/a	n/a	n/a	43.1	0.0	164.4	5.6	1.0	12.0
May	n/a	20.1	38.5	n/a	n/a	n/a	20.2	0.0	87.8	5.8	1.0	15.0
June	n/a	21.3	37.4	n/a	n/a	n/a	14.9	0.0	182.9	5.9	2.0	15.0
July	n/a	20.6	36.6	n/a	n/a	n/a	10.7	0.0	67.0	6.3	3.0	11.0
August	n/a	20.2	36.6	n/a	n/a	n/a	18.9	0.0	120.2	6.8	2.0	14.0
September	n/a	22.6	38.0	n/a	n/a	n/a	11.0	0.0	134.9	6.2	2.0	14.0
October	n/a	19.0	38.3	n/a	n/a	n/a	8.8	0.0	50.6	6.7	2.0	13.0
November	n/a	18.8	37.5	n/a	n/a	n/a	26.2	0.0	172.4	5.5	1.0	13.0
December	n/a	17.3	37.4	n/a	n/a	n/a	12.3	0.0	106.1	4.5	2.0	10.0

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Noise and Vibration

C2

1 Noise Baseline Data

The following figures show the time series of either in approximate one-minute, 10-minute, or one-hour L_{Aeq} and L_{A90}, depending on the monitoring frequency of each measurement. The International Finance Corporation (IFC) noise limits are shown for comparison.

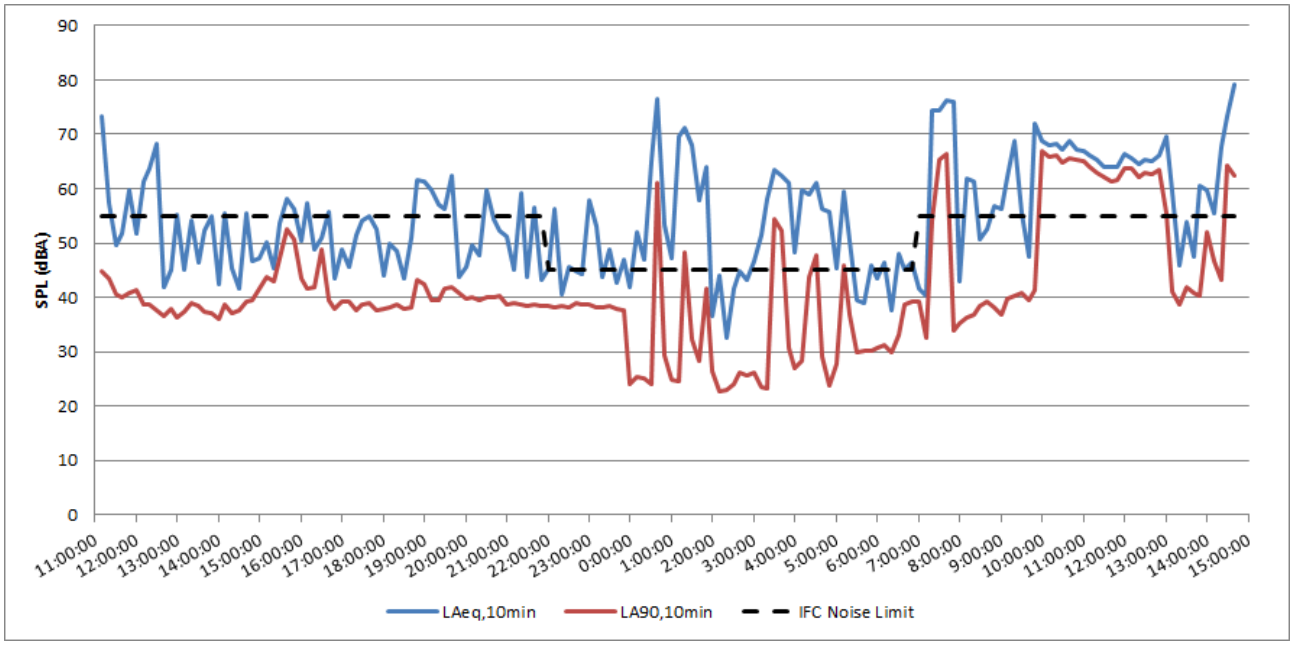

Figure 1: Time history graph of measured baseline noise levels at Lokichar (October 22 to 23, 2015)

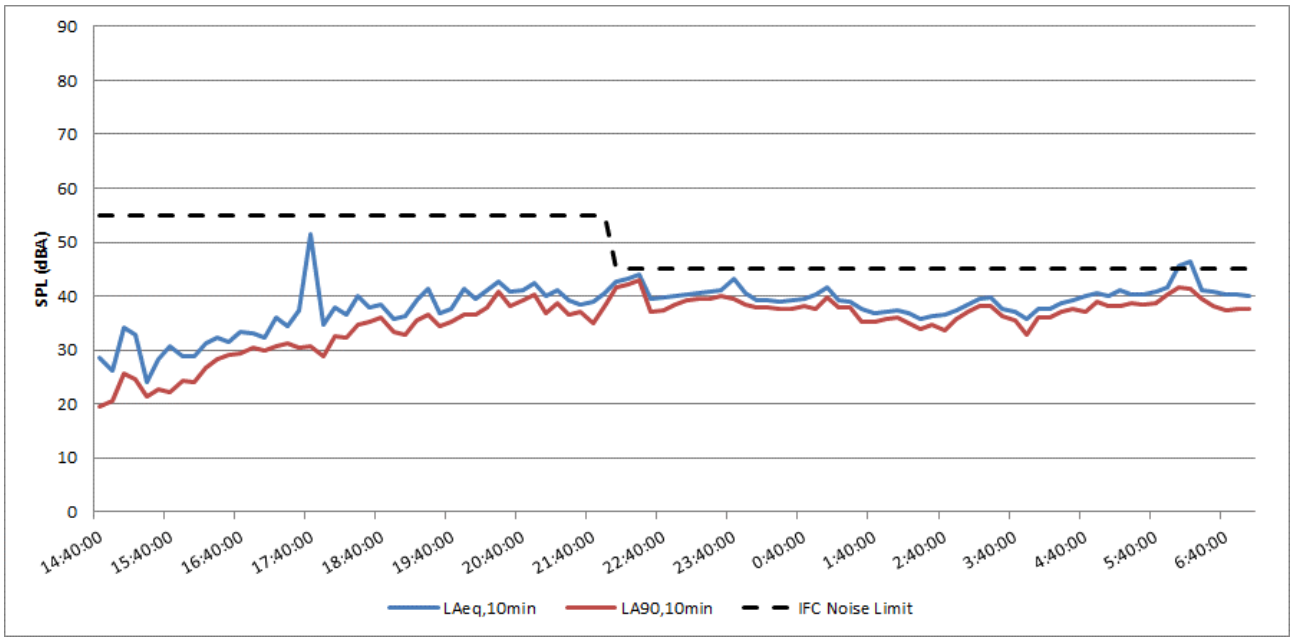

Figure 2: Time history graph of measured baseline noise levels at Twiga-1 (October 29 to 30, 2015)

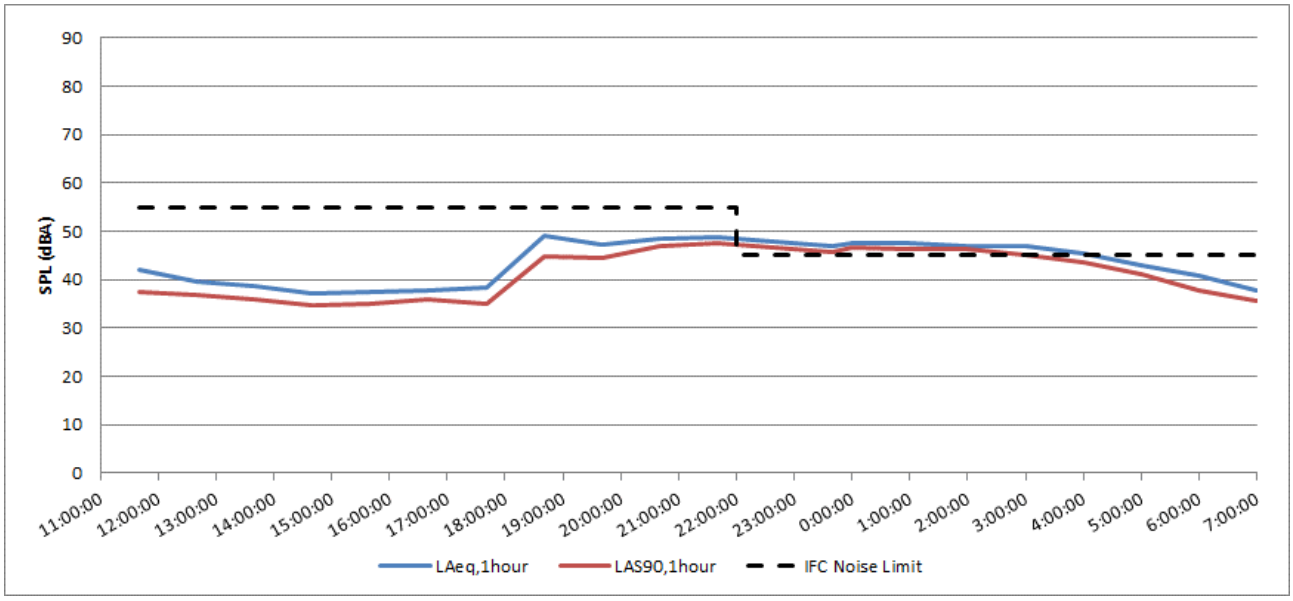

Figure 3: Time history graph of measured baseline noise levels at Twiga-1 (January 10 to 11, 2016)

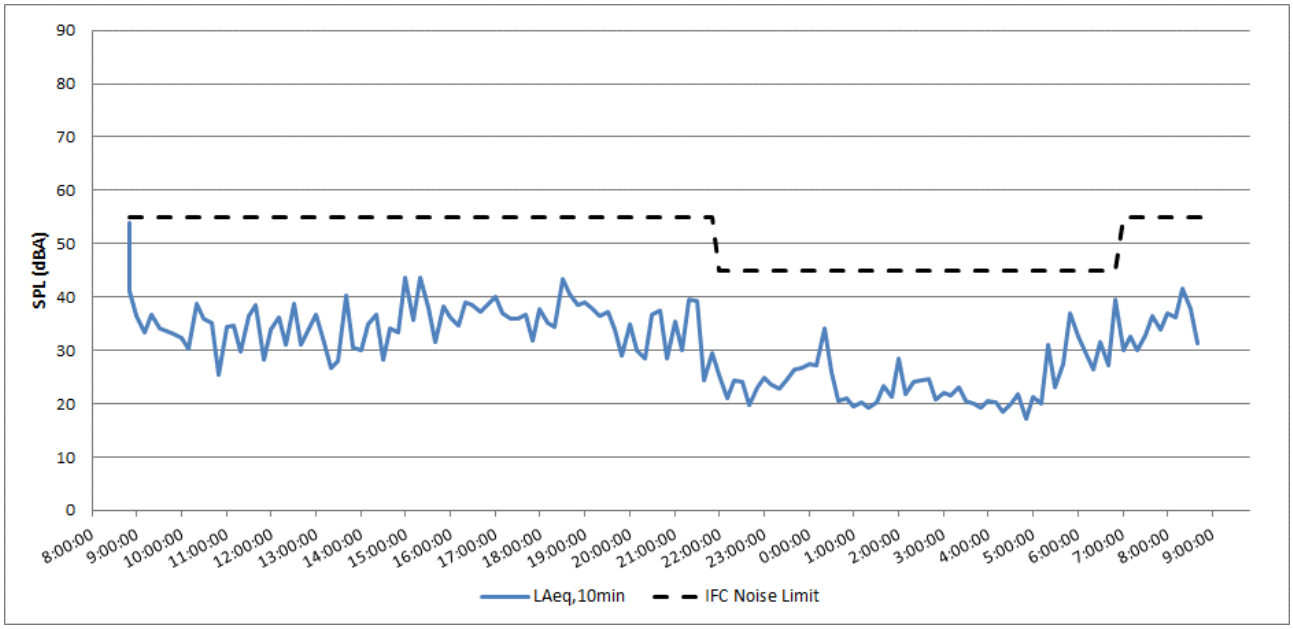

Figure 4: Time history graph of measured baseline noise levels at Twiga-1 (December 6 to 7, 2018)

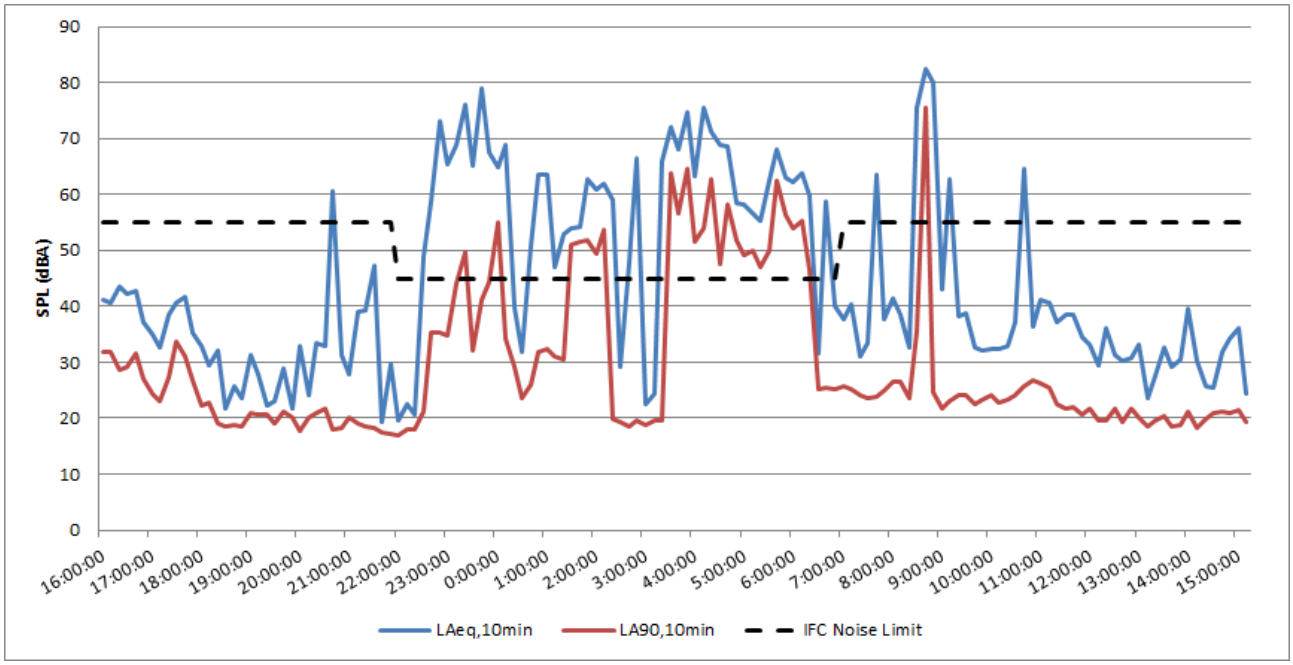

Figure 5: Time history graph of measured baseline noise levels at Amosing-5 (October 25 to 26, 2015)

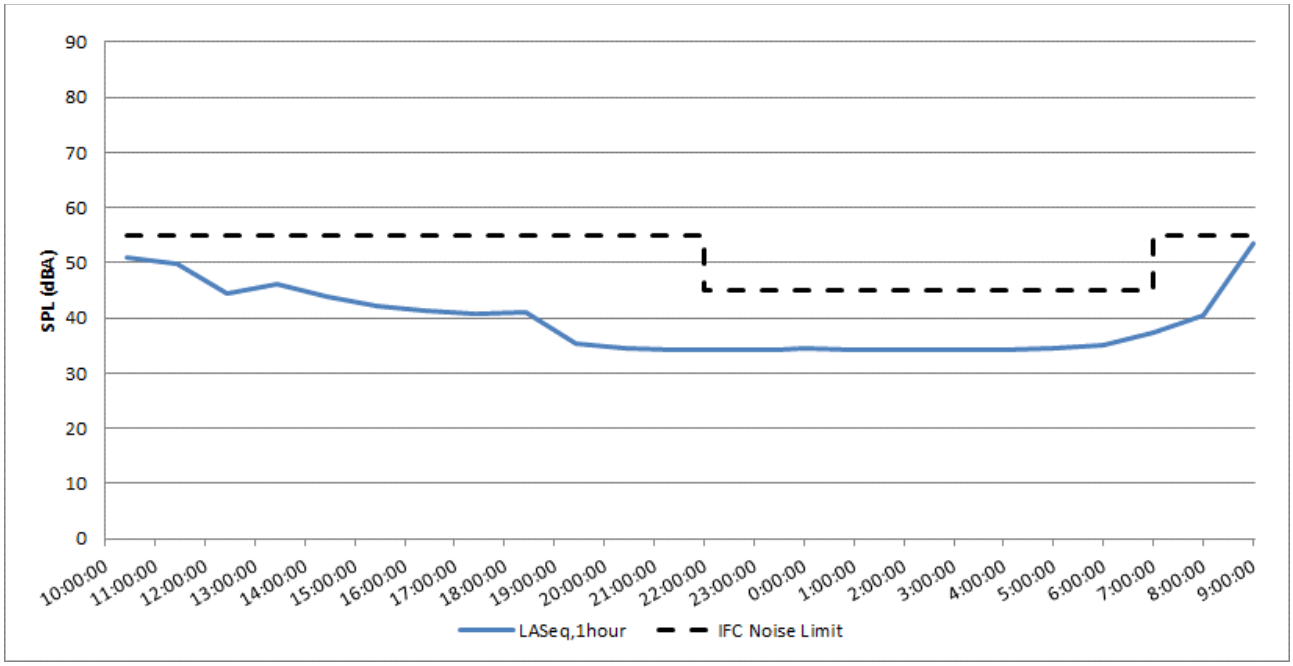

Figure 6: Time history graph of measured baseline noise levels at Amosing-5 (January 12 to 13, 2016)

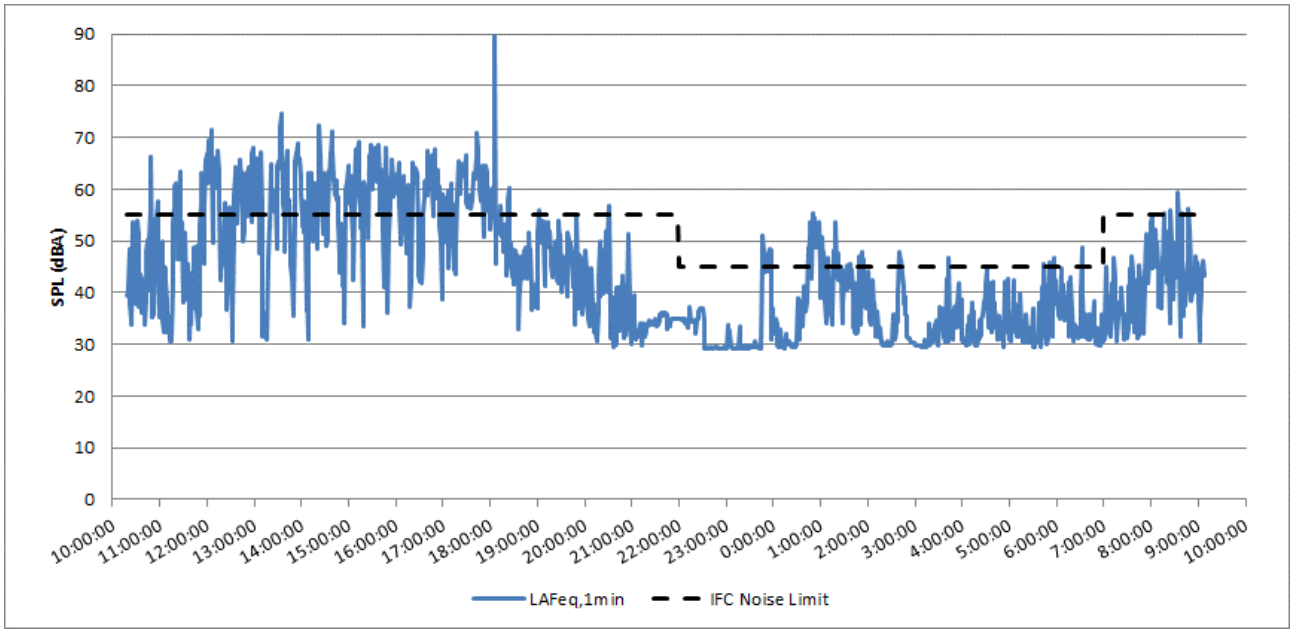

Figure 7: Time history graph of measured baseline noise levels at Amosing-5 (October 3 to 4, 2016)

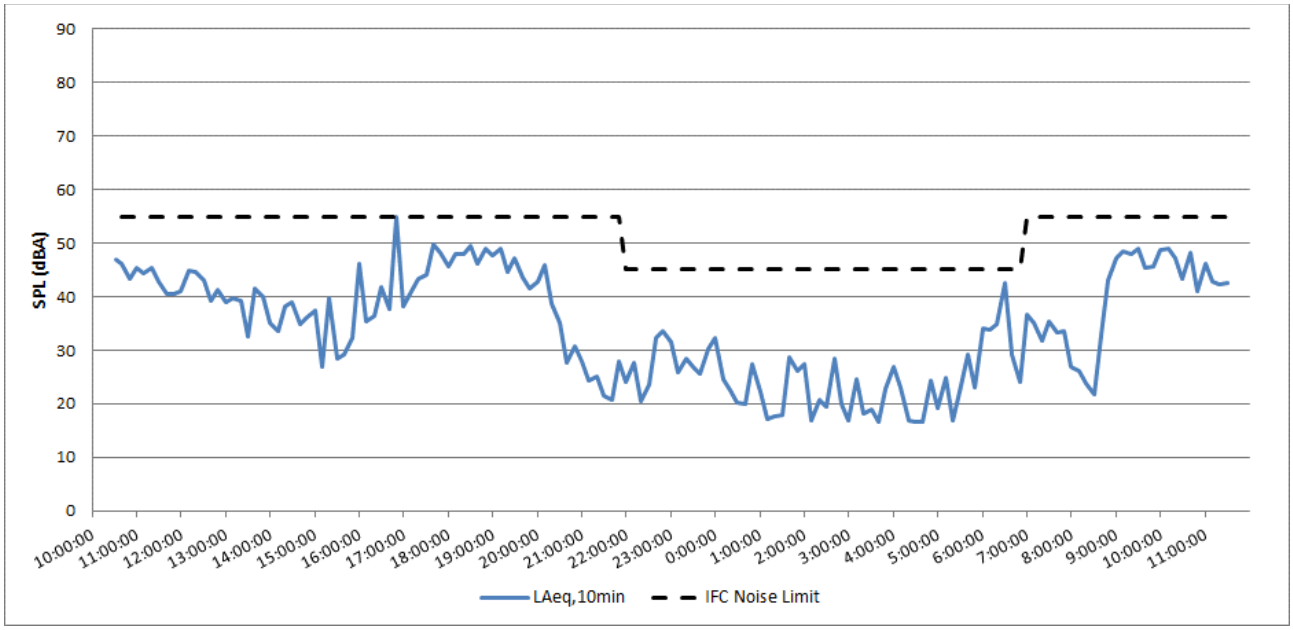

Figure 8: Time history graph of measured baseline noise levels at Amosing-5 (March 12 to 13, 2019)

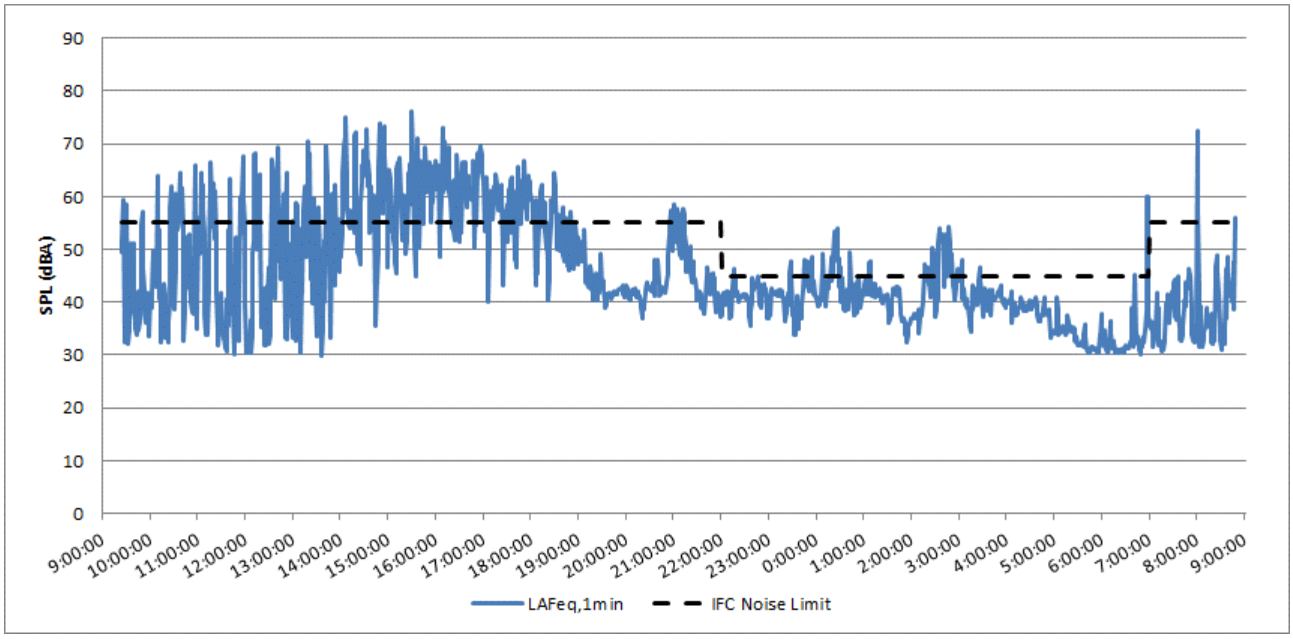

Figure 9: Time history graph of measured baseline noise levels at Ngamia-5/6 (October 2 to 3, 2016)

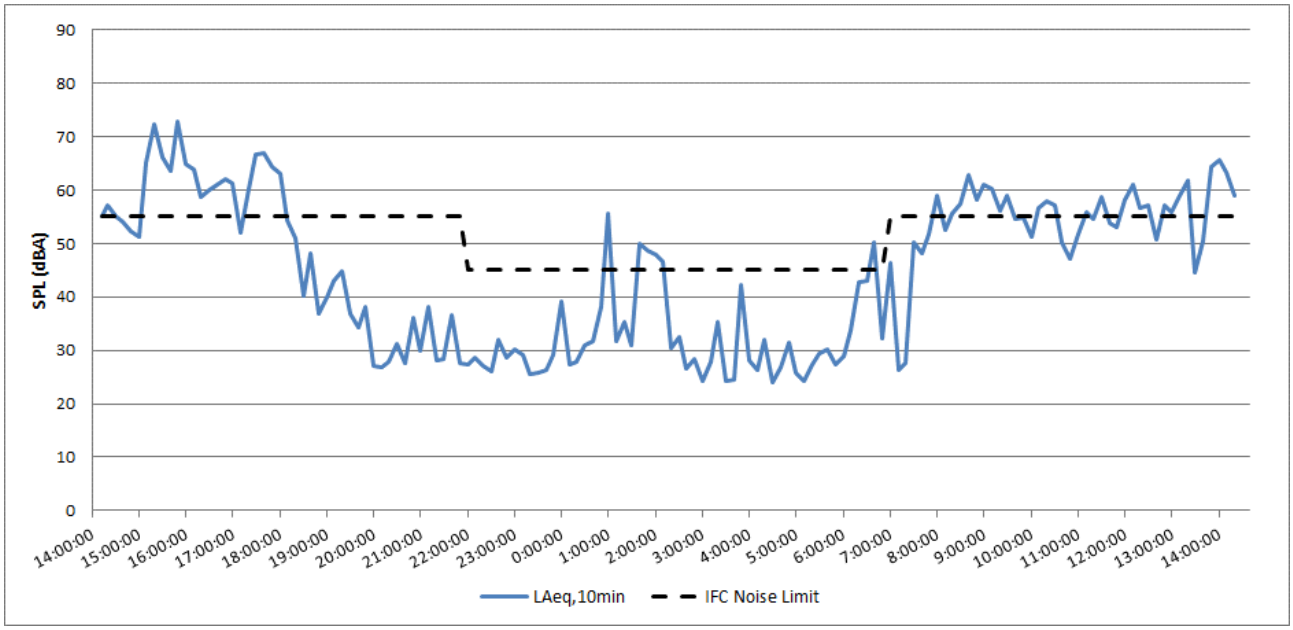

Figure 10: Time history graph of measured baseline noise levels at Ngamia-5/6 (December 3 to 4, 2018)

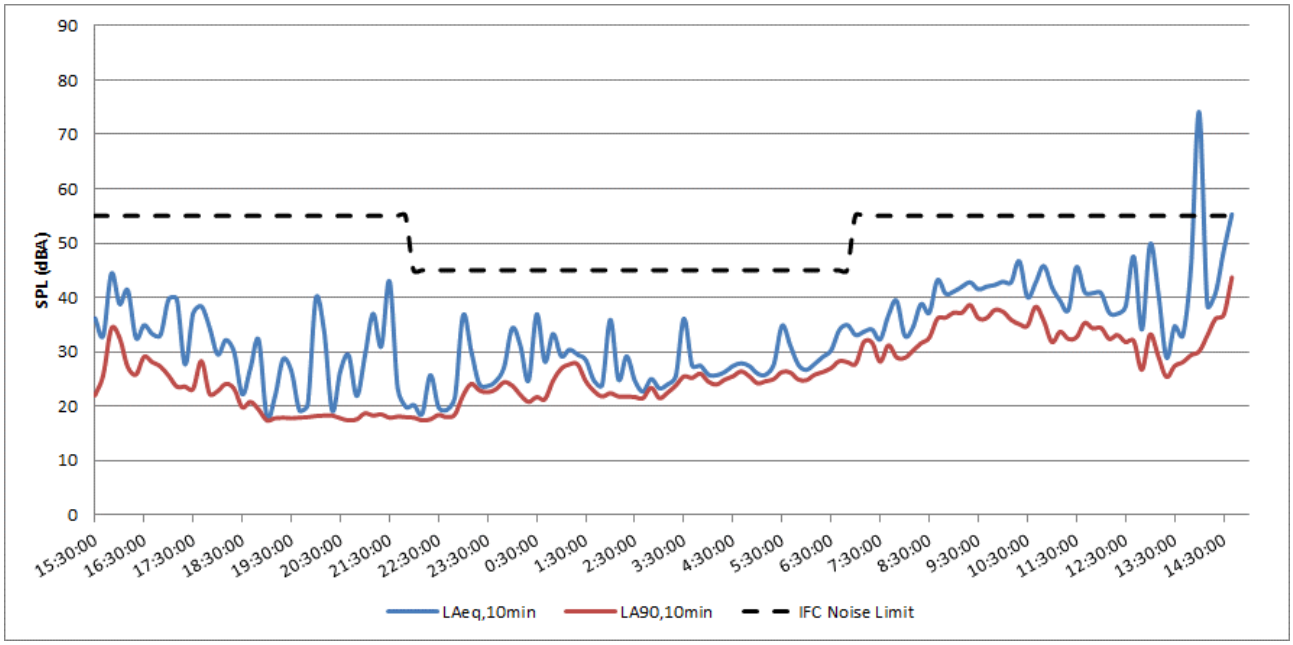

Figure 11: Time history graph of measured baseline noise levels at Kapese Camp (October 23 to 24, 2015)

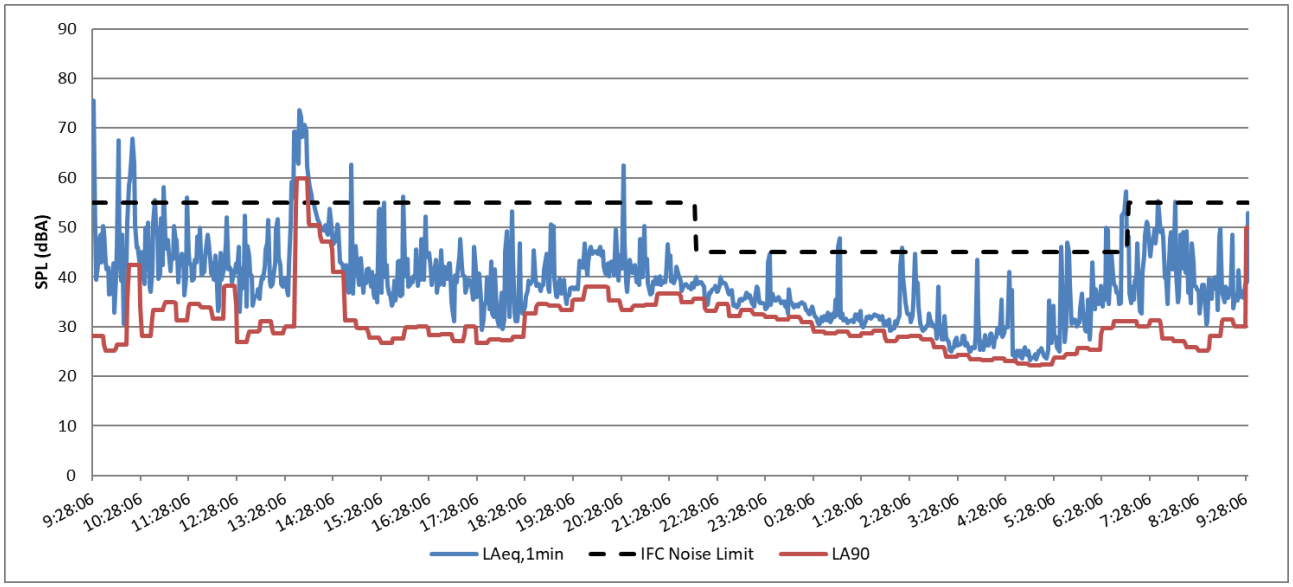

Figure 12: Time history graph of measured baseline noise levels at Ekales (December 08 to 09, 2020)

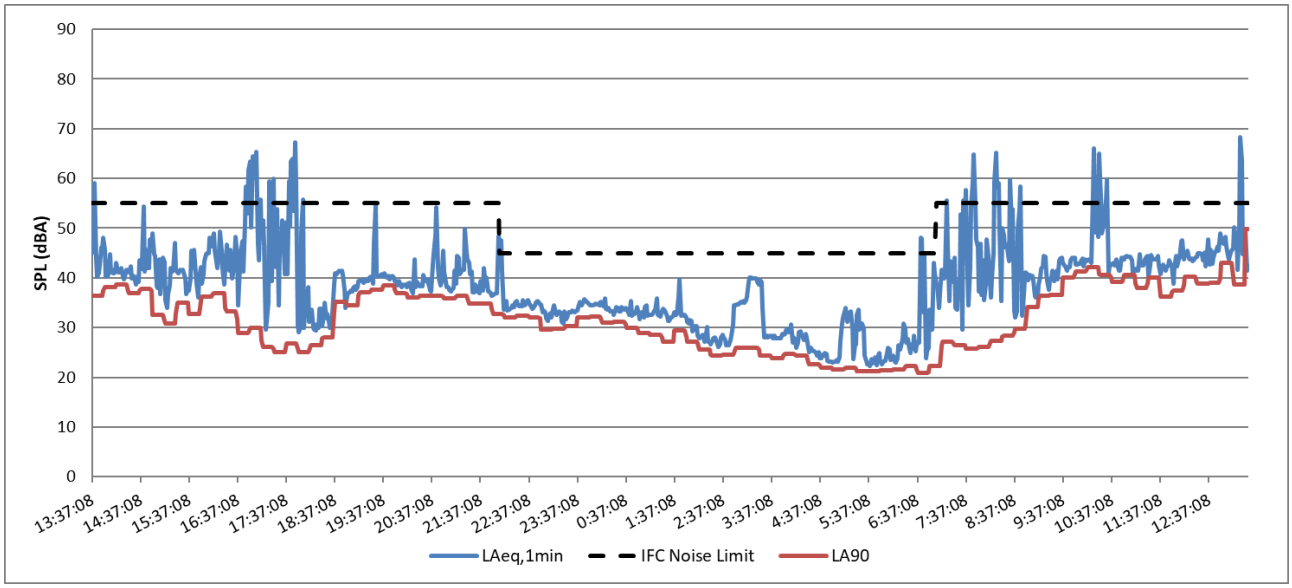

Figure 13: Time history graph of measured baseline noise levels at Etom 3 (December 09 to 10, 2020)

Water Quality

C3

1 Laboratory Certificates - Water Quality

Date: 22/12/2015

SGS Kenya Limited Laboratory Services

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Analysis Report MA15-05242.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.001 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW1 TIME: 11:10HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	8.39		6.5	8.5
Total coliform count	ISO 9308-2	[33]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	3.26	mg/l	--	--
Total Nitrogen	VELP	0.22	%	--	--
Total Phosphorus as P	APHA 3120	0.01	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	8.76	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	0.01	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	10.32	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

22122015 1626 0000058332

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Kenya

TULLOW KENYA B.V
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NAIROBI

Analysis Report MA15-05242.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.001 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW1 TIME: 11:10HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	0.21	mg/l	--	--
Magnesium as Mg	APHA 3120 B	7.52	mg/l	--	100
Potassium as K	APHA 3120 B	2.16	mg/l	--	50
Sodium as Na	APHA 3120 B	[265.72]	mg/l	--	200
Silica as Si	APHA 3120 B	2.24	mg/l	--	--
Vanadium as V	APHA 3120 B	0.04	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.54	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	11.87	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	250.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	0.41	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	1.20	mg/l	--	50
Phosphate As PO4	ICARDA	0.01	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	814.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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REISSUE COMMENT:	ADDITION OF PARAMETERS
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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.4	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	3.14	mg/l	--	--
Total Dissolved Solids	APHA 2540C	569.80	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	56.73	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.002 Re-issue: 1

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REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW2 TIME: 10:50HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	[8.75]		6.5	8.5
Total coliform count	ISO 9308-2	[14]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	4.56	mg/l	--	--
Total Nitrogen	VELP	0.18	%	--	--
Total Phosphorus as P	APHA 3120	0.03	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	10.23	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	0.01	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	6.54	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

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TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	0.24	mg/l	--	--
Magnesium as Mg	APHA 3120 B	7.80	mg/l	--	100
Potassium as K	APHA 3120 B	2.59	mg/l	--	50
Sodium as Na	APHA 3120 B	[376.85]	mg/l	--	200
Silica as Si	APHA 3120 B	2.13	mg/l	--	--
Vanadium as V	APHA 3120 B	0.05	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

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TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.41	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	8.43	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	350.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	**[0.96]**	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	**[0.08]**	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	1.40	mg/l	--	50
Phosphate As PO4	ICARDA	0.03	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	1201.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

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TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.3	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Date: 22/12/2015

SGS Kenya Limited Laboratory Services

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Analysis Report MA15-05242.002 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.002 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW2 TIME: 10:50HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	2.45	mg/l	--	--
Total Dissolved Solids	APHA 2540C	840.70	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	48.45	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.003 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.003 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW3 TIME: 11:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	[8.84]		6.5	8.5
Total coliform count	ISO 9308-2	[70]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	[23]	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	2.74	mg/l	--	--
Total Nitrogen	VELP	0.21	%	--	--
Total Phosphorus as P	APHA 3120	0.02	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	7.42	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	0.04	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	49.86	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.003 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.003 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW3 TIME: 11:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	0.69	mg/l	--	--
Magnesium as Mg	APHA 3120 B	17.49	mg/l	--	100
Potassium as K	APHA 3120 B	5.49	mg/l	--	50
Sodium as Na	APHA 3120 B	74.76	mg/l	--	200
Silica as Si	APHA 3120 B	2.53	mg/l	--	--
Vanadium as V	APHA 3120 B	0.04	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.003 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.003 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
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REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW3 TIME: 11:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.54	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	8.94	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	540.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	**[0.71]**	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	3.10	mg/l	--	50
Phosphate As PO4	ICARDA	0.02	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	1423.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.003 Re-issue: 1

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PRODUCT DESCRIPTION:	BORE HOLE WATER
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REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW3 TIME: 11:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.1	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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Analysis Report MA15-05242.003 Re-issue: 1

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PRODUCT DESCRIPTION:	BORE HOLE WATER
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REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW3 TIME: 11:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	4.81	mg/l	--	--
Total Dissolved Solids	APHA 2540C	996.10	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	196.53	mg/l	--	--

Authorised Signatory

Walter Ogara - Multi-Lab Manager

Technical Signatory

Justus Amenya-Chemist

Technical Signatory

George Nduko-Chemist

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Analysis Report MA15-05242.004 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.004 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4 TIME: 08:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	8.47		6.5	8.5
Total coliform count	ISO 9308-2	[23]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	[5]	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	3.08	mg/l	--	--
Total Nitrogen	VELP	0.18	%	--	--
Total Phosphorus as P	APHA 3120	0.02	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	7.62	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	0.03	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	49.48	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.004 Re-issue: 1

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SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4 TIME: 08:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	0.05	mg/l	--	3
Strontium as Sr	APHA 3120 B	0.68	mg/l	--	--
Magnesium as Mg	APHA 3120 B	17.51	mg/l	--	100
Potassium as K	APHA 3120 B	5.41	mg/l	--	50
Sodium as Na	APHA 3120 B	72.18	mg/l	--	200
Silica as Si	APHA 3120 B	2.38	mg/l	--	--
Vanadium as V	APHA 3120 B	0.04	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4 TIME: 08:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.38	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	8.86	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	310.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	**[0.68]**	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	3.40	mg/l	--	50
Phosphate As PO4	ICARDA	0.02	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	419.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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Analysis Report MA15-05242.004 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.004 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4 TIME: 08:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.4	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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Analysis Report MA15-05242.004 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.004 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4 TIME: 08:30HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	3.01	mg/l	--	--
Total Dissolved Solids	APHA 2540C	293.30	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	195.65	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.005 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.005 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
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ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4/D TIME: 0900HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	[8.57]		6.5	8.5
Total coliform count	ISO 9308-2	[22]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	[11]	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	2.51	mg/l	--	--
Total Nitrogen	VELP	0.14	%	--	--
Total Phosphorus as P	APHA 3120	0.01	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	9.66	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	0.02	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	32.65	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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Analysis Report MA15-05242.005 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.005 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	0.01	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	0.26	mg/l	--	--
Magnesium as Mg	APHA 3120 B	21.70	mg/l	--	100
Potassium as K	APHA 3120 B	0.83	mg/l	--	50
Sodium as Na	APHA 3120 B	117.76	mg/l	--	200
Silica as Si	APHA 3120 B	3.31	mg/l	--	--
Vanadium as V	APHA 3120 B	0.08	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.005 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.005 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
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MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4/D TIME: 0900HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.47	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	5.74	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	420.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	**[0.99]**	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	4.90	mg/l	--	50
Phosphate As PO4	ICARDA	0.01	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	720.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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Analysis Report MA15-05242.005 Re-issue: 1

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.1	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.005 Re-issue: 1

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	2.99	mg/l	--	--
Total Dissolved Solids	APHA 2540C	504.00	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	170.88	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.006 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.006 dated 091215 issued by SGS ****

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SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW5 TIME: 11:40HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	[8.83]		6.5	8.5
Total coliform count	ISO 9308-2	[110]	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	2.58	mg/l	--	--
Total Nitrogen	VELP	0.12	%	--	--
Total Phosphorus as P	APHA 3120	0.04	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	9.69	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	<0.002	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	0.08	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Date: 22/12/2015

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NAIROBI

Analysis Report MA15-05242.006 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.006 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW5 TIME: 11:40HRS PROJECT: 60360 Based on the below tested parameters, the test results in [ ] are not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	<0.005	mg/l	--	--
Magnesium as Mg	APHA 3120 B	<0.03	mg/l	--	100
Potassium as K	APHA 3120 B	<0.10	mg/l	--	50
Sodium as Na	APHA 3120 B	2.48	mg/l	--	200
Silica as Si	APHA 3120 B	1.25	mg/l	--	--
Vanadium as V	APHA 3120 B	<0.008	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.49	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	0.09	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	346.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	0.47	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	1.00	mg/l	--	50
Phosphate As PO4	ICARDA	0.04	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	762.0	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.5	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	4.12	mg/l	--	--
Total Dissolved Solids	APHA 2540C	533.40	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	0.26	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	[8.54]		6.5	8.5
Total coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	4.01	mg/l	--	--
Total Nitrogen	VELP	0.31	%	--	--
Total Phosphorus as P	APHA 3120	0.00	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	8.77	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	<0.002	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	0.39	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

Justus Amenya-Chemist

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TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	0.01	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	0.01	mg/l	--	3
Strontium as Sr	APHA 3120 B	<0.005	mg/l	--	--
Magnesium as Mg	APHA 3120 B	<0.03	mg/l	--	100
Potassium as K	APHA 3120 B	0.25	mg/l	--	50
Sodium as Na	APHA 3120 B	3.98	mg/l	--	200
Silica as Si	APHA 3120 B	0.56	mg/l	--	--
Vanadium as V	APHA 3120 B	<0.008	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.55	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	0.17	mg/l	--	400
CHLORIDES	APHA 4500	>30.000	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	410.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	0.38	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	0.68	mg/l	--	50
Phosphate As PO4	ICARDA	0.00	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	71.3	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.4	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Date: 22/12/2015

SGS Kenya Limited Laboratory Services

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Analysis Report MA15-05242.007 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.007 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	27/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE SAMPLE REF: GW4/FB TIME: 11:10HRS PROJECT: 60360 Based on the below tested parameters, the test result in [ ] in not within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	1.92	mg/l	--	--
Total Dissolved Solids	APHA 2540C	49.91	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	1.12	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.008 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.008 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	20/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE DEIONIZED WATER TIME: TRIP BLANK PROJECT: 60360 Based on the below tested parameters, the test results are within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
pH	APHA 4500 H+	8.18		6.5	8.5
Total coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml	--	0
BOD 5 @ 20oC	SGS TW4 020	1.04	mg/l	--	--
Total Nitrogen	VELP	0.18	%	--	--
Total Phosphorus as P	APHA 3120	0.08	mg/l	--	--
Chemical Oxygen Demand	APHA 5220 D	4.72	mg/l	--	--
Chromium Trivalent as Cr 3+	APHA 3120 B	<0.007	mg/l	--	--
Aluminium as Al	APHA 3120 B	<0.04	mg/l	--	0.1
Arsenic as As	APHA 3120 B	Not detected	mg/l	--	0.01
Barium as Ba	APHA 3120 B	<0.002	mg/l	--	0.1
Beryllium as Be	APHA 3120 B	<0.0003	mg/l	--	--
Boron as B	APHA 3120 B	<0.005	mg/l	--	--
Cadmium as Cd	APHA 3120 B	Not detected	mg/l	--	0.003
Calcium as Ca	APHA 3120 B	<0.01	mg/l	--	250

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.008 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.008 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	20/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE DEIONIZED WATER TIME: TRIP BLANK PROJECT: 60360 Based on the below tested parameters, the test results are within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Chromium as Cr	APHA 3120 B	<0.007	mg/l	--	0.05
Copper as Cu	APHA 3120 B	<0.006	mg/l	--	0.01
Iron as Fe	APHA 3120 B	<0.007	mg/l	--	2
Lead as Pb	APHA 3120 B	Not detected	ppm	--	0.01
Manganese as Mn	APHA 3120 B	<0.002	mg/l	--	0.5
Nickel as Ni	APHA 3120 B	<0.015	mg/l	--	--
Selenium as Se	APHA 3120 B	<0.01	mg/l	--	0.01
Zinc as Zn	APHA 3120 B	<0.002	mg/l	--	3
Strontium as Sr	APHA 3120 B	<0.005	mg/l	--	--
Magnesium as Mg	APHA 3120 B	<0.03	mg/l	--	100
Potassium as K	APHA 3120 B	0.62	mg/l	--	50
Sodium as Na	APHA 3120 B	5.07	mg/l	--	200
Silica as Si	APHA 3120 B	0.61	mg/l	--	--
Vanadium as V	APHA 3120 B	<0.008	mg/l	--	--
Benzene	SGS TW 46	<0.01	mg/l	--	--

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Analysis Report MA15-05242.008 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.008 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	20/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE DEIONIZED WATER TIME: TRIP BLANK PROJECT: 60360 Based on the below tested parameters, the test results are within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Ethylbenzene	SGS TW 46	<0.01	mg/l	--	--
Toluene	SGS TW 46	<0.01	mg/l	--	--
Xylene	SGS TW 46	<0.01	mg/l	--	--
Mercury as Hg	SGS TW 12	Not detected	mg/l	--	0.001
Fluoride as F-	APHA 4500 F- D. SPADNS METHOD	0.17	mg/l	--	4
Sulphate (SO4--)	APHA-4500-S04	Nil	mg/l	--	400
CHLORIDES	APHA 4500	4.820	mg/l	--	250
Total alkalinity as CaCO3	ISO 9963-1	272.00	mg/l	--	--
Ammonia As NH3	ASTM D 1426	0.08	mg/l	--	0.5
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l	--	0.005
Nitrate as NO3-	APHA-4500-NO3	0.25	mg/l	--	50
Phosphate As PO4	ICARDA	0.08	mg/l	--	2.2
Conductivity at 25 °C	SGS TW 15	43.7	µS/cm	--	--
Acenaphthene	SGS TW 47	<0.01	mg/l	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.008 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.008 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	20/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE DEIONIZED WATER TIME: TRIP BLANK PROJECT: 60360 Based on the below tested parameters, the test results are within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
Acenaphthylene	SGS TW 47	<0.01	mg/l	--	--
Anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)anthracene	SGS TW 47	<0.01	mg/l	--	--
Benzo(a)pyrene	SGS TW 47	<0.01	mg/l	--	--
Benzo(g,h,i)perylene	SGS TW 47	<0.01	mg/l	--	--
Benzo(k)fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Chrysene	SGS TW 47	<0.01	mg/l	--	--
Dibenz(a,h)anthracene	SGS TW 47	<0.01	mg/l	--	--
Fluoranthene	SGS TW 47	<0.01	mg/l	--	--
Fluorene	SGS TW 47	<0.01	mg/l	--	--
Indeno(1,2,3-c,d)pyrene	SGS TW 47	<0.01	mg/l	--	--
Naphthalene	SGS TW 47	<0.01	mg/l	--	--
Phenanthrene	SGS TW 47	<0.01	mg/l	--	--
Pyrene	SGS TW 47	<0.01	mg/l	--	--
Temperature		26.0	°C	--	--

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | Justus Amenya-Chemist | George Nduko-Chemist

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Analysis Report MA15-05242.008 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA15-05242.008 dated 091215 issued by SGS ****

PRODUCT DESCRIPTION:	BORE HOLE WATER
SAMPLED BY:	SGS
DATE SAMPLED:	20/11/2015
SAMPLE RECEIVED:	02/12/2015
ANALYSIS STARTED:	02/12/2015
REISSUE COMMENT:	ADDITION OF PARAMETERS
MARKS:	CONDITION OF SAMPLE: DELIVERED IN A STERILIN/AMBER BOTTLE DEIONIZED WATER TIME: TRIP BLANK PROJECT: 60360 Based on the below tested parameters, the test results are within the KS 459-7:2007 limits of specification.
REPORT COMMENTS:	Lead as Pb Detection limit = 0.004 Cadmium as Cd Detection limit = 0.004 Arsenic as As detection limit = 0.05 Mercury as Hg detection limit = 0.005

TESTS	METHOD	RESULT	UNITS	MIN	MAX
TPH C6-C44	SGS TW 56	<0.01	mg/l	--	--
Dissolved Oxygen	APHA-4500 O C	1.71	mg/l	--	--
Total Dissolved Solids	APHA 2540C	30.59	mg/l	--	1000
Total Suspended Solids	APHA 2540	2	mg/l	--	--
Total Hardness	APHA 2340 B	Nil	mg/l	--	--

End of Analytical Results

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — Justus Amenya-Chemist

Technical Signatory — George Nduko-Chemist

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Date: 24/06/2016

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KENYA

Analysis Report MA16-02977.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 3- RIVER DATE:28/05/16 TIME:0945HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	1.24	mg/l
Sulphate (SO4--)	APHA-4500-S04	34.46	mg/l
Chloride (Cl-)	APHA-4500-CL B	64.86	mg/l
Alkalinity Total	APHA 2320A	35	mg/l
Phosphate In Water	APHA 4500-P	1.89	mg/l
Nitrate as NO3-	APHA-4500-NO3	4.18	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	1.78	mg/l
Conductivity at 25 °C	APHA 2510 B	348.0	µS/cm
pH	APHA 4500 H+	7.56	
Temperature		24.8	°C
Dissolved Oxygen	APHA EXT	6.80	mg/l
Total Dissolved Solids	APHA 2540C	226.20	mg/l
Total Suspended Solids	APHA 2540	345	mg/l
BOD 5 @ 20oC	APHA 5210 B	54.98	mg/l
Chemical Oxygen Demand	APHA 5220 D	109.76	mg/l
Total Nitrogen	APHA 4500	3.68	mg/l
Naphthalene	SGS TW 65	4.00	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

24062016 1207 0000064676

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Member of the SGS Group (Société Générale de Surveillance)

Date: 24/06/2016

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KENYA

Analysis Report MA16-02977.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 3- RIVER DATE:28/05/16 TIME:0945HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	0.11	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	0.05	mg/l
n-Eicosane	SGS TW 56	0.06	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-02977.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 3- RIVER DATE:28/05/16 TIME:0945HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	0.05	mg/l
n-Tetradecane	SGS TW 56	<0.01	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	>1800	MPN/100ml
Faecal coliform count	ISO 9308-2	>1800	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	35.30	mg/l
Magnesium as Mg	APHA 3120 B	4.41	mg/l
Potassium as K	APHA 3120 B	6.12	mg/l
Sodium as Na	APHA 3120 B	20.09	mg/l
Silica as Si	APHA 3120 B	8.52	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Member of the SGS Group (Société Générale de Surveillance)

Date: 24/06/2016

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Analysis Report MA16-02977.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 3- RIVER DATE:28/05/16 TIME:0945HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.02	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.08	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	0.01	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l
Strontium as Sr	APHA 3120 B	0.36	mg/l
Total Phosphorus as P	APHA 3120 B	0.08	mg/l
Total Hardness	APHA 2340 B	106.30	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*



Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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EMC CONSULTANTS
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KENYA

Analysis Report MA16-02977.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 3- BOREHOLE DATE:29/05/16 TIME:0938HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	0.68	mg/l
Sulphate (SO4--)	APHA-4500-S04	52.06	mg/l
Chloride (Cl-)	APHA-4500-CL B	536.86	mg/l
Alkalinity Total	APHA 2320A	28	mg/l
Phosphate In Water	APHA 4500-P	0.54	mg/l
Nitrate as NO3-	APHA-4500-NO3	3.65	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.54	mg/l
Conductivity at 25 °C	APHA 2510 B	1913.0	µS/cm
pH	APHA 4500 H+	7.24	
Temperature		25.5	°C
Dissolved Oxygen	APHA EXT	7.54	mg/l
Total Dissolved Solids	APHA 2540C	1245.26	mg/l
Total Suspended Solids	APHA 2540	2	mg/l
BOD 5 @ 20oC	APHA 5210 B	24.56	mg/l
Chemical Oxygen Demand	APHA 5220 D	48.07	mg/l
Total Nitrogen	APHA 4500	4.69	mg/l
Naphthalene	SGS TW 65	0.04	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	0.04	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

24062016 1207 0000064676

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Analysis Report MA16-02977.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 3- BOREHOLE DATE:29/05/16 TIME:0938HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	0.03	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	<0.01	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	<0.01	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*



Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-02977.002

PRODUCT DESCRIPTION:	WATER
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SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 3- BOREHOLE DATE:29/05/16 TIME:0938HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	<0.01	mg/l
n-Tetradecane	SGS TW 56	<0.01	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	1600	MPN/100ml
Faecal coliform count	ISO 9308-2	2	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	11.77	mg/l
Magnesium as Mg	APHA 3120 B	7.90	mg/l
Potassium as K	APHA 3120 B	3.39	mg/l
Sodium as Na	APHA 3120 B	347.19	mg/l
Silica as Si	APHA 3120 B	25.21	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*



Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-02977.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 3- BOREHOLE DATE:29/05/16 TIME:0938HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	0.12	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.13	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.05	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l
Strontium as Sr	APHA 3120 B	0.21	mg/l
Total Phosphorus as P	APHA 3120 B	Nil	mg/l
Total Hardness	APHA 2340 B	61.90	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-02977.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK DATE:29/05/16 TIME:0950HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	1.18	mg/l
Sulphate (SO4--)	APHA-4500-S04	0.89	mg/l
Chloride (Cl-)	APHA-4500-CL B	0.94	mg/l
Alkalinity Total	APHA 2320A	0.33	mg/l
Phosphate In Water	APHA 4500-P	0.27	mg/l
Nitrate as NO3-	APHA-4500-NO3	2.22	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.74	mg/l
Conductivity at 25 °C	APHA 2510 B	16.3	µS/cm
pH	APHA 4500 H+	6.88	
Temperature		25.3	°C
Dissolved Oxygen	APHA EXT	6.82	mg/l
Total Dissolved Solids	APHA 2540C	10.53	mg/l
Total Suspended Solids	APHA 2540	1	mg/l
BOD 5 @ 20oC	APHA 5210 B	25.76	mg/l
Chemical Oxygen Demand	APHA 5220 D	46.42	mg/l
Total Nitrogen	APHA 4500	2.06	mg/l
Naphthalene	SGS TW 65	0.04	mg/l
Acenaphthene	SGS TW 65	0.04	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	0.04	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-02977.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK DATE:29/05/16 TIME:0950HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	<0.01	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	<0.01	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*



Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Member of the SGS Group (Société Générale de Surveillance)

Date: 24/06/2016

SGS Kenya Limited Laboratory Services
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EMC CONSULTANTS
P.O.BOX 9648-00100
NAIROBI
KENYA

Analysis Report MA16-02977.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK DATE:29/05/16 TIME:0950HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	0.06	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	0.04	mg/l
n-Tetradecane	SGS TW 56	0.05	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	Not detected	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	<0.01	mg/l
Magnesium as Mg	APHA 3120 B	0.04	mg/l
Potassium as K	APHA 3120 B	<0.10	mg/l
Sodium as Na	APHA 3120 B	1.81	mg/l
Silica as Si	APHA 3120 B	12.52	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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NAIROBI
KENYA

Analysis Report MA16-02977.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK DATE:29/05/16 TIME:0950HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	0.08	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.06	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	0.17	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	0.01	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	<0.008	mg/l
Zinc as Zn	APHA 3120 B	0.01	mg/l
Strontium as Sr	APHA 3120 B	<0.005	mg/l
Total Phosphorus as P	APHA 3120 B	Nil	mg/l
Total Hardness	APHA 2340 B	0.10	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Date: 24/06/2016

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EMC CONSULTANTS
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KENYA

Analysis Report MA16-02977.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 5- G/WATEER DATE:29/05/16 TIME:1430HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	0.25	mg/l
Sulphate (SO4--)	APHA-4500-S04	34.85	mg/l
Chloride (Cl-)	APHA-4500-CL B	282.17	mg/l
Alkalinity Total	APHA 2320A	45	mg/l
Phosphate In Water	APHA 4500-P	2.14	mg/l
Nitrate as NO3-	APHA-4500-NO3	3.05	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	1.07	mg/l
Conductivity at 25 °C	APHA 2510 B	1234.0	µS/cm
pH	APHA 4500 H+	7.16	
Temperature		24.9	°C
Dissolved Oxygen	APHA EXT	6.44	mg/l
Total Dissolved Solids	APHA 2540C	800.75	mg/l
Total Suspended Solids	APHA 2540	3	mg/l
BOD 5 @ 20oC	APHA 5210 B	22.46	mg/l
Chemical Oxygen Demand	APHA 5220 D	39.48	mg/l
Total Nitrogen	APHA 4500	1.58	mg/l
Naphthalene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-02977.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 5- G/WATEER DATE:29/05/16 TIME:1430HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	<0.01	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	0.07	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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KENYA

Analysis Report MA16-02977.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 5- G/WATEER DATE:29/05/16 TIME:1430HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	<0.01	mg/l
n-Tetradecane	SGS TW 56	<0.01	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	1600	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	45.88	mg/l
Magnesium as Mg	APHA 3120 B	24.31	mg/l
Potassium as K	APHA 3120 B	1.88	mg/l
Sodium as Na	APHA 3120 B	122.30	mg/l
Silica as Si	APHA 3120 B	39.52	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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KENYA

Analysis Report MA16-02977.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 5- G/WATEER DATE:29/05/16 TIME:1430HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	0.08	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.01	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.09	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	0.01	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.07	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l
Strontium as Sr	APHA 3120 B	0.34	mg/l
Total Phosphorus as P	APHA 3120 B	0.06	mg/l
Total Hardness	APHA 2340 B	214.66	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*



Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Date: 24/06/2016

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Analysis Report MA16-02977.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 1- RIVER DATE:29/05/16 TIME:1128HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	1.65	mg/l
Sulphate (SO4--)	APHA-4500-S04	28.54	mg/l
Chloride (Cl-)	APHA-4500-CL B	108.72	mg/l
Alkalinity Total	APHA 2320A	140	mg/l
Phosphate In Water	APHA 4500-P	1.86	mg/l
Nitrate as NO3-	APHA-4500-NO3	2.54	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	1.16	mg/l
Conductivity at 25 °C	APHA 2510 B	655.0	µS/cm
pH	APHA 4500 H+	6.85	
Temperature		25.0	°C
Dissolved Oxygen	APHA EXT	7.71	mg/l
Total Dissolved Solids	APHA 2540C	429.16	mg/l
Total Suspended Solids	APHA 2540	4	mg/l
BOD 5 @ 20oC	APHA 5210 B	36.54	mg/l
Chemical Oxygen Demand	APHA 5220 D	64.78	mg/l
Total Nitrogen	APHA 4500	2.86	mg/l
Naphthalene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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KENYA

Analysis Report MA16-02977.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 1- RIVER DATE:29/05/16 TIME:1128HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	0.03	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	0.07	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	<0.01	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Date: 24/06/2016

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Kenya

EMC CONSULTANTS
P.O.BOX 9648-00100
NAIROBI
KENYA

Analysis Report MA16-02977.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 1- RIVER DATE:29/05/16 TIME:1128HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	<0.01	mg/l
n-Tetradecane	SGS TW 56	<0.01	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	>1800	MPN/100ml
Faecal coliform count	ISO 9308-2	>1800	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	77.74	mg/l
Magnesium as Mg	APHA 3120 B	10.15	mg/l
Potassium as K	APHA 3120 B	8.41	mg/l
Sodium as Na	APHA 3120 B	22.69	mg/l
Silica as Si	APHA 3120 B	10.87	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

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Date: 24/06/2016

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Analysis Report MA16-02977.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE SW 1- RIVER DATE:29/05/16 TIME:1128HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.07	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.10	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.01	mg/l
Zinc as Zn	APHA 3120 B	0.02	mg/l
Strontium as Sr	APHA 3120 B	0.90	mg/l
Total Phosphorus as P	APHA 3120 B	0.01	mg/l
Total Hardness	APHA 2340 B	235.90	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Date: 24/06/2016

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Kenya

EMC CONSULTANTS
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NAIROBI
KENYA

Analysis Report MA16-02977.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 1- BOREHOLE DATE:28/05/16 TIME:0920HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	0.76	mg/l
Sulphate (SO4--)	APHA-4500-S04	17.86	mg/l
Chloride (Cl-)	APHA-4500-CL B	243.65	mg/l
Alkalinity Total	APHA 2320A	80	mg/l
Phosphate In Water	APHA 4500-P	0.75	mg/l
Nitrate as NO3-	APHA-4500-NO3	4.07	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	3.45	mg/l
Conductivity at 25 °C	APHA 2510 B	1061.0	µS/cm
pH	APHA 4500 H+	7.84	
Temperature		25.1	°C
Dissolved Oxygen	APHA EXT	7.06	mg/l
Total Dissolved Solids	APHA 2540C	690.08	mg/l
Total Suspended Solids	APHA 2540	2	mg/l
BOD 5 @ 20oC	APHA 5210 B	28.16	mg/l
Chemical Oxygen Demand	APHA 5220 D	49.76	mg/l
Total Nitrogen	APHA 4500	3.07	mg/l
Naphthalene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	0.04	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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KENYA

Analysis Report MA16-02977.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 1- BOREHOLE DATE:28/05/16 TIME:0920HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	<0.01	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	<0.01	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-02977.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 1- BOREHOLE DATE:28/05/16 TIME:0920HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	<0.01	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	<0.01	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	<0.01	mg/l
n-Tetradecane	SGS TW 56	<0.01	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	1600	MPN/100ml
Faecal coliform count	ISO 9308-2	1600	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	28.05	mg/l
Magnesium as Mg	APHA 3120 B	11.49	mg/l
Potassium as K	APHA 3120 B	4.93	mg/l
Sodium as Na	APHA 3120 B	146.42	mg/l
Silica as Si	APHA 3120 B	24.85	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-02977.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW 1- BOREHOLE DATE:28/05/16 TIME:0920HRS
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.01	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.09	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	0.02	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.02	mg/l
Zinc as Zn	APHA 3120 B	0.02	mg/l
Strontium as Sr	APHA 3120 B	0.35	mg/l
Total Phosphorus as P	APHA 3120 B	0.03	mg/l
Total Hardness	APHA 2340 B	117.34	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-02977.007

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE SAMPLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Flouride as F	SGS TW 9	0.49	mg/l
Sulphate (SO4--)	APHA-4500-S04	15.19	mg/l
Chloride (Cl-)	APHA-4500-CL B	241.43	mg/l
Alkalinity Total	APHA 2320A	70	mg/l
Phosphate In Water	APHA 4500-P	0.68	mg/l
Nitrate as NO3-	APHA-4500-NO3	3.18	mg/l
Nitrite as NO2	APHA-4500-NO2	Nil	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	4.26	mg/l
Conductivity at 25 °C	APHA 2510 B	1072.0	µS/cm
pH	APHA 4500 H+	7.28	
Temperature		25.2	°C
Dissolved Oxygen	APHA EXT	7.15	mg/l
Total Dissolved Solids	APHA 2540C	684.00	mg/l
Total Suspended Solids	APHA 2540	3	mg/l
BOD 5 @ 20oC	APHA 5210 B	24.38	mg/l
Chemical Oxygen Demand	APHA 5220 D	52.14	mg/l
Total Nitrogen	APHA 4500	3.15	mg/l
Naphthalene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l
Phenanthrene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-02977.007

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE SAMPLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Anthracene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
n-Decane	SGS TW 56	<0.01	mg/l
n-Docosane	SGS TW 56	<0.01	mg/l
n-Dodecane	SGS TW 56	<0.01	mg/l
n-Dotetracontane	SGS TW 56	<0.01	mg/l
n-Dotriacontane	SGS TW 56	<0.01	mg/l
n-Eicosane	SGS TW 56	<0.01	mg/l
n-Hexacosane	SGS TW 56	<0.01	mg/l
n-Hexadecane	SGS TW 56	<0.01	mg/l
n-Hexane	SGS TW 56	<0.01	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Member of the SGS Group (Société Générale de Surveillance)

Date: 24/06/2016

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EMC CONSULTANTS
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NAIROBI
KENYA

Analysis Report MA16-02977.007

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE SAMPLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
n-Hexatriacontane	SGS TW 56	<0.01	mg/l
n-Octacosane	SGS TW 56	0.12	mg/l
n-Octadecane	SGS TW 56	<0.01	mg/l
n-Octane	SGS TW 56	0.15	mg/l
n-Octatriacontane	SGS TW 56	<0.01	mg/l
n-Tetracontane	SGS TW 56	<0.01	mg/l
n-Tetracosane	SGS TW 56	<0.01	mg/l
n-Tetradecane	SGS TW 56	0.07	mg/l
n-Tetratetracontane	SGS TW 56	<0.01	mg/l
n-Tetratriacontane	SGS TW 56	<0.01	mg/l
n-Triacontane	SGS TW 56	<0.01	mg/l
Total coliform count	ISO 9308-2	>1800	MPN/100ml
Faecal coliform count	ISO 9308-2	>1800	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	27.33	mg/l
Magnesium as Mg	APHA 3120 B	11.44	mg/l
Potassium as K	APHA 3120 B	4.67	mg/l
Sodium as Na	APHA 3120 B	143.83	mg/l
Silica as Si	APHA 3120 B	24.70	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

David Omondi-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-02977.007

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
SAMPLE RECEIVED:	08/06/2016
ANALYSIS STARTED:	08/06/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE SAMPLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	0.09	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	0.02	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.02	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l
Strontium as Sr	APHA 3120 B	0.33	mg/l
Total Phosphorus as P	APHA 3120 B	0.01	mg/l
Total Hardness	APHA 2340 B	115.36	mg/l

End of Analytical Results

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Justus Amenya-Chemist

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Date: 09/09/2016

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KENYA

Analysis Report MA16-04944.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW1-GROUNDWATER DATE:29/08/16 TIME:9.50AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride as F-	APHA 4500 F- C	1.71	mg/l
Sulphate (SO4--)	APHA-4500-S04	21.33	mg/l
Chloride (Cl-)	APHA-4500-CL B	29.01	mg/l
Alkalinity Total	APHA 2320A	100	mg/l
Phosphate In Water	APHA 4500-P	0.87	mg/l
Nitrate as NO3-	APHA-4500-NO3	2.13	mg/l
Nitrite as NO2	APHA-4500-NO2	0.050	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.03	mg/l
Conductivity at 25 °C	APHA 2510 B	831.0	µS/cm
pH	APHA 4500 H+	7.73	
Temperature		23.7	°C
Dissolved Oxygen	APHA EXT	7.80	mg/l
Total Dissolved Solids	APHA 2540D	540.00	mg/l
Total Suspended Solids	APHA 2540 C	3	mg/l
BOD 5 @ 20oC	APHA 5210 B	28.6	mg/l
Chemical Oxygen Demand	APHA 5220 D	54.61	mg/l
Total Nitrogen	APHA 4500	1.23	mg/l
Naphthalene	SGS TW 65	0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

09092016 1821 0000067726

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Date: 09/09/2016

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Analysis Report MA16-04944.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW1-GROUNDWATER DATE:29/08/16 TIME:9.50AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluorene	SGS TW 65	<0.01	mg/l
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	0.02	mg/l
Toluene	SGS TW 46	0.03	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.29	mg/l
TPH (C12 - C28)	SGS TW 56	0.36	mg/l
TPH (C28 - C44)	SGS TW 56	0.02	mg/l
TPH C5-C44	SGS TW 56	0.67	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-04944.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW1-GROUNDWATER DATE:29/08/16 TIME:9.50AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total coliform count	ISO 9308-2	17	MPN/100ml
Faecal coliform count	ISO 9308-2	7	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	20.41	mg/l
Magnesium as Mg	APHA 3120 B	11.02	mg/l
Potassium as K	APHA 3120 B	3.82	mg/l
Sodium as Na	APHA 3120 B	132.68	mg/l
Silica as Si	APHA 3120 B	2.33	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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KENYA

Analysis Report MA16-04944.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW1-GROUNDWATER DATE:29/08/16 TIME:9.50AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.03	mg/l
Zinc as Zn	APHA 3120 B	0.01	mg/l
Strontium as Sr	APHA 3120 B	0.34	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	96.36	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-04944.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW3-GROUNDWATER DATE:29/08/16 TIME:11.00AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride as F-	APHA 4500 F- C	1.72	mg/l
Sulphate (SO4--)	APHA-4500-S04	21.57	mg/l
Chloride (Cl-)	APHA-4500-CL B	38.37	mg/l
Alkalinity Total	APHA 2320A	210	mg/l
Phosphate In Water	APHA 4500-P	0.65	mg/l
Nitrate as NO3-	APHA-4500-NO3	3.22	mg/l
Nitrite as NO2	APHA-4500-NO2	0.030	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.02	mg/l
Conductivity at 25 °C	APHA 2510 B	1436.0	µS/cm
pH	APHA 4500 H+	7.87	
Temperature		23.2	°C
Dissolved Oxygen	APHA EXT	6.40	mg/l
Total Dissolved Solids	APHA 2540D	933.40	mg/l
Total Suspended Solids	APHA 2540 C	2	mg/l
BOD 5 @ 20oC	APHA 5210 B	28.21	mg/l
Chemical Oxygen Demand	APHA 5220 D	57.23	mg/l
Total Nitrogen	APHA 4500	1.61	mg/l
Naphthalene	SGS TW 65	0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

09092016 1821 0000067726

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Date: 09/09/2016

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Analysis Report MA16-04944.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW3-GROUNDWATER DATE:29/08/16 TIME:11.00AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluorene	SGS TW 65	<0.01	mg/l
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	0.05	mg/l
Toluene	SGS TW 46	0.02	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.32	mg/l
TPH (C12 - C28)	SGS TW 56	0.31	mg/l
TPH (C28 - C44)	SGS TW 56	<0.01	mg/l
TPH C5-C44	SGS TW 56	0.63	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

09092016 1821 0000067726

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Date: 09/09/2016

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Analysis Report MA16-04944.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW3-GROUNDWATER DATE:29/08/16 TIME:11.00AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total coliform count	ISO 9308-2	17	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	6.90	mg/l
Magnesium as Mg	APHA 3120 B	7.77	mg/l
Potassium as K	APHA 3120 B	2.43	mg/l
Sodium as Na	APHA 3120 B	327.06	mg/l
Silica as Si	APHA 3120 B	2.33	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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Date: 09/09/2016

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Kenya

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Analysis Report MA16-04944.002

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SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
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REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.06	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l
Strontium as Sr	APHA 3120 B	0.24	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	49.25	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-04944.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW5-GROUNDWATER DATE:29/08/16 TIME:9.18AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride as F-	APHA 4500 F- C	1.84	mg/l
Sulphate (SO4--)	APHA-4500-S04	39.07	mg/l
Chloride (Cl-)	APHA-4500-CL B	58.02	mg/l
Alkalinity Total	APHA 2320A	130	mg/l
Phosphate In Water	APHA 4500-P	0.41	mg/l
Nitrate as NO3-	APHA-4500-NO3	2.64	mg/l
Nitrite as NO2	APHA-4500-NO2	0.040	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.04	mg/l
Conductivity at 25 °C	APHA 2510 B	1101.0	µS/cm
pH	APHA 4500 H+	7.55	
Temperature		23.1	°C
Dissolved Oxygen	APHA EXT	8.00	mg/l
Total Dissolved Solids	APHA 2540D	715.65	mg/l
Total Suspended Solids	APHA 2540 C	1	mg/l
BOD 5 @ 20oC	APHA 5210 B	27.9	mg/l
Chemical Oxygen Demand	APHA 5220 D	52.01	mg/l
Total Nitrogen	APHA 4500	1.91	mg/l
Naphthalene	SGS TW 65	0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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ANALYSIS STARTED:	02/09/2016
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REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluorene	SGS TW 65	<0.01	mg/l
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	0.03	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.29	mg/l
TPH (C12 - C28)	SGS TW 56	0.32	mg/l
TPH (C28 - C44)	SGS TW 56	<0.01	mg/l
TPH C5-C44	SGS TW 56	0.61	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total coliform count	ISO 9308-2	7	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	48.87	mg/l
Magnesium as Mg	APHA 3120 B	27.22	mg/l
Potassium as K	APHA 3120 B	0.77	mg/l
Sodium as Na	APHA 3120 B	110.55	mg/l
Silica as Si	APHA 3120 B	3.64	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	0.03	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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Analysis Report MA16-04944.003

PRODUCT DESCRIPTION:	WATER
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ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW5-GROUNDWATER DATE:29/08/16 TIME:9.18AM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.07	mg/l
Zinc as Zn	APHA 3120 B	0.03	mg/l
Strontium as Sr	APHA 3120 B	0.37	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	234.10	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-04944.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	30/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW4-GROUNDWATER DATE:30/08/16 TIME:3.06PM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS	
Fluoride as F-	APHA 4500 F- C	1.40	mg/l	
Sulphate (SO4--)	APHA-4500-S04	14.97	mg/l	
Chloride (Cl-)	APHA-4500-CL B	30.88	mg/l	
Alkalinity Total	APHA 2320A	110	mg/l	
Phosphate In Water	APHA 4500-P	0.66	mg/l	
Nitrate as NO3-	APHA-4500-NO3	2.49	mg/l	
Nitrite as NO2	APHA-4500-NO2	0.090	mg/l	
AMMONIA as NH3	APHA-4500- NH3 F	0.01	mg/l	#
Conductivity at 25 °C	APHA 2510 B	612.0	µS/cm	
pH	APHA 4500 H+	7.46		
Temperature		23.5	°C	
Dissolved Oxygen	APHA EXT	7.70	mg/l	
Total Dissolved Solids	APHA 2540D	397.80	mg/l	
Total Suspended Solids	APHA 2540 C	3	mg/l	
BOD 5 @ 20oC	APHA 5210 B	29.03	mg/l	
Chemical Oxygen Demand	APHA 5220 D	50.63	mg/l	
Total Nitrogen	APHA 4500	1.54	mg/l	
Naphthalene	SGS TW 65	<0.01	mg/l	
Acenaphthylene	SGS TW 65	<0.01	mg/l	
Acenaphthene	SGS TW 65	<0.01	mg/l	

- Result is outside of test method limits and/or analytical range used in method precision study

Authorised Signatory

Walter Ogara - Multi-Lab Manager

Technical Signatory

George Nduko-Chemist

Technical Signatory

Justus Amenya-Chemist

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Analysis Report MA16-04944.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	30/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW4-GROUNDWATER DATE:30/08/16 TIME:3.06PM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluorene	SGS TW 65	<0.01	mg/l
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	0.03	mg/l
Toluene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.29	mg/l
TPH (C12 - C28)	SGS TW 56	0.29	mg/l
TPH (C28 - C44)	SGS TW 56	<0.01	mg/l
TPH C5-C44	SGS TW 56	0.58	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-04944.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	30/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW4-GROUNDWATER DATE:30/08/16 TIME:3.06PM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total coliform count	ISO 9308-2	>1800	MPN/100ml
Faecal coliform count	ISO 9308-2	540	MPN/100ml
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	46.31	mg/l
Magnesium as Mg	APHA 3120 B	16.31	mg/l
Potassium as K	APHA 3120 B	4.55	mg/l
Sodium as Na	APHA 3120 B	37.70	mg/l
Silica as Si	APHA 3120 B	2.61	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	0.03	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	0.06	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE GW4-GROUNDWATER DATE:30/08/16 TIME:3.06PM
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.04	mg/l
Zinc as Zn	APHA 3120 B	0.16	mg/l
Strontium as Sr	APHA 3120 B	0.59	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	182.80	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Date: 09/09/2016

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EMC CONSULTANTS
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KENYA

Analysis Report MA16-04944.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE-GROUNDWATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride as F-	APHA 4500 F- C	1.97	mg/l
Sulphate (SO4--)	APHA-4500-S04	21.57	mg/l
Chloride (Cl-)	APHA-4500-CL B	56.15	mg/l
Alkalinity Total	APHA 2320A	220	mg/l
Phosphate In Water	APHA 4500-P	0.54	mg/l
Nitrate as NO3-	APHA-4500-NO3	2.99	mg/l
Nitrite as NO2	APHA-4500-NO2	0.040	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.03	mg/l
Conductivity at 25 °C	APHA 2510 B	1439.0	µS/cm
pH	APHA 4500 H+	7.98	
Temperature		23.4	°C
Dissolved Oxygen	APHA EXT	7.50	mg/l
Total Dissolved Solids	APHA 2540D	933.40	mg/l
Total Suspended Solids	APHA 2540 C	1	mg/l
BOD 5 @ 20oC	APHA 5210 B	28.64	mg/l
Chemical Oxygen Demand	APHA 5220 D	53.53	mg/l
Total Nitrogen	APHA 4500	1.45	mg/l
Naphthalene	SGS TW 65	<0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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Date: 09/09/2016

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Analysis Report MA16-04944.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE-GROUNDWATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.34	mg/l
TPH (C12 - C28)	SGS TW 56	0.33	mg/l
TPH (C28 - C44)	SGS TW 56	<0.01	mg/l
TPH C5-C44	SGS TW 56	0.64	mg/l
Total coliform count	ISO 9308-2	17	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Date: 09/09/2016

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KENYA

Analysis Report MA16-04944.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE-GROUNDWATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	6.92	mg/l
Magnesium as Mg	APHA 3120 B	7.77	mg/l
Potassium as K	APHA 3120 B	2.43	mg/l
Sodium as Na	APHA 3120 B	329.10	mg/l
Silica as Si	APHA 3120 B	2.34	mg/l
Aluminium as Al	APHA 3120 B	<0.04	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	<0.007	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	<0.002	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Vanadium as V	APHA 3120 B	0.06	mg/l
Zinc as Zn	APHA 3120 B	<0.002	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Date: 09/09/2016

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Analysis Report MA16-04944.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE DUPLICATE-GROUNDWATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Strontium as Sr	APHA 3120 B	0.24	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	49.27	mg/l

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Analysis Report MA16-04944.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK-DEIONIZED WATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride as F-	APHA 4500 F- C	66.80	mg/l
Sulphate (SO4--)	APHA-4500-S04	0.53	mg/l
Chloride (Cl-)	APHA-4500-CL B	37.44	mg/l
Alkalinity Total	APHA 2320A	20	mg/l
Phosphate In Water	APHA 4500-P	0.09	mg/l
Nitrate as NO3-	APHA-4500-NO3	1.87	mg/l
Nitrite as NO2	APHA-4500-NO2	0.010	mg/l
AMMONIA as NH3	APHA-4500- NH3 F	0.02	mg/l
Conductivity at 25 °C	APHA 2510 B	400.0	µS/cm
pH	APHA 4500 H+	6.33	
Temperature		23.7	°C
Dissolved Oxygen	APHA EXT	7.80	mg/l
Total Dissolved Solids	APHA 2540D	260.00	mg/l
Total Suspended Solids	APHA 2540 C	2	mg/l
BOD 5 @ 20oC	APHA 5210 B	27.53	mg/l
Chemical Oxygen Demand	APHA 5220 D	51.91	mg/l
Total Nitrogen	APHA 4500	1.01	mg/l
Naphthalene	SGS TW 65	0.01	mg/l
Acenaphthylene	SGS TW 65	<0.01	mg/l
Acenaphthene	SGS TW 65	<0.01	mg/l
Fluorene	SGS TW 65	<0.01	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Date: 09/09/2016

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Analysis Report MA16-04944.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK-DEIONIZED WATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Phenanthrene	SGS TW 65	<0.01	mg/l
Anthracene	SGS TW 65	<0.01	mg/l
Fluoranthene	SGS TW 65	<0.01	mg/l
Pyrene	SGS TW 65	<0.01	mg/l
Benzo(a)anthracene	SGS TW 65	<0.01	mg/l
Chrysene	SGS TW 65	<0.01	mg/l
Benzo(k)fluoranthene	SGS TW 65	<0.01	mg/l
Benzo(a)pyrene	SGS TW 65	<0.01	mg/l
Benzo(g,h,i)perylene	SGS TW 65	<0.01	mg/l
Dibenz(a,h)anthracene	SGS TW 65	<0.01	mg/l
Indeno(1,2,3,-cd)pyrene	SGS TW 65	<0.01	mg/l
Benzo(b)fluoranthene	SGS TW 65	<0.01	mg/l
Benzene	SGS TW 46	<0.01	mg/l
Toluene	SGS TW 46	<0.01	mg/l
Ethylbenzene	SGS TW 46	<0.01	mg/l
TPH (C5 - C12)	SGS TW 56	0.34	mg/l
TPH (C12 - C28)	SGS TW 56	0.40	mg/l
TPH (C28 - C44)	SGS TW 56	<0.01	mg/l
TPH C5-C44	SGS TW 56	0.74	mg/l
Total coliform count	ISO 9308-2	Not detected	MPN/100ml
Faecal coliform count	ISO 9308-2	Not detected	MPN/100ml

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager

George Nduko-Chemist

Justus Amenya-Chemist

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Analysis Report MA16-04944.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK-DEIONIZED WATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Mercury as Hg	SGS TW 12	Not detected	mg/l
Calcium as Ca	APHA 3120 B	0.59	mg/l
Magnesium as Mg	APHA 3120 B	0.14	mg/l
Potassium as K	APHA 3120 B	2.01	mg/l
Sodium as Na	APHA 3120 B	65.92	mg/l
Silica as Si	APHA 3120 B	2.67	mg/l
Aluminium as Al	APHA 3120 B	0.14	mg/l
Arsenic as As	APHA 3120 B	Not detected	mg/l
Barium as Ba	APHA 3120 B	<0.002	mg/l
Beryllium as Be	APHA 3120 B	<0.003	mg/l
Boron as B	APHA 3120 B	<0.005	mg/l
Cadmium as Cd	APHA 3120 B	Not detected	mg/l
Chromium as Cr	APHA 3120 B	<0.007	mg/l
Copper as Cu	APHA 3120 B	<0.006	mg/l
Iron as Fe	APHA 3120 B	0.37	mg/l
Lead as Pb	APHA 3120 B	Not detected	ppm
Manganese as Mn	APHA 3120 B	0.02	mg/l
Nickel as Ni	APHA 3120 B	<0.015	mg/l
Selenium as Se	APHA 3120 B	0.03	mg/l
Vanadium as V	APHA 3120 B	<0.008	mg/l
Zinc as Zn	APHA 3120 B	0.03	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | George Nduko-Chemist | Justus Amenya-Chemist

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Date: 09/09/2016

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Analysis Report MA16-04944.006

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	Client
DATE SAMPLED:	29/08/2016
SAMPLE RECEIVED:	02/09/2016
ANALYSIS STARTED:	02/09/2016
MARKS:	DELIVERED IN AMBER/STERILIN BOTTLE FIELD BLANK-DEIONIZED WATER DATE:29/08/16
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Strontium as Sr	APHA 3120 B	<0.005	mg/l
Total Phosphorus as P	APHA 3120 B	<0.01	mg/l
Total Hardness	APHA 2340 B	2.04	mg/l

End of Analytical Results

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — George Nduko-Chemist

Technical Signatory — Justus Amenya-Chemist

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Date: 09/04/2019

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GOLDER ASSOCIATES (UK) LTD
CAVENDISH HOUSE
BUCKINGHAMSHIRE
BOURNE END BUSINESS PARK,
UNITED KINGDOM
SL8

Analysis Report MA19-01403.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA19-01403.001 dated 08-04-19 issued by SGS ****

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	ECOLOGICS CONSULTANTS LTD
DATE SAMPLED:	25/03/2019
SAMPLING LOCATION:	MALMATE RIVER
SAMPLE RECEIVED:	28/03/2019
ANALYSIS STARTED:	29/03/2019
SGS ORDERNO:	524994
REISSUE COMMENT:	CHANGE OF ADDRESS
MARKS:	CONDITION OF SAMPLE : DELIVERED IN AN STERILIN/AMBER BOTTLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Faecal coliform count	ISO 9308-2:1990	13	MPN/100ml
Total coliform count	ISO 9308-2:1990	33	MPN/100ml
pH	APHA 4500 H+	7.87	
Fluoride (mg/l)	APHA 4500 F- C	0.18	mg/l
Sulphate as SO4	APHA-4500-S04 E	9.70	mg/l
Chloride	APHA-4500-CL E	6.41	mg/l
Nitrate as N	APHA-4500-NO3	1.24	mg/l
Nitrite as NO2	APHA-4500-NO2	<0.01	mg/l
Ammoniacal Nitrogen as N mg/l	APHA-4500- NH3 F	2.69	mg/l
Ammonia as NH3	APHA-4500-NH3 F	3.27	mg/l
Total Alkalinity	APHA 2320B	253.50	mg/l
Bicarbonate	APHA 2320 B	152.10	mg/l
Conductivity	SGS TW 15	567.69	µS/cm
Orthophosphate as H2PO4	APHA-4500-P G	1.17	mg/l
Dissolved Oxygen	APHA EXT	10.13	mg/l
Total Dissolved Solids	APHA 2540 C	369.00	mg/l
Total Suspended Solids	APHA 2540 D	6.00	mg/l
TPH C6 - C44	EPA 8015C	<100.00	µg/L
GRO (TPH C6 - C10)	EPA 8015C	<100.00	µg/L

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Mue Bahati-Chemist

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Date: 09/04/2019

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Analysis Report MA19-01403.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA19-01403.001 dated 08-04-19 issued by SGS ****

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	ECOLOGICS CONSULTANTS LTD
DATE SAMPLED:	25/03/2019
SAMPLING LOCATION:	MALMATE RIVER
SAMPLE RECEIVED:	28/03/2019
ANALYSIS STARTED:	29/03/2019
SGS ORDERNO:	524994
REISSUE COMMENT:	CHANGE OF ADDRESS
MARKS:	CONDITION OF SAMPLE : DELIVERED IN AN STERILIN/AMBER BOTTLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Polynuclear Aromatic Hydrocarbons in water	EPA 8270D		
Acenaphthene		<50.00	µg/L
Acenaphthylene		<50.00	µg/L
Anthracene		<50.00	µg/L
Benzo(a)anthracene		<50.00	µg/L
Benzo(a)pyrene		<50.00	µg/L
Benzo(b)fluoranthene		<50.00	µg/L
Benzo(g,h,i)perylene		<50.00	µg/L
Benzo(k)fluoranthene		<50.00	µg/L
Chrysene		<50.00	µg/L
Dibenz(a,h)anthracene		<50.00	µg/L
Fluoranthene		<50.00	µg/L
Fluorene		<50.00	µg/L
Indeno(1,2,3-cd)pyrene		<50.00	µg/L
Naphthalene		<50.00	µg/L
Phenanthrene		<50.00	µg/L
Pyrene		<50.00	µg/L
Volatile Organic Compounds in water	EPA 8260B		

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Walter Ogara - Multi-Lab Manager | David Omondi-Chemist | Mue Bahati-Chemist

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Analysis Report MA19-01403.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA19-01403.001 dated 08-04-19 issued by SGS ****

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	ECOLOGICS CONSULTANTS LTD
DATE SAMPLED:	25/03/2019
SAMPLING LOCATION:	MALMATE RIVER
SAMPLE RECEIVED:	28/03/2019
ANALYSIS STARTED:	29/03/2019
SGS ORDERNO:	524994
REISSUE COMMENT:	CHANGE OF ADDRESS
MARKS:	CONDITION OF SAMPLE : DELIVERED IN AN STERILIN/AMBER BOTTLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Volatile Organic Compounds in water	EPA 8260B		
Benzene		<10	µg/L
Toluene		<10	µg/L
Ethylbenzene		<10	µg/L
MTBE		<10	µg/L
Aluminium as Al	APHA 3120 B	199.00	µg/L
Arsenic as As	APHA 3120 B	<10.00	µg/L
Calcium as Ca	APHA 3120 B	31.64	mg/l
Magnesium as Mg	APHA 3120 B	11.54	mg/l
Sodium as Na	APHA 3120 B	11.11	mg/l
Potassium as K	APHA 3120 B	2.94	mg/l
Boron as B	APHA 3120 B	<5.00	µg/L
Barium as Ba	APHA 3120 B	90.00	µg/L
Cadmium as Cd	APHA 3120 B	<7.00	µg/L
Beryllium as Be	APHA 3120 B	<3.00	µg/L
Chromium as Cr	APHA 3120 B	<20.00	µg/L
Copper as Cu	APHA 3120 B	<10.00	µg/L
Iron as Fe	APHA 3120 B	190.00	µg/L
Manganese as Mn	APHA 3120 B	<10.00	µg/L

Authorised Signatory	*Technical Signatory*	*Technical Signatory*
Walter Ogara - Multi-Lab Manager	David Omondi-Chemist	Mue Bahati-Chemist

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Analysis Report MA19-01403.001 Re-issue: 1

**** This Amended Report cancels and supersedes the Report No.MA19-01403.001 dated 08-04-19 issued by SGS ****

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	ECOLOGICS CONSULTANTS LTD
DATE SAMPLED:	25/03/2019
SAMPLING LOCATION:	MALMATE RIVER
SAMPLE RECEIVED:	28/03/2019
ANALYSIS STARTED:	29/03/2019
SGS ORDERNO:	524994
REISSUE COMMENT:	CHANGE OF ADDRESS
MARKS:	CONDITION OF SAMPLE : DELIVERED IN AN STERILIN/AMBER BOTTLE
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Nickel as Ni	APHA 3120 B	<20.00	µg/L
Lead as Pb	APHA 3120 B	<4.00	µg/L
Selenium as Se	APHA 3120 B	<10.00	µg/L
Silica as Si	APHA 3120 B	12840.00	µg/L
Strontium as Sr	APHA 3120 B	210.00	µg/L
Tin as Sn	APHA 3120 B	<5.00	µg/L
Vanadium as V	APHA 3120 B	10.00	µg/L
Zinc as Zn	APHA 3120 B	<10.00	µg/L
Total Hardness	APHA 2340 B	126.51	mg/l
Mercury as Hg	COLD VAPOUR	<10.00	µg/L

End of Analytical Results

Authorised Signatory — Walter Ogara - Multi-Lab Manager

Technical Signatory — David Omondi-Chemist

Technical Signatory — Mue Bahati-Chemist

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Analysis Report MA21-01101.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER NGAMIA EAST
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride	APHA 4500 F- C	1.15	mg/l
Sulphate as SO4	APHA-4500-S04 E	37.60	mg/l
Chloride	APHA-4500-CL B	71.79	mg/l
Nitrate as NO3	APHA-4500-NO3 B	24.52	mg/l
Nitrite as NO2	APHA-4500-NO2 B	<0.01	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	0.08	mg/l
Total Alkalinity	APHA 2320B	374.07	mg/l
Bicarbonate	APHA 2320 B	170.09	mg/l
Total Dissolved Solids	APHA 2540 C	851.00	mg/l
Total Suspended Solids	APHA 2540 D	<5.00	mg/l
Calcium as Ca	APHA 3120 B	11.16	mg/l
Magnesium as Mg	APHA 3120 B	8.83	mg/l
Potassium as K	APHA 3120 B	3.69	mg/l
Sodium as Na	APHA 3120 B	189.48	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Barium as Ba	APHA 3120 B	0.02	mg/l
Boron as B	APHA 3120 B	0.11	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Caroline Chege-Chemist

Technical Signatory

Ednah Wambui-Chemist

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Date: 25/03/2021

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Analysis Report MA21-01101.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER NGAMIA EAST
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.24	mg/l
Total Hardness	APHA 2340 B	64.23	mg/l
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/l
Acenaphthylene		<0.10	mg/l
Anthracene		<0.10	mg/l
Benzo(a)anthracene		<0.10	mg/l
Benzo(a)pyrene		<0.10	mg/l
Benzo(b)fluoranthene		<0.10	mg/l
Benzo(g,h,i)perylene		<0.10	mg/l
Benzo(k)fluoranthene		<0.10	mg/l
Chrysene		<0.10	mg/l
Dibenz(a,h)anthracene		<0.10	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Caroline Chege-Chemist

Technical Signatory

Ednah Wambui-Chemist

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Analysis Report MA21-01101.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER NGAMIA EAST
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Fluoranthene		<0.10	mg/l
Fluorene		<0.10	mg/l
Indeno(1,2,3-cd)pyrene		<0.10	mg/l
Naphthalene		<0.10	mg/l
Phenanthrene		<0.10	mg/l
Pyrene		<0.10	mg/l
Boric Acid	CALCULATION	0.60	mg/l
Benzene	DIN 38407-9-1	<1	µg/L
Toluene	DIN 38407-9-1	2	µg/L
Ethylbenzene	DIN 38407-9-1	<1	µg/L
Xylene	DIN 38407-9-1	<2	µg/L

Authorised Signatory — Anselm Riungu - Technical Manager

Technical Signatory — Caroline Chege-Chemist

Technical Signatory — Ednah Wambui-Chemist

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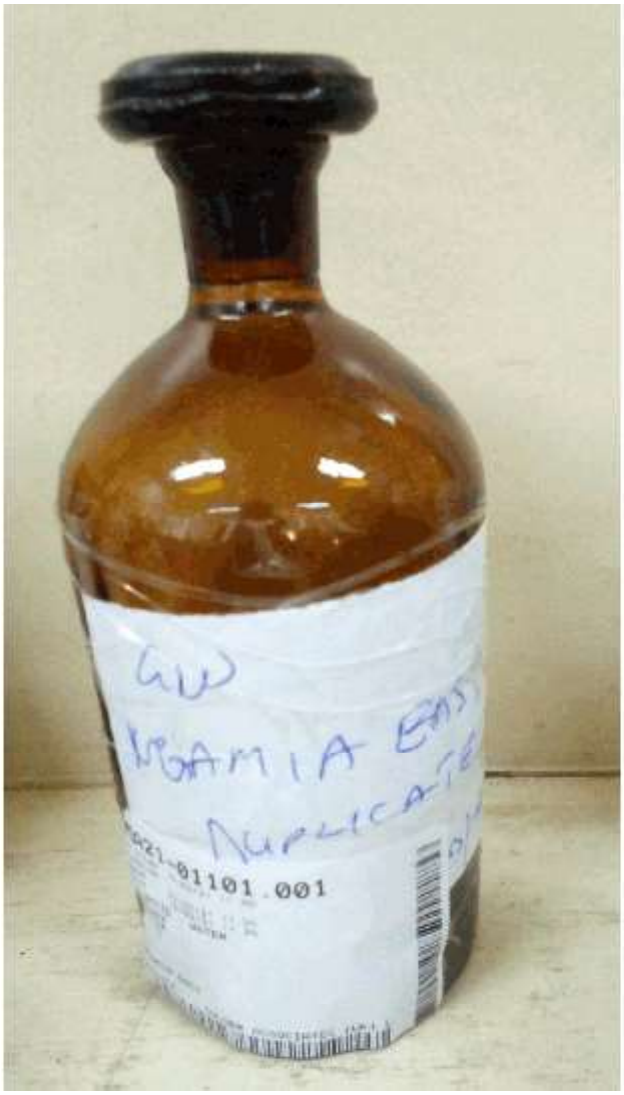

MA21-01101.001

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Caroline Chege-Chemist

Technical Signatory

Ednah Wambui-Chemist

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Date: 25/03/2021

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Analysis Report MA21-01101.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT:GROUND WATER GW5 LOPEROT
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Fluoride	APHA 4500 F- C	1.35	mg/l
Sulphate as SO4	APHA-4500-S04 E	36.50	mg/l
Chloride	APHA-4500-CL B	67.00	mg/l
Nitrate as NO3	APHA-4500-NO3 B	28.02	mg/l
Nitrite as NO2	APHA-4500-NO2 B	<0.01	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	0.03	mg/l
Total Alkalinity	APHA 2320B	247.70	mg/l
Bicarbonate	APHA 2320 B	150.36	mg/l
Total Dissolved Solids	APHA 2540 C	671.00	mg/l
Total Suspended Solids	APHA 2540 D	<5.00	mg/l
Calcium as Ca	APHA 3120 B	44.92	mg/l
Magnesium as Mg	APHA 3120 B	35.75	mg/l
Potassium as K	APHA 3120 B	1.49	mg/l
Sodium as Na	APHA 3120 B	75.48	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Barium as Ba	APHA 3120 B	0.02	mg/l
Boron as B	APHA 3120 B	0.06	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Caroline Chege-Chemist | Ednah Wambui-Chemist

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Date: 25/03/2021

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Analysis Report MA21-01101.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT:GROUND WATER GW5 LOPEROT
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.43	mg/l
Total Hardness	APHA 2340 B	259.39	mg/l
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Acenaphthene		<0.10	mg/l
Acenaphthylene		<0.10	mg/l
Anthracene		<0.10	mg/l
Benzo(a)anthracene		<0.10	mg/l
Benzo(a)pyrene		<0.10	mg/l
Benzo(b)fluoranthene		<0.10	mg/l
Benzo(g,h,i)perylene		<0.10	mg/l
Benzo(k)fluoranthene		<0.10	mg/l
Chrysene		<0.10	mg/l
Dibenz(a,h)anthracene		<0.10	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Caroline Chege-Chemist | Ednah Wambui-Chemist

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Date: 25/03/2021

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CAVENDISH HOUSE
BUCKINGHAMSHIRE
BOURNE END BUSINESS PARK,
UNITED KINGDOM
SL8

Analysis Report MA21-01101.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	25/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT:GROUND WATER GW5 LOPEROT
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Polycyclic Aromatic Hydrocarbons	EPA 8270D		
Fluoranthene		<0.10	mg/l
Fluorene		<0.10	mg/l
Indeno(1,2,3-cd)pyrene		<0.10	mg/l
Naphthalene		<0.10	mg/l
Phenanthrene		<0.10	mg/l
Pyrene		<0.10	mg/l
Boric Acid	CALCULATION	0.35	mg/l
Benzene	DIN 38407-9-1	<1	µg/L
Toluene	DIN 38407-9-1	10	µg/L
Ethylbenzene	DIN 38407-9-1	<1	µg/L
Xylene	DIN 38407-9-1	<2	µg/L

Authorised Signatory — Anselm Riungu - Technical Manager

Technical Signatory — Caroline Chege-Chemist

Technical Signatory — Ednah Wambui-Chemist

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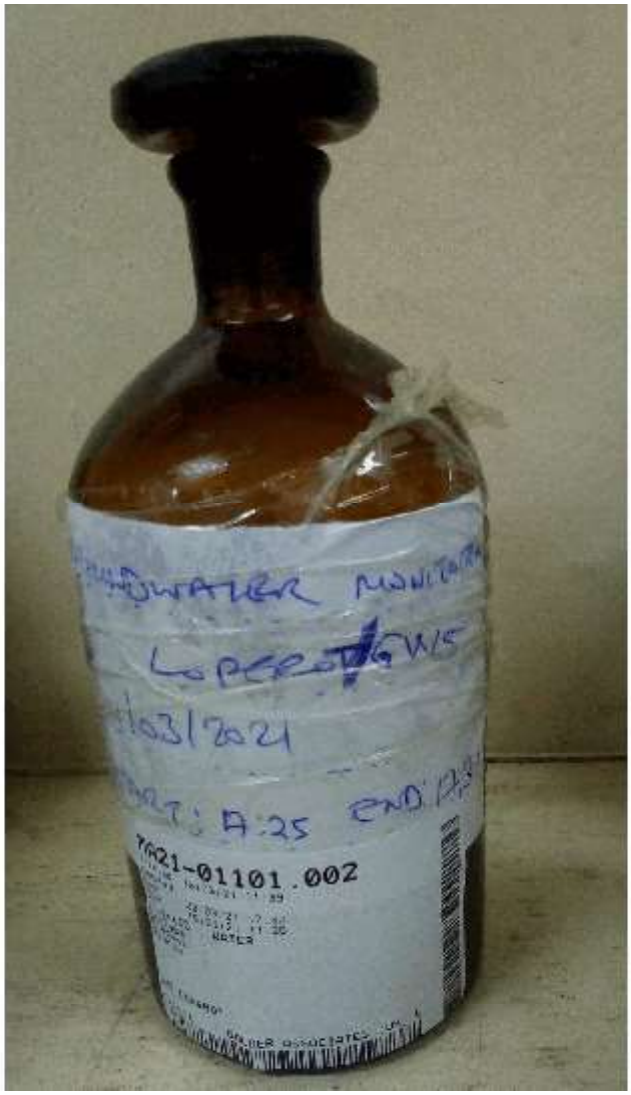

MA21-01101.002

End of Analytical Results

Authorised Signatory	*Technical Signatory*	*Technical Signatory*
Anselm Riungu - Technical Manager	Caroline Chege-Chemist	Ednah Wambui-Chemist

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Member of the SGS Group (Société Générale de Surveillance)

Date: 22/03/2021

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SL8

Analysis Report MA21-01102.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER EAST LOKICHAR 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total Suspended Solids	APHA 2540 D	<5.00	mg/l
Total Dissolved Solids	APHA 2540 C	505.00	mg/l
Fluoride	APHA 4500 F- C	1.00	mg/l
Nitrate as NO3	APHA-4500-NO3 B	32.42	mg/l
Nitrite as NO2	APHA-4500-NO2 B	<0.01	mg/l
Sulphate as SO4	APHA-4500-S04 E	18.60	mg/l
Chloride	APHA-4500-CL B	34.70	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	5.60	mg/l
Alkalinity as CaCO3	EPA 310.2	242.60	mg/l
Bicarbonate	APHA 2320 B	187.00	mg/l
Total Hardness	APHA 2340 B	100.07	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Calcium as Ca	APHA 3120 B	19.89	mg/l
Magnesium as Mg	APHA 3120 B	12.24	mg/l
Potassium as K	APHA 3120 B	4.79	mg/l
Sodium as Na	APHA 3120 B	109.14	mg/l
Barium as Ba	APHA 3120 B	0.01	mg/l

Authorised Signatory — Anselm Riungu - Technical Manager

Technical Signatory — Florah Mshimba-Chemist

Technical Signatory — Stephen Musyoka-Chemist

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Date: 22/03/2021

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BOURNE END BUSINESS PARK,
UNITED KINGDOM
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Analysis Report MA21-01102.001

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER EAST LOKICHAR 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Boron as B	APHA 3120 B	0.10	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.36	mg/l
Boric Acid	CALCULATION	0.60	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Florah Mshimba-Chemist

Technical Signatory

Stephen Musyoka-Chemist

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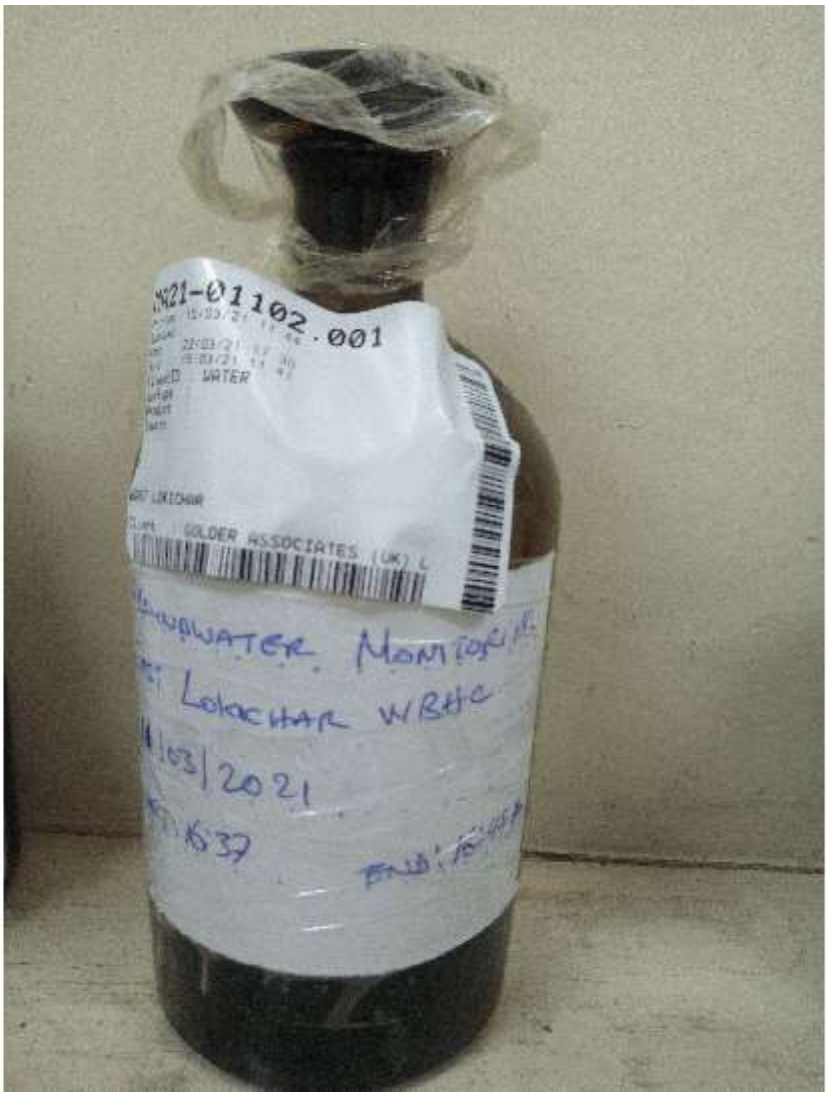

MA21-01102.001

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Florah Mshimba-Chemist | Stephen Musyoka-Chemist

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Date: 22/03/2021

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Analysis Report MA21-01102.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: SURFACE WATER SW1 KALAPATA 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total Suspended Solids	APHA 2540 D	5.00	mg/l
Total Dissolved Solids	APHA 2540 C	266.00	mg/l
Fluoride	APHA 4500 F- C	0.61	mg/l
Nitrate as NO3	APHA-4500-NO3 B	38.26	mg/l
Nitrite as NO2	APHA-4500-NO2 B	3.30	mg/l
Sulphate as SO4	APHA-4500-S04 E	8.40	mg/l
Chloride	APHA-4500-CL B	11.96	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	0.53	mg/l
Alkalinity as CaCO3	EPA 310.2	121.52	mg/l
Bicarbonate	APHA 2320 B	91.18	mg/l
Total Hardness	APHA 2340 B	103.07	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Calcium as Ca	APHA 3120 B	34.75	mg/l
Magnesium as Mg	APHA 3120 B	3.96	mg/l
Potassium as K	APHA 3120 B	7.28	mg/l
Sodium as Na	APHA 3120 B	37.41	mg/l
Barium as Ba	APHA 3120 B	0.03	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Florah Mshimba-Chemist | Stephen Musyoka-Chemist

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Date: 22/03/2021

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Analysis Report MA21-01102.002

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: SURFACE WATER SW1 KALAPATA 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Boron as B	APHA 3120 B	0.05	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.42	mg/l
Boric Acid	CALCULATION	0.30	mg/l

Authorised Signatory — Anselm Riungu - Technical Manager

Technical Signatory — Florah Mshimba-Chemist

Technical Signatory — Stephen Musyoka-Chemist

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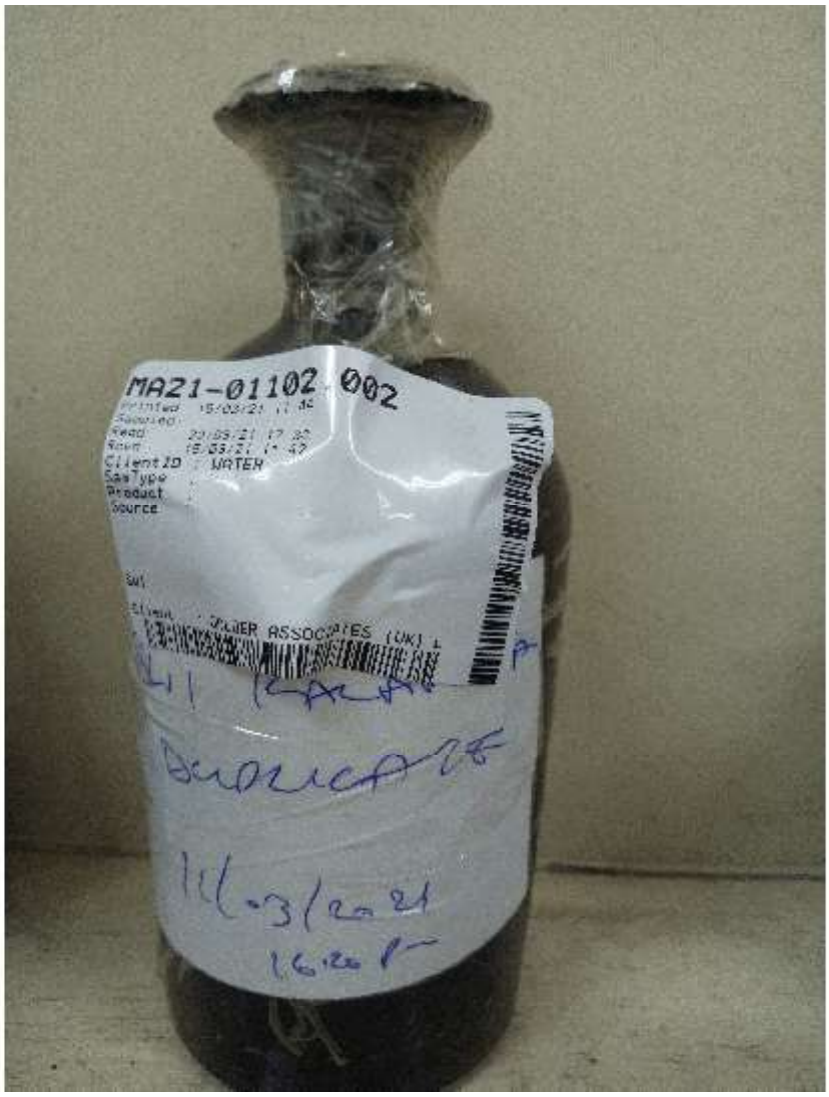

MA21-01102.002

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Florah Mshimba-Chemist | Stephen Musyoka-Chemist

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Date: 22/03/2021

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Analysis Report MA21-01102.003

PRODUCT DESCRIPTION: WATER
SAMPLED BY: CLIENT
SAMPLE RECEIVED: 15/03/2021
ANALYSIS STARTED: 15/03/2021
ANALYSIS COMPLETED: 22/03/2021
SGS ORDERNO: 5000266
MARKS: CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES
PRODUCT: GROUND WATER
NAKUKULAS 10
11/02/2021
REPORT COMMENTS: This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total Suspended Solids	APHA 2540 D	<5.00	mg/l
Total Dissolved Solids	APHA 2540 C	382.00	mg/l
Fluoride	APHA 4500 F- C	0.79	mg/l
Nitrate as NO3	APHA-4500-NO3 B	14.30	mg/l
Nitrite as NO2	APHA-4500-NO2 B	<0.01	mg/l
Sulphate as SO4	APHA-4500-S04 E	8.00	mg/l
Chloride	APHA-4500-CL B	10.77	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	8.48	mg/l
Alkalinity as CaCO3	EPA 310.2	204.14	mg/l
Bicarbonate	APHA 2320 B	148.54	mg/l
Total Hardness	APHA 2340 B	152.82	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Calcium as Ca	APHA 3120 B	31.83	mg/l
Magnesium as Mg	APHA 3120 B	17.81	mg/l
Potassium as K	APHA 3120 B	1.90	mg/l
Sodium as Na	APHA 3120 B	66.07	mg/l
Barium as Ba	APHA 3120 B	0.02	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Florah Mshimba-Chemist | Stephen Musyoka-Chemist

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Date: 22/03/2021

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UNITED KINGDOM
SL8

Analysis Report MA21-01102.003

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER NAKUKULAS 10 11/02/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Boron as B	APHA 3120 B	0.04	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.52	mg/l
Boric Acid	CALCULATION	0.21	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Florah Mshimba-Chemist

Technical Signatory

Stephen Musyoka-Chemist

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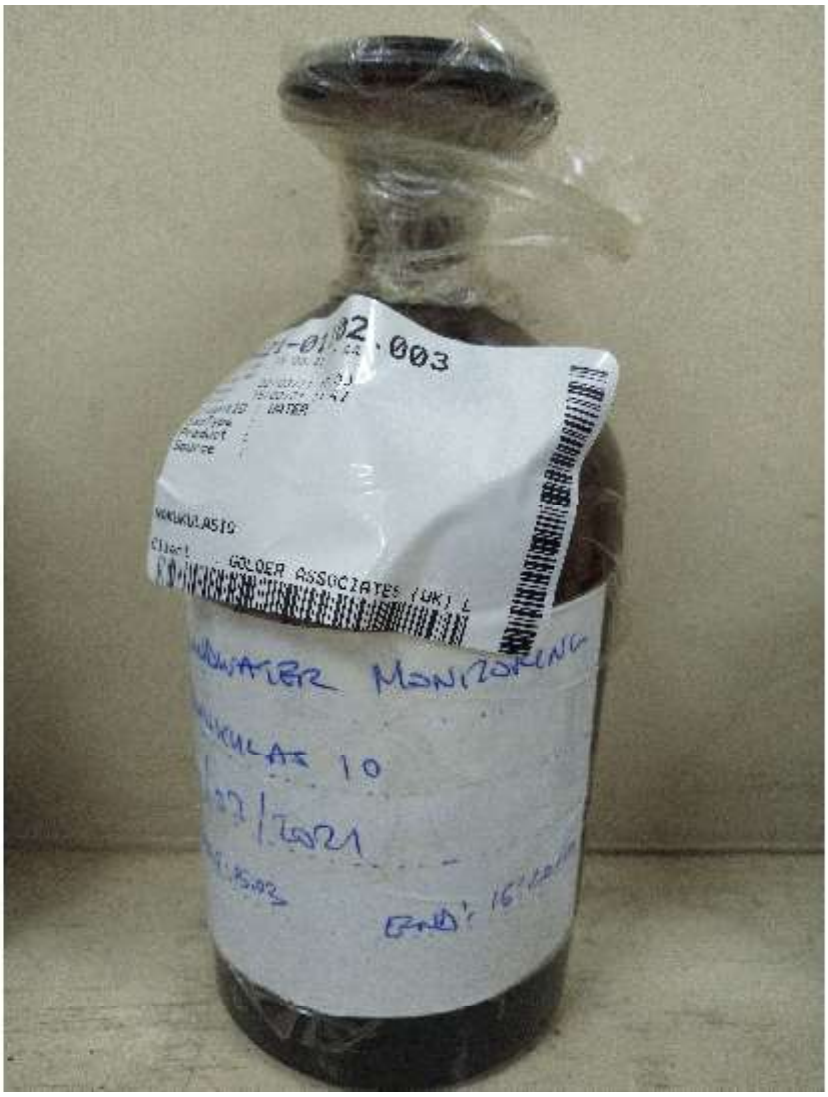

MA21-01102.003

Authorised Signatory	*Technical Signatory*	*Technical Signatory*
Anselm Riungu - Technical Manager	Florah Mshimba-Chemist	Stephen Musyoka-Chemist

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SGS Kenya Ltd.

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Date: 22/03/2021

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UNITED KINGDOM
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Analysis Report MA21-01102.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER GW1 KAPESE 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total Suspended Solids	APHA 2540 D	<5.00	mg/l
Total Dissolved Solids	APHA 2540 C	377.00	mg/l
Fluoride	APHA 4500 F- C	1.01	mg/l
Nitrate as NO3	APHA-4500-NO3 B	25.38	mg/l
Nitrite as NO2	APHA-4500-NO2 B	<0.01	mg/l
Sulphate as SO4	APHA-4500-S04 E	15.50	mg/l
Chloride	APHA-4500-CL B	20.34	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	5.29	mg/l
Alkalinity as CaCO3	EPA 310.2	171.72	mg/l
Bicarbonate	APHA 2320 B	121.16	mg/l
Total Hardness	APHA 2340 B	182.60	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Calcium as Ca	APHA 3120 B	44.13	mg/l
Magnesium as Mg	APHA 3120 B	17.58	mg/l
Potassium as K	APHA 3120 B	5.29	mg/l
Sodium as Na	APHA 3120 B	45.25	mg/l
Barium as Ba	APHA 3120 B	0.03	mg/l

Authorised Signatory | *Technical Signatory* | *Technical Signatory*

Anselm Riungu - Technical Manager | Florah Mshimba-Chemist | Stephen Musyoka-Chemist

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Analysis Report MA21-01102.004

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT: GROUND WATER GW1 KAPESE 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Boron as B	APHA 3120 B	0.07	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.64	mg/l
Boric Acid	CALCULATION	0.42	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Florah Mshimba-Chemist

Technical Signatory

Stephen Musyoka-Chemist

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MA21-01102.004

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Anselm Riungu - Technical Manager	Florah Mshimba-Chemist	Stephen Musyoka-Chemist

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Analysis Report MA21-01102.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT:SURFACE WATER SW2 KALAPATA 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Total Suspended Solids	APHA 2540 D	6.00	mg/l
Total Dissolved Solids	APHA 2540 C	275.00	mg/l
Fluoride	APHA 4500 F- C	0.20	mg/l
Nitrate as NO3	APHA-4500-NO3 B	58.24	mg/l
Nitrite as NO2	APHA-4500-NO2 B	1.24	mg/l
Sulphate as SO4	APHA-4500-S04 E	12.30	mg/l
Chloride	APHA-4500-CL B	11.96	mg/l
Orthophosphate as H2PO4	APHA-4500-P G	2.28	mg/l
Alkalinity as CaCO3	EPA 310.2	103.89	mg/l
Bicarbonate	APHA 2320 B	48.29	mg/l
Total Hardness	APHA 2340 B	160.24	mg/l
Aluminium as Al	APHA 3120 B	<0.05	mg/l
Arsenic as As	APHA 3120 B	<0.01	mg/l
Calcium as Ca	APHA 3120 B	53.06	mg/l
Magnesium as Mg	APHA 3120 B	6.74	mg/l
Potassium as K	APHA 3120 B	9.25	mg/l
Sodium as Na	APHA 3120 B	12.22	mg/l
Barium as Ba	APHA 3120 B	0.09	mg/l

Authorised Signatory — Anselm Riungu - Technical Manager

Technical Signatory — Florah Mshimba-Chemist

Technical Signatory — Stephen Musyoka-Chemist

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Date: 22/03/2021

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Analysis Report MA21-01102.005

PRODUCT DESCRIPTION:	WATER
SAMPLED BY:	CLIENT
SAMPLE RECEIVED:	15/03/2021
ANALYSIS STARTED:	15/03/2021
ANALYSIS COMPLETED:	22/03/2021
SGS ORDERNO:	5000266
MARKS:	CONDITION OF SAMPLE: DELIVERED IN AMBER GLASS BOTTLES PRODUCT:SURFACE WATER SW2 KALAPATA 11/03/2021
REPORT COMMENTS:	This report refers to a submitted sample and all details in respect of source; quantities; marks are not verified or confirmed.

TESTS	METHOD	RESULT	UNITS
Boron as B	APHA 3120 B	0.07	mg/l
Chromium as Cr	APHA 3120 B	<0.02	mg/l
Copper as Cu	APHA 3120 B	<0.01	mg/l
Iron as Fe	APHA 3120 B	<0.02	mg/l
Lead as Pb	APHA 3120 B	<0.004	mg/l
Manganese as Mn	APHA 3120 B	<0.01	mg/l
Selenium as Se	APHA 3120 B	<0.01	mg/l
Zinc as Zn	APHA 3120 B	<0.01	mg/l
Strontium as Sr	APHA 3120 B	0.77	mg/l
Boric Acid	CALCULATION	0.42	mg/l

Authorised Signatory

Anselm Riungu - Technical Manager

Technical Signatory

Florah Mshimba-Chemist

Technical Signatory

Stephen Musyoka-Chemist

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MA21-01102.005

End of Analytical Results

Authorised Signatory	*Technical Signatory*	*Technical Signatory*
Anselm Riungu - Technical Manager	Florah Mshimba-Chemist	Stephen Musyoka-Chemist

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Water Quality

C3

2 Field Parameters Data - Water Quality

Field Parameters 23 and 27 of November 2015

Parameter	Locations				
	GW1	GW2	GW3	GW4	GW5
Temp (° C)	39.1	34.7	35.2	31.6	34.5
DO (%)	16	10.7	31	34.1	23.7
DO (mg/l)	1.15	0.7	1.9	2	1.65
pH	7.73	7.96	7.7	6.6	7.39
ORP (mV)	-172.1	-203.9	-166.8	-120.7	-141.5
Conductivity (µS/cm)	910	1317	1663	890	924

Field Parameters 25 May and 1 June 2016

Parameter	Locations				
	SW1	SW3	GW1	GW3	GW5
Temp (° C)	30.1	28.7	34.6	34.7	34.2
DO (ppm)	2.02	5.02	5.51	3.66	3.11
pH	7.37	7.85	7.89	7.92	7.34
ORP (mV)	77.6	62.3	81.9	62.0	149.3
Conductivity (µS/cm)	575	273.5	955	1399	1083

Field Parameters 24 and 31 August 2016

Parameter	Locations				
	GW1	GW2	GW3	GW4	GW5
Temp (° C)	34.5	Pump removed	34.7	29.7	33.1
pH	7.95		8.92	8.59	7.41
Conductivity (µS/cm)	721		1248	525	928
TDS (mg/l)	360		625	263	465

Field Parameters September 2018 and March 2019

Parameter	Locations		
	Turkwel (13 March)	**Malmalte (September 2018)**	**Malmalte - Kainuk (17 March)**
Temp (° C)	23.0	27.2	23.3
DO (ppm)	7.06	No measurement	6.82
DO (mg/l)	No measurement	7.73	No measurement
SPC (uS/cm)	20.7	No measurement	19.8
EC (uS/cm)	19.8	200	19.2
pH	7.07	8.67	6.81
ORP (mV)	+191.4	No measurement	+187.4

Field Parameters 11 of March 2021

Parameter	Locations						
	GW1	**GW2**	**GW4**	**GW5**	**Nakukulas 10**	**SW1**	**SW2**
Temp (° C)	34.76	34.30	32.13	34.09	34.10	33.2	30.94
pH	6.85	6.97	6.59	6.88	7.02	7.10	7.29
Conductivity (µS/cm)	1032	1329	636	1174	699	631	628

Water Quality

C3

3 Groundwater quality baseline data

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	East Lokichar C	East Lokichar C	East Lokichar C	East Lokichar C	East Lokichar C	27/11/2015	East Lokichar C	East Lokichar C	GW1	East Lokichar C	GW1	East Lokichar C	East Lokichar C	East Lokichar C	East Lokichar C	East Lokichar C	East Lokichar C	Kaimegur A	Kaimegur A	Kaimegur A	Kaimegur A	East Lokichar	Number of Analyses	Number of Analyses with Numerical Result	Result		
			Min	Max	Source	Sample ID	EL-C	3		3-OCT-15	1/NOV/2015	GW1	6-DEC-15	AQ 47836b		AQ 48446b		AQ 48993	AQ 49750	Kapese lab	SGS	SGS (03805.003)	SGS LE-C	(SGS MA18-00633.003)	East Lokichar BH	(SGS MA18-04598.0	MA18-05094.007	MA18-05739.005	MA19-00061.005	MA21-01102.001			Min	Mean	Max
						Date	11/08/2014	26/07/2015	21/09/2015	02/11/2015	26/11/2015	27/11/2015	30/12/2015	08/04/2016	28/05/2016	15/06/2016	29/08/2016	30/08/2016	31/10/2016	01/02/2017	01/04/2017	16/08/2017	04/10/2017	09/02/2018	01/05/2018	27/06/2018	01/09/2018	01/10/2018	30/11/2018	01/12/2018	11/03/2021					
Major Ions																																	
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		16.9	20.14	18.95	14.12	17.7	10.32	6.53	2.58	28.05	7.66	20.41	8.29	1.58		17.61	18.99	24.28	17.89	24.86	21.15	17.66	17.7	14.28	11.49	19.89	24	24	1.58	15.79	28.05
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		10.9	11.82	11.26	9.38	11.02	7.52	8.15	2.58	11.49	1.6	11.02	11.64	2.43		10.78	12.3	13.8	11.29	12.66	11.04	10.86	11.2	9.34	7.65	12.24	24	24	1.6	9.75	13.8
Potassium	mg/l	0.1		No project standard			3.2	3.63	3.88	3.48	3.65	2.16	2.56	2.35	4.93	7.03	3.82	4.21	3.06	3	3.35	3.41	3.66	3.41	4.06	3.98	3.19	3.87	3.3	2.66	4.79	25	25	2.16	3.63	7.03
Sodium	mg/l	0.1		50	WHO DWS		128	125.94	109.23	121.57	116.47	265.72	315.62	328	146.42	6.42	132.68	339	25.17		117.4	147.83	222.04	90.1	137.2	127.8	104.86	107.05	75.65	54.73	109.14	24	24	6.42	143.92	339
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water			1.08	0.79	0.66	1.2	0.54	1.3	1.4	0.76	1.07	1.71	<	<	0.94	0.55	1.02	1.1	0.87	0.84	0.09	1.35	1.27	0.71	0.89	0.9979	24	22	0.09	0.96	1.71
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		17	19.14	19.1	18	16.05	11.87	21.8	15.89	17.86	7.28	21.33	23.5	3.23	20	18.34	20.58	27.99	17.29	20.7	22.43	24.49	19.35	32.1	24.28	18.6	25	25	3.23	19.13	32.1
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		34	38	33.75	34.32	41.49	>30	26.59	87.5	243.65	55.3	29.01	50.14	35.39	32	27.34	27.2	34.6	30.37	30.32	30.86	28.93	28.93	72.34	29.78	34.7	25	24	26.59	46.52	243.65
Alkalinity (HCO3)	mg/l	1		No project standard																											1	1	187	187	187
Nutrients																																	
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		<0.5	Nil	Not detected	Nil	Nil	0.01	Nil	1.25	0.75	0.56	0.87	13.02	0.85	0.62	<0.02	0.02	0.01	0.12	0.03	0.49	3.55	3.34	1.08	<0.02	5.6	25	17	0.01	1.89	13.02
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (Water Quality Regulat		28	22.6	2.51	59.5	17.5	1.2	18	2.9	4.07	2.94	2.13	43.75	31.47	Nil	4.55	1.99	1.34	42.36	38.63	45	20.25	40.21	8.6	5.73	32.42	25	24	1.2	19.90	59.5
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			<	<	3	<	<	<	<0.001	<	<0.001	0.05	<0.001	<0.01	0.01	Nil	0.08	0.2	Not detected	not detected	not detected	Not detected	Not detected	0.033	Not detected	<0.01	24	6	0.01	0.56	3
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.05	0.07	0.06	0.05		0.04	<0.001		<0.001		<0.001	<0.001	0.04	0.02	0.03	0.08	0.03	<0.02	12.26	0.42	0.21	2.18	<0.1		20	14	0.02	1.11	12.26
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water							0.41			3.45		0.03														3	1	0.03	1.30	3.45
Physico-chemical																																	
Total Alkalinity as CaCO3	mg/l	1		No project standard				290	290	244	270	250	550	172	80	211	100	516	148.68	285	400	357.3	379.25	287	418.8	392.63	365.04	395.46	304.2	242.6	24	24	80	302.22	550
Electrical Conductivity	mS/cm	2		No project standard				0.72	0.749	0.666	0.657	0.814	1.086	0.7	1.061	0.77	0.831	0.7	0.7		0.972	0.844	0.841	0.832	0.914	1.034	1.057	0.64848	0.926	1.063		22	22	0.64848	0.84	1.086
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental Management and Co		8.3	7.71	7.75	7.56	7.57	8.39	7.89	8.49	7.84	7.72	7.73	8.02	7.77		8.12	7.56	7.83	7.78	7.84	7.42	7.68	7.67	7.56	7.44		23	23	7.42	7.81	8.49
Redox (Eh)	mV	not specified			No project standard																										0	0			
Temprature	°C	0.5			No project standard							26.4			25.1		23.7														3	3	23.7	25.07	26.4
Dissolved Oxygen	mg/l	1			No project standard							3.14			7.06		7.8														3	3	3.14	6.00	7.8
TDS	mg/l	35		1000	KEBS requirements for drinking water		595	468	486.85	432.9	427	569.8	705.9	350	690.08	386	540	350	350		631.8	476	484	541	526	594	611	380	602	691	505	24	24	350	516.39	705.9
TSS	mg/l	10		0	KEBS requirements for drinking water			Not detectable	Detectable	Not detectable	Not detectable	Not detectable	Not detectable	Not detectable	8	2	Nil	3	Nil	Nil		Not detected	Not detected	Not detected	Not detected	7.84	Not detected	Not detected	Not detected	Not detected	Not detected	23	4	2	5.21	8
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water			98.98	73.87	73.87	89.58	56.73	49.85	15.98	117.34	26	96.36	68	13.95	85	88.35	98.6	117.46	91.18	117.2	98.29	88.8	90.31	74.15	60.17	100.07	23	23	13.95	78.97	117.46
Silica	mg/l	0.01		No project standard			26	15.71	15.19	20.21	2.15	2.24	3.02	<0.001	24.85	<0.001	2.33	<0.001		Nil	2.08	11.76	24.94	21.29	22.75	18.43	18.93	21.39	16.78	14.18		23	19	2.08	14.96	26
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02		<0.02	0.014		0.04		0.015	0.01		<0.02	<0.02	<0.02	<0.02	absent	Absent	Absent	Absent	<0.02	<0.02		19	4	0.01	0.02	0.04
Organics and Oils																																	
TPH CWG - Aliphatics																																	
>C5-C6 [#]	mg/l	0.005		No project standard																											0	0			
>C6-C10 [#]	mg/l	0.005		No project standard																											0	0			
>C6-C8 [#]	mg/l	0.005		No project standard																											0	0			
>C10-C12 [#]	mg/l	0.005		No project standard																											0	0			
>C12-C16 [#]	mg/l	0.01		No project standard																											0	0			
>C16-C21 [#]	mg/l	0.01		No project standard																											0	0			
>C21-C35 [#]	mg/l	0.01		No project standard																											0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard																											0	0			
TPH CWG - Aromatics																																	
>C5-EC7 [#]	mg/l	0.005		No project standard																											0	0			
>EC7-EC8 [#]	mg/l	0.005		No project standard																											0	0			
>EC8-EC10 [#]	mg/l	0.005		No project standard																											0	0			
>EC10-EC12 [#]	mg/l	0.005		No project standard																											0	0			
>EC12-EC16 [#]	mg/l	0.01		No project standard																											0	0			
>EC16-EC21 [#]	mg/l	0.01		No project standard																											0	0			
>EC21-EC35 [#]	mg/l	0.01		No project standard																											0	0			
Total aromatics C5-35	mg/l	0.01		No project standard																											0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard								<0.01					0.67														2	1	0.67	0.67	0.67
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water							<0.01			<0.01		0.02														3	1	0.02	0.02	0.02
Toluene	mg/l	0.0005		0.7	WHO DWS							<0.01			<0.01		0.03														3	1	0.03	0.03	0.03
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS							<0.01			<0.01		<0.01														3	0			
Xylene (total)	mg/l			0.5	WHO DWS							<0.01																			1	0			
m/p-Xylene	mg/l	not analysed		No project standard																											0	0			
o-Xylene	mg/l	not analysed		No project standard																											0	0			
Polyaromatic Hydrocarbons																																	
Naphthalene	mg/l	0.00001		No project standard								<0.01			<0.01		0.01														3	1	0.01	0.01	0.01
Acenaphthylene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Acenaphthene	mg/l	0.00001		No project standard								<0.01			0.04		<0.01														3	1	0.04	0.04	0.04
Fluorene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Phenanthrene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Fluoranthene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Pyrene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Chrysene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.02														3	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS							<0.01			<0.01		<0.01														3	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01														3	0			
Inorganics and Trace Metals																																	
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.3	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.001	<0.04	0.2	<0.04	<0.001	0.1	Nil	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	25	2	0.1	0.15	0.2
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01	Nil	Not detected	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	24	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		<0.1	<0.002	<0.002	<0.002	<0.002	0.01	<0.002	<0.001	0.01	<0.001	<0.002	<0.001	<0.01		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.01	<0.004	<0.004	0.01	24	4	0.01	0.01	0.01
Beryllium	mg/l	0.005		No project standard								<0.0003			<0.003		<0.003														3	0			
Boron	mg/l	0.002		2.4	WHO DWS							<0.005			0.09		<0.005				0.11		0.1							0.1	6	4	0.09	0.10	0.11
Boron as boric acid	mg/l	0.001		0.3	KEBS requirements for drinking water		<0.5	<0.005	0.06		0.08		0.24	<0.001		<0.001		<0.001	<0.01	0.19	0.61	Not detected	Nil	0.59	Nil	Nil	Nil	Nil	Nil	Nil	0.6	21	7	0.06	0.34	0.61
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001		<0.001	<0.001		<0.001		<0.001	<0.001		<0.001	<0.001	0.04	<0.001	Nil		<0.001	To follow			15	1	0.04	0.04	0.04
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected		22	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.001	<0.007	<0.001	<0.007	<0.001	<0.01	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	24	1	0.02	0.02	0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regulat		<0.2	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.26	<0.006	0.41	<0.006	<0.001	<0.01	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25	3	0.08	0.25	0.41
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil	Nil	Nil	<0.001		<0.001		<0.001	<0.001		Nil	Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	19	0			
Iron (Ferrous)	mg/l	0.00002		No project standard																											0	0			
Iron (Feric)	mg/l	0.00002		No project standard																											0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.1	<0.007	<0.007	0.02	<0.007	<0.007	<0.007	0.19	0.02	0.22	<0.007	0.01	0.08	0.23	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	25	7	0.01	0.11	0.23
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	<0.004	Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	23	0			
Lithium	mg/l	0.004		No project standard			<0.05	<0.004	<0.002	<0.004	<0.004		<0.004	<0.001		<0.001		<0.001	<0.001		<0.004	<0.004	<0.004	<0.004	<0.004	<11.04	<0.004	<0.004	<0.004	<0.004		20	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.14	<0.002	0.62	<0.002	0.15	0.02	0.08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25	5	0.02	0.20	0.62
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	Not detected	Not detected	Not detected	not detected	Not detected	Not detected	Not detected	Not detected	Not detected		22	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.001	<0.015	<0.001	<0.015	<0.001	<0.01	Nil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		23	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001	<0.01		Not detected	Not detected	Not detected	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	23	1	0.02	0.02	0.02
Vanadium	mg/l	0.0006		No project standard								0.04			0.02		0.03														3	3	0.02	0.03	0.04
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (Water Quality Regulat		<0.05	<0.002	0.04	0.02	<0.002	<0.002	0.01	1.58	0.02	<0.001	0.01	<0.001	0.21	Nil	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25	7	0.01	0.27	1.58
Strontium	mg/l	0.005		No project standard			0.3	0.35	0.34	0.26	<0.005	0.21	0.23	<0.001	0.35	<0.001	0.34	<0.001	<0.01		0.34	0.33	0.39	0.33	0.37	0.34	0.33	0.33	0.27	0.24	0.36	24	19	0.21	0.32	0.39
Sanitary																																	
BOD	mg/l	1		No project standard								3.26			28.16		28.6														3	3	3.26	20.01	28.6
COD	mg/l	7		No project standard								8.76			49.76		54.61														3	3	8.76	37.71	54.61
Total nitrogen	mg/l	0.5		No project standard								0.22			3.07		1.23														3	3	0.22	1.51	3.07
Total phosphorous	mg/l	0.5		No project standard								0.01			0.03		<0.01														3	2	0.01	0.02	0.03
Total coliform bacteria	MPN/100ml	not specified		No project standard								33			1600		17														3	3	17	550.00	1600
Fecal coliforms	MPN/100ml	not specified		No project standard								<			1600		7														3	2	7	803.50	1600

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Ngamia East	GW2	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Ngamia East	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID								NG.E (SGS MA18-00633.002)	MA18-02360.002	MA18-0285233.002)	(SGS MA18-04598.007)	MA18-050948.009	MA18-05739.003	MA19-00061.004	MA21-01101.001					
			Min	Max	Source	Date	17/02/2015	26/07/2015	21/09/2015	27/10/2015	27/11/2015	27/11/2015	30/12/2015	09/02/2018	09/03/2018	09/04/2018	01/09/2018	01/10/2018	01/11/2018	01/12/2018	11/03/2021			Min	Mean	Max
Major Ions																									
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		5.52	11.02	9.79	10.65	11.22	6.54	31.6	7.03	13.13	6.44	22.27	9.73	7.98	6.6	11.16	15	15	5.52	11.38	31.6
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		6.14	8.17	7.79	8.46	8.3	7.8	17.33	6.82	9.27	6.08	14.72	8.65	6.79	5.81	8.83	15	15	5.81	8.73	17.33
Potassium	mg/l	0.1		No project standard				2.08	2.3	2.2	2.18	2.59	1.55	1.97	2.02	2.41	1.24	2.4	1.87	1.48	3.69	14	14	1.24	2.14	3.69
Sodium	mg/l	0.1		50	WHO DWS			237.57	212.68	224.18	214.19	376.85	65.15	157.13	160.7	170.56	52.63	123.47	79.25	83.66	189.48	14	14	52.63	167.68	376.85
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		1.11	1.2	0.9	0.63	0.82	0.41	0.83	0.97	0.68	1.18	1.13	1.41	0.98	0.96	1.15	15	15	0.41	0.96	1.41
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		44	37.46	38.3	30	34.57	8.43	5.4	26.55	23.3	35.4	6.79	20.79	41.16	28.61	37.6	15	15	5.4	27.89	44
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		102.73	66.5	72.32	56.58	67.89	>30	8.86	54.96	48.9	64.12	5.1	53.6	75.3	46.79	71.79	15	14	5.1	56.82	102.73
Alkalinity (HCO3)	mg/l	1		No project standard																	170.09	1	1	170.09	170.09	170.09
Nutrients																										
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water							0.03		0.09	0.06	0.77	5.3	2.79	2.18	0.18	0.08	9	9	0.03	1.28	5.3
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (Water Quality Regulati		12.2	3.2	47.7	9.9	1.4	12.9	35.77	31.98	6.44	10.3	22.15	6.39	6.89	24.52		14	14	1.4	16.55	47.7
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			<	<	<	<	0.08	<	Not detected	Not detected	Not detected	Not detected	0.04	0.103	Not detected	<0.01	14	3	0.04	0.07	0.103
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.06	0.9	0.01	0.07		0.04	0.04	0.02	12.01	0.34	0.27	2.12	<0.1		12	11	0.01	1.44	12.01
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water							0.96										1	1	0.96	0.96	0.96
Physico-chemical																										
Total Alkalinity as CaCO3	mg/l	1		No project standard				430	430	350	480	350	230	430.5	602.03	575.85	324.48	425.88	446.16	507	374.07	14	14	230	425.43	602.03
Electrical Conductivity	mS/cm	2		No project standard				1.073	1.128	1.032	0.994	1.201	0.448	1.117	0.69	1.313	0.763	0.927	1.326	1.428		13	13	0.448	1.03	1.428
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.76	7.91	7.87	7.74	7.81	8.75	7.84	8.14	7.79	8.07	7.56	7.95		7.92		13	13	7.56	7.93	8.75
Redox (Eh)	mV	not specified		No project standard																		0	0			
Temperature	°C	0.5		No project standard								26.3										1	1	26.3	26.30	26.3
Dissolved Oxygen	mg/l	1		No project standard								2.45										1	1	2.45	2.45	2.45
TDS	mg/l	35		1000	KEBS requirements for drinking water		852	697.45	733.2	670.8	646.1	840.7	291.2	726	407	762	446	539	862	925	851	15	15	291.2	683.30	925
TSS	mg/l	10		0	KEBS requirements for drinking water			Not detectable	Detectable	Not detectable	Not detectable		Not detectable	Not detectable	Not detectable	Detectable	Not detected	Detectable	Not detected	Not detected	3	13	1	3	3.00	3
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		39.09	61.16		61.4	62.21	48.45	150.28	45.63	70.95	41.11	116.2	59.91	47.87	40.42	64.23	14	14	39.09	64.92	150.28
Silica	mg/l	0.01		No project standard				16.7	15.82	22.56	2.29	2.13	3.51									6	6	2.13	10.50	22.56
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	absent	Absent	Absent	Absent	0.02	<0.02		12	1	0.02	0.02	0.02
Organics and Oils																										
TPH CWG - Aliphatics																										
>C5-C6 #	mg/l	0.005		No project standard																		0	0			
>C8-C10 #	mg/l	0.005		No project standard																		0	0			
>C6-C8 #	mg/l	0.005		No project standard																		0	0			
>C10-C12#	mg/l	0.005		No project standard																		0	0			
>C12-C16#	mg/l	0.01		No project standard																		0	0			
>C16-C21#	mg/l	0.01		No project standard																		0	0			
>C21-C35#	mg/l	0.01		No project standard																		0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard																		0	0			
TPH CWG - Aromatics																										
>C5-EC7 #	mg/l	0.005		No project standard																		0	0			
>EC7-EC8 #	mg/l	0.005		No project standard																		0	0			
>EC8-EC10 #	mg/l	0.005		No project standard																		0	0			
>EC10-EC12#	mg/l	0.005		No project standard																		0	0			
>EC12-EC16#	mg/l	0.01		No project standard																		0	0			
>EC16-EC21#	mg/l	0.01		No project standard																		0	0			
>EC21-EC35#	mg/l	0.01		No project standard																		0	0			
Total aromatics C5-35	mg/l	0.01		No project standard																		0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard								<0.01										1	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water							<0.01										1	0			
Toluene	mg/l	0.0005		0.7	WHO DWS							<0.01										1	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS							<0.01										1	0			
Xylene (total)	mg/l			0.5	WHO DWS							<0.01										1	0			
m/p-Xylene	mg/l	not analysed		No project standard																		0	0			
o-Xylene	mg/l	not analysed		No project standard																		0	0			
Polyaromatic Hydrocarbons																										
Naphthalene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Acenaphthylene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Acenaphthene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Fluorene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Phenanthrene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Anthracene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Fluoranthene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Pyrene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Chrysene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS							<0.01									<0.10	2	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard								<0.01									<0.10	2	0			
Inorganics and Trace Metals																										
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water			<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	14	0			
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	14	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.02	<0.002	<0.002	<0.002	<0.002	0.01	<0.002	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.02	15	3	0.01	0.02	0.02
Beryllium	mg/l	0.005		No project standard								<0.0003										1	0			
Boron	mg/l	0.002		2.4	WHO DWS							<0.005		0.05							0.11	3	2	0.05	0.08	0.11
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			<0.005	0.1		0.1		0.16	0.52	0.67	Nil	Nil	Nil	Nil	Nil	0.6	12	6	0.1	0.36	0.67
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001		<0.001	<0.001	<0.001	<0.001	<0.001					8	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			<	<	<	<	<	<	Not detected	Not detected	not detected	Not detected	Not detected	Not detected	Not detected		13	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	14	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regulati			<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	14	0			
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil		Nil	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		12	0			
Iron (Ferrous)	mg/l	0.00002		No project standard																		0	0			
Iron (Feric)	mg/l	0.00002		No project standard																		0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		0.007	<0.007	0.05	0.01	<0.007	<0.007	<0.007	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	15	3	0.007	0.02	0.05
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	Not detected	<0.004	<0.004	<0.02	<0.004	<0.004	<0.004	<0.004	14	0			
Lithium	mg/l	0.004		No project standard				<0.004	<0.002	<0.004	<0.004		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		12	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15	1	0.002	0.002	0.002
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			<	<	<	<	<	<	Not detected	Not detected	Not detected		Not detected	Not detected	Not detected		12	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.02	<0.02	<[0.02	<0.02	<0.02	<0.02	<0.02		13	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.04	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	14	1	0.02	0.02	0.02
Vanadium	mg/l	0.0006		No project standard								0.05										1	1	0.05	0.05	0.05
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		0.01	<0.002	0.03	<0.002	0.01	<0.002	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15	4	0.01	0.02	0.03
Strontium	mg/l	0.005		No project standard				0.23	0.21	0.22	<0.005	0.24	0.46	0.17	0.25	0.15	0.41	0.24	0.2	0.16	0.24	14	13	0.15	0.24	0.46
Sanitary																										
BOD	mg/l	1		No project standard								4.56										1	1	4.56	4.56	4.56
COD	mg/l	7		No project standard								10.23										1	1	10.23	10.23	10.23
Total nitrogen	mg/l	0.5		No project standard								0.18										1	1	0.18	0.18	0.18
Total phosphorous	mg/l	0.5		No project standard								0.03										1	1	0.03	0.03	0.03
Total coliform bacteria	MPN/100ml	not specified		No project standard								14										1	1	14	14.00	14
Fecal coliforms	MPN/100ml	not specified		No project standard								<										1	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	GW3	Nakukulas 9	Nakukulas 9	GW3	Nakukulas 9	Nakukulas 9	GW3	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Nakukulas 9	Water flowing from Nak	Number of Analyses	Number of Analyses with Numerical Result	Result		
			Min	Max	Source	Sample ID	NAK-1	5		5-OCT-15	7/NOV/2015		3-DEC-15	AQ 47838b		AQ 48444b		AQ 49002	AQ 49747	Kapese lab	SGS	SGS (03805.001)	SGS NK 09	MA17-05350.002	SGS MA18-00633.001)			MA18-04598.0	MA18-05094.01	MA18-05739.001	MA19-00061.002	MA18-05739.006				
						Date	11/08/2014	26/07/2015	21/09/2015	02/11/2015	27/11/2015	27/11/2015	30/12/2015	08/04/2016	29/05/2016	15/06/2016	29/08/2016	30/08/2016	31/10/2016	01/02/2017	01/04/2017	16/08/2017	04/12/2017	08/11/2017	09/02/2018	25/05/2018	27/06/2018	01/09/2018	01/10/2018	30/11/2018	01/12/2018	30/11/2018			
Major Ions																																	
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		7.7	6.3	6.21	6.29	6.58	49.86	20.62	14.85	11.77	6.83	6.9	<0.001	0.62		5.28	6.07	7.42	6.23	5.77	7.2	5.78	4.79	5.46	4.41	3.61	6.42	25	24	0.62	8.87	49.86
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		8.5	7.91	8.25	8.32	8.42	17.49	11.15	2.85	7.9	1.19	7.77	4.69	0.09		6.97	7.84	8.82	7.79	7.3	8.54	7.15	6.72	7.94	6.19	5.22	6.59	25	25	0.09	7.26	17.49
Potassium	mg/l	0.1		No project standard			<2	2.23	2.52	2.57	2.51	5.49	3.85	2.98	3.39	4.76	2.43	0.69	1.37	1.4	2.17	2.31	2.36	0.24	2.13	2.62	2.47	1.96	2.71	2.13	1.8	2.19	26	25	0.34	2.45	5.49
Sodium	mg/l	0.1		50	WHO DWS		321	318.9	291.13	324.84	297.83	74.76	126.16	619	347.19	5.64	327.06	553	148.56		298.63	378.15	556.94	9.25	217.69	247.81	227.21	220.09	171.87	123.91	171.26	110.02	25	25	5.64	259.52	619
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water			1.5	1.1	0.68	1.5	0.54	1.1	1.5	0.68	1.73	1.72	0.82	0.05	1.13	0.47	1.43	1.67	0.71	1.07	1.24	1.46	1.84	1.76	0.89	1.19	8.53	25	25	0.05	1.45	8.53
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		24	25.31	26.1	21	23.67	8.94	16.3	10.57	52.06	2.82	21.57	2.2	27.71	2	14.28	23.87	23.87	18.32	22.84	21.8	20.79	20.79	18.52	27.99	59.27	41.57	26	26	2	22.24	59.27
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		30	47.5	33.74	30.18	42.43	>30	33.68	87.9	536.86	40.55	38.37	42.77	39.82	28	29.35	38.85	30.27	25.95	32.3	30.75	29.89	28.93	30.63	89.33	29.78	55.3	26	25	25.95	59.33	536.86
Alkalinity (HCO3)	mg/l	1		No project standard																												0	0			
Nutrients																																			
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		<0.5	Nil	Not detected	Nil	Nil	0.02	Nil	<0.001	0.54	0.24	0.65	25.07	0.75	0.54	<0.02	0.02	0.01	Nil	0.24	0.49	Not detected	0.28	2.97	1.8	0.42	<0.01	26	15	0.01	2.27	25.07
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		22	17	4.1	82.3	20.6	3.1	20.5	10.5	3.65	1.62	3.22	12	16.56	1.64	4.58	3.26	1.63	2.42	30.28	20.78	1.46	23.16	27.63	8.06	5.72	<0.01	26	25	1.46	13.91	82.3
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	0.03	<0.001	<0.01	0.009	Nil	0.43	0.3	Nil	not detected	not detected		Not detected	Not detected	0.03	Not detected	0.56	24	6	0.009	0.23	0.56
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.01	0.07	0.09	0.02		0.03	<0.001		<0.001		<0.001	<0.001	0.11	0.02	0.26	0.04	0.2	0.02	0.05	12.1	0.38	0.2	2.03	0.1	<0.02	22	17	0.01	0.93	12.1
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water							0.71			0.54			0.02														3	3	0.02	0.42	0.71
Physico-chemical																																			
Total Alkalinity as CaCO3	mg/l	1		No project standard				640	650	552	550	540	250	309	28	195	210	186	70	590	360	784.08	820	697	697	811.43	837.6	790.92	760.5	481.65	709.8	557.7	25	24	28	511.09	837.6
Electrical Conductivity	mS/cm	2		No project standard				1.332	1.448	1.276	1.267	1.423	0.591	1.27	1.913	1.28	1.436	1.28	1.26		1.755	1.5	1.519	1.591	1.453	1.624	1.787	1.771	1.166	1.674	1.917	1.482	24	24	0.591	1.46	1.917
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		8.5	7.96	7.53	7.65	7.88	8.84	7.74	8.39	7.24	8	7.87	7.9	8.01		8.09	7.86	7.82	7.94	8.02	8.13	7.76		8.08	7.87	7.71	8.27	24	24	7.24	7.96	8.84
Redox (Eh)	mV	not specified		No project standard																												0	0			
Temperature	°C	0.5		No project standard								26.1			25.5		23.2															3	3	23.2	24.93	26.1
Dissolved Oxygen	mg/l	1		No project standard								4.81			7.54		6.4															3	3	4.81	6.25	7.54
TDS	mg/l	35		1000	KEBS requirements for drinking water		1246	865.8	941.2	829.4	823.55	996.1	384.15	635	1245.26	640	399.4	640	630		1140.75	842	890	1034	944	939	1061	1013	676	1088	1246	981	25	25	384.15	885.22	1246
TSS	mg/l	10		0	KEBS requirements for drinking water			Not detectable	Not detectable	Not detectable	Not detectable	2	Not detectable	Nil	2	Nil	2	Nil	2		Not detected	Not detected	Not detected	not detected	Detectable	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	24	4	2	2.00	2
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water			48.29	49.99	51.1	196.53	97.42	47.9	61.9	22	49.25	19	1.91	55	41.88	47.45	54.86	47.65	44.47	53.16	43.85	39.62	46.33	36.49	30.51	43.17	24	24	1.91	51.24	196.53
Silica	mg/l	0.01		No project standard			25	15.48	15.12	21.48	2.15	2.53	2.99	<0.001	25.21	<0.001	2.33	<0.001		1.3	2.07	11.99	24.92	2.22	21.45	24.14	18.46	19.14	21.65	16.74	14.11	17.48	25	22	1.3	14.00	25.21
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02		<0.02	0.01		0.03		0.01	0.06		<0.02	<0.02	<0.02	<0.02	<0.02	absent	absent	Absent	Absent	<0.02	<0.02	<0.02	21	4	0.01	0.03	0.06
Organics and Oils																																			
TPH CWG - Aliphatics																																			
>C5-C6 [#]	mg/l	0.005		No project standard																												0	0			
>C8-C10 [#]	mg/l	0.005		No project standard																												0	0			
>C6-C8 [#]	mg/l	0.005		No project standard																												0	0			
>C10-C12 [#]	mg/l	0.005		No project standard																												0	0			
>C12-C16 [#]	mg/l	0.01		No project standard																												0	0			
>C16-C21 [#]	mg/l	0.01		No project standard																												0	0			
>C21-C35 [#]	mg/l	0.01		No project standard																												0	0			
Total aliphatics CS-35	mg/l	0.01		No project standard																												0	0			
TPH CWG - Aromatics																																			
>C5-EC7 [#]	mg/l	0.005		No project standard																												0	0			
>EC7-EC8 [#]	mg/l	0.005		No project standard																												0	0			
>EC8-EC10 [#]	mg/l	0.005		No project standard																												0	0			
>EC10-EC12 [#]	mg/l	0.005		No project standard																												0	0			
>EC12-EC16 [#]	mg/l	0.01		No project standard																												0	0			
>EC16-EC21 [#]	mg/l	0.01		No project standard																												0	0			
>EC21-EC35 [#]	mg/l	0.01		No project standard																												0	0			
Total aromatics CS-35	mg/l	0.01		No project standard																												0	0			
Total aliphatics and aromatics(CS-35)	mg/l	0.01		No project standard								<0.01					0.63															2	1	0.63	0.63	0.63
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water							<0.01			<0.01		0.05															3	1	0.05	0.05	0.05
Toluene	mg/l	0.0005		0.7	WHO DWS							<0.01			<0.01		0.02															3	1	0.02	0.02	0.02
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS							<0.01			<0.01		<0.01															3	0			
Xylene (total)	mg/l			0.5	WHO DWS							<0.01																				1	0			
m/p-Xylene	mg/l	not analysed		No project standard																												0	0			
o-Xylene	mg/l	not analysed		No project standard																												0	0			
Polyaromatic Hydrocarbons																																			
Naphthalene	mg/l	0.00001		No project standard								<0.01			0.04		0.01															3	2	0.01	0.03	0.04
Acenaphthylene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Acenaphthene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Fluorene	mg/l	0.00001		No project standard								<0.01			0.04		<0.01															3	1	0.04	0.04	0.04
Phenanthrene	mg/l	0.00001		No project standard								<0.01			0.03		<0.01															3	1	0.03	0.03	0.03
Anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Fluoranthene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Pyrene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Chrysene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.02															3	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS							<0.01			<0.01		<0.01															3	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard								<0.01			<0.01		<0.01															3	0			
Inorganics and Trace Metals																																			
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.3	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.001	0.12	0.28	<0.04	<0.001	0.1	<0.001	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06	<0.05	<0.05	26	3	0.1	0.17	0.28
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01	Nil	Not detected	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2.06	25	1	2.06	2.06	2.06
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		<0.1	<0.002	<0.002	<0.002	<0.002	0.04	<0.002	<0.001	<0.002	<0.001	<0.002	<0.001	<0.01		<0.004	<0.004	<0.004	<0.004	<0.004	0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	25	2	0.001	0.02	0.04
Beryllium	mg/l	0.005		No project standard								<0.0003			<0.003		<0.003															3	0			
Boron	mg/l	0.002		2.4	WHO DWS							<0.005			0.13		<0.005															3	1	0.13	0.13	0.13
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water		<0.5	<0.005	0.1		0.1		0.2	<0.001		<0.001		<0.001	<0.01	0.15	0.9	Not detected	0.52	0.52	0.92	0.08	not detected	Nil	Nil	Nil	Nil	Not detected	22	9	0.08	0.39	0.92
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001		<0.001	<0.001		<0.001		<0.001	<0.001		<0.001	<0.001	0.016	<0.001	<0.001	<0.001		<0.001				0.077	16	2	0.016	0.05	0.077
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	Not detected	Not detected	not detected	not detected	Not detected	Not detected	not detected	Not detected	Not detected	Not detected	Not detected	<0.01	24	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.001	<0.007	<0.001	<0.007	<0.001	<0.01	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	25	1	0.02	0.02	0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.2	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.1	<0.006	0.27	<0.006	<0.001	<0.01	Nil	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25	2	0.1	0.19	0.27
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil		Nil	<0.001		<0.001		<0.001	<0.001		Nil	Nil	Nil	Nil	<0.001			<0.001	<0.001	<0.001	<0.001	1.07	19	1	1.07	1.07	1.07
Iron (Ferrous)	mg/l	0.00002		No project standard																												0	0			
Iron (Feric)	mg/l	0.00002		No project standard																												0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.1	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.001	<0.007	0.16	<0.007	0.34	0.12	0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	26	4	0.1	0.18	0.34
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	<0.004	Not detected	Not detected	Not detected	<0.004	0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	24	1	0.004	0.00	0.004
Lithium	mg/l	0.004		No project standard			<0.05	<0.004	<0.002	<0.004	<0.004		<0.004	<0.001		<0.001		<0.001	<0.001		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	22	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.022	<0.002	0.44	<0.002	0.15	0.02	0.004	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	25	5	0.004	0.13	0.44
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			<	<	<	<	<	<	<0.001	<	<0.001	<	<0.001	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Nil	24	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.001	<0.015	<0.001	<0.015	<0.001	<0.01	<0.001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.001	25	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001	<0.01		Not detected	Not detected	Not detected	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	Not detected	24	1	0.03	0.03	0.03
Vanadium	mg/l	0.0006		No project standard								0.04			0.05		0.06															3	3	0.04	0.05	0.06
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.05	<0.002	<0.002	<0.002	<0.002	<0.002	0.03	0.04	<0.002	<0.001	<0.002	0.45	0.04	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	26	5	0.01	0.11	0.45
Strontium	mg/l	0.005		No project standard			0.2	0.24	0.24	0.23	<0.005	0.69	0.33	<0.001	0.21	<0.001	0.24	<0.001	<0.01		Not detected	0.22	0.25	0.24	0.22	0.25	0.22	0.21	0.24	0.02	0.16	0.2	25	19	0.02	0.24	0.69
Sanitary																																			
BOD	mg/l	1		No project standard								2.74			24.56		28.21															3	3	2.74	18.50	28.21
COD	mg/l	7		No project standard								7.42			48.07		57.23															3	3	7.42	37.57	57.23
Total nitrogen	mg/l	0.5		No project standard								0.21			4.69		1.61															3	3	0.21	2.17	4.69
Total phosphorous	mg/l	0.5		No project standard								0.02			<		<0.01															3	1	0.02	0.02	0.02
Total coliform bacteria	MPN/100ml	not specified		No project standard								70			1600		17															3	3	17	562.33	1600
Fecal coliforms	MPN/100ml	not specified		No project standard								23			2		<															3	2	2	12.50	23

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	GW4	GW4	Kapese Hand Pump	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID			MA21-01102.004			Min	Mean	Max
			Min	Max	Source	Date	27/11/2015	30/08/2016	11/03/2021					
Major Ions														
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		49.48	46.31	44.13	3	3	44.13	46.64	49.48
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		17.51	16.31	17.58	3	3	16.31	17.13	17.58
Potassium	mg/l	0.1		No project standard			5.41	4.55	5.29	3	3	4.55	5.08	5.41
Sodium	mg/l	0.1		50	WHO DWS		72.18	37.7	45.25	3	3	37.7	51.71	72.18
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.38	1.4	1.013	3	3	0.38	0.93	1.4
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		8.86	14.97	15.5	3	3	8.86	13.11	15.5
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		>30	30.88	20.34	3	2	20.34	25.61	30.88
Alkalinity (HCO3)	mg/l	1		No project standard					121.16	1	1	121.16	121.16	121.16
Nutrients														
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		0.02	0.66	5.29	3	3	0.02	1.99	5.29
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordin		3.4	2.49	25.38	3	3	2.49	10.42	25.38
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		<	0.09	<0.01	3	1	0.09	0.09	0.09
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water					0	0			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water		0.68	0.01		2	2	0.01	0.35	0.68
Physico-chemical														
Total Alkalinity as CaCO3	mg/l	1		No project standard			310	110	171.72	3	3	110	197.24	310
Electrical Conductivity	mS/cm	2		No project standard			0.419	0.612		2	2	0.419	0.52	0.612
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/En		8.47	7.46		2	2	7.46	7.97	8.47
Redox (Eh)	mV	not specified		No project standard						0	0			
Temperature	°C	0.5		No project standard			26.4	23.5		2	2	23.5	24.95	26.4
Dissolved Oxygen	mg/l	1		No project standard			3.01	7.7		2	2	3.01	5.36	7.7
TDS	mg/l	35		1000	KEBS requirements for drinking water		293.3	397.8	377	3	3	293.3	356.03	397.8
TSS	mg/l	10		0	KEBS requirements for drinking water		2	3	1	3	3	1	2.00	3
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		195.65	182.8	182.6	3	3	182.6	187.02	195.65
Silica	mg/l	0.01		No project standard			2.38	2.61		2	2	2.38	2.50	2.61
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water					0	0			
Organics and Oils														
TPH CWG - Aliphatics														
>C5-C6 #	mg/l	0.005		No project standard						0	0			
>C8-C10 #	mg/l	0.005		No project standard						0	0			
>C6-C8 #	mg/l	0.005		No project standard						0	0			
>C10-C12#	mg/l	0.005		No project standard						0	0			
>C12-C16#	mg/l	0.01		No project standard						0	0			
>C16-C21#	mg/l	0.01		No project standard						0	0			
>C21-C35#	mg/l	0.01		No project standard						0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard						0	0			
TPH CWG - Aromatics														
>C5-EC7 #	mg/l	0.005		No project standard						0	0			
>EC7-EC8 #	mg/l	0.005		No project standard						0	0			
>EC8-EC10 #	mg/l	0.005		No project standard						0	0			
>EC10-EC12#	mg/l	0.005		No project standard						0	0			
>EC12-EC16#	mg/l	0.01		No project standard						0	0			
>EC16-EC21#	mg/l	0.01		No project standard						0	0			
>EC21-EC35#	mg/l	0.01		No project standard						0	0			
Total aromatics C5-35	mg/l	0.01		No project standard						0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard			<0.01	0.58		2	1	0.58	0.58	0.58
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for dr		<0.01	0.03		2	1	0.03	0.03	0.03
Toluene	mg/l	0.0005		0.7	WHO DWS		<0.01	<0.01		2	0	0	#DIV/0!	0
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS		<0.01	<0.01		2	0	0	#DIV/0!	0
Xylene (total)	mg/l			0.5	WHO DWS		<0.01			1	0	0	#DIV/0!	0
m/p-Xylene	mg/l	not analysed		No project standard						0	0			
o-Xylene	mg/l	not analysed		No project standard						0	0			
Polyaromatic Hydrocarbons														
Naphthalene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Acenaphthylene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Acenaphthene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Fluorene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Phenanthrene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Anthracene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Fluoranthene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Pyrene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Benzo(a)anthracene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Chrysene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard			<0.01	<0.02		2	0	0	#DIV/0!	0
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS		<0.01	<0.01		2	0	0	#DIV/0!	0
Indeno(123cd)pyrene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Benzo(ghi)perylene	mg/l	0.00001		No project standard			<0.01	<0.01		2	0	0	#DIV/0!	0
Inorganics and Trace Metals														
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	<0.04	<0.05	3	0	0	#DIV/0!	0
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<	<	<0.01	3	0	0	#DIV/0!	0
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.03	0.03	0.03	3	3	0.03	0.03	0.03
Beryllium	mg/l	0.005		No project standard			<0.0003	<0.003		2	0	0	#DIV/0!	0
Boron	mg/l	0.002		2.4	WHO DWS		<0.005	<0.005	0.07	3	1	0.07	0.07	0.07
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water				0.42	1	1	0.42	0.42	0.42
Bromate as BrO3	mg/L	0.001		No project standard						0	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		<	<		2	0	0	#DIV/0!	0
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.007	<0.007	<0.02	3	0	0	#DIV/0!	0
Copper	mg/l	0.003		0.05	Environmental Management and Coordin		<0.006	<0.006	<0.01	3	0	0	#DIV/0!	0
Cyanide	mg/l			0.07	KEBS requirements for drinking water					0	0			
Iron (Ferrous)	mg/l	0.00002		No project standard						0	0			
Iron (Feric)	mg/l	0.00002		No project standard						0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	0.06	<0.02	3	1	0.06	0.06	0.06
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<	<	<0.004	3	0	0	#DIV/0!	0
Lithium	mg/l	0.004		No project standard						0	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	<0.002	<0.01	3	0	0	#DIV/0!	0
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		<	<		2	0	0	#DIV/0!	0
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015	<0.015		2	0	0	#DIV/0!	0
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.01	3	0	0	#DIV/0!	0
Vanadium	mg/l	0.0006		No project standard			0.04	0.04		2	2	0.04	0.04	0.04
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordin		0.05	0.16	<0.01	3	2	0.05	0.11	0.16
Strontium	mg/l	0.005		No project standard			0.68	0.59	0.64	3	3	0.59	0.64	0.68
Sanitary														
BOD	mg/l	1		No project standard			3.08	29.03		2	2	3.08	16.06	29.03
COD	mg/l	7		No project standard			7.62	50.63		2	2	7.62	29.13	50.63
Total nitrogen	mg/l	0.5		No project standard			0.18	1.54		2	2	0.18	0.86	1.54
Total phosphorous	mg/l	0.5		No project standard			0.02	<0.01		2	1	0.02	0.02	0.02
Total coliform bacteria	MPN/100ml	not specified		No project standard			23	>1800		2	1	23	23.00	23
Fecal coliforms	MPN/100ml	not specified		No project standard			5	540		2	2	5	272.50	540

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	GW5	GW5	GW5	Loperot	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID				MA21-01101.002					
			Min	Max	Source	Date	27/11/2015	29/05/2016	29/08/2016	11/03/2021			Min	Mean	Max
Major Ions															
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		0.08	45.88	48.87	44.92	4	4	0.08	34.94	48.87
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		<0.03	24.31	27.22	35.75	4	3	24.31	29.09	35.75
Potassium	mg/l	0.1		No project standard			<0.01	1.88	0.77	1.49	4	3	0.77	1.38	1.88
Sodium	mg/l	0.1		50	WHO DWS		2.48	122.3	110.55	75.48	4	4	2.48	77.70	122.3
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.49	0.25	1.84	1.35	4	4	0.25	0.98	1.84
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		0.09	34.85	39.07	36.5	4	4	0.09	27.63	39.07
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		>30	282.17	58.02	67	4	3	58.02	135.73	282.17
Alkalinity (HCO3)	mg/l	1		No project standard						150.36	1	1	150.36	150.36	150.36
Nutrients															
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		0.04	2.14	0.41	0.03	4	4	0.03	0.66	2.14
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		1	3.05	2.64	28.02	4	4	1	8.68	28.02
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		<	<	0.04	<0.01	4	1	0.04	0.04	0.04
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water						0	0			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water		0.47	1.07	0.04		3	3	0.04	0.53	1.07
Physico-chemical															
Total Alkalinity as CaCO3	mg/l	1		No project standard			346	45	130	247.7	4	4	45	192.18	346
Electrical Conductivity	mS/cm	2		No project standard			0.762	1.234	1.101		3	3	0.762	1.03	1.234
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		8.83	7.16	7.55		3	3	7.16	7.85	8.83
Redox (Eh)	mV	not specified		No project standard							0	0			
Temperature	°C	0.5		No project standard			26.5	24.9	23.1		3	3	23.1	24.83	26.5
Dissolved Oxygen	mg/l	1		No project standard			4.12	6.44	8		3	3	4.12	6.19	8
TDS	mg/l	35		1000	KEBS requirements for drinking water		533.4	800.75	715.65	671	4	4	533.4	680.20	800.75
TSS	mg/l	10		0	KEBS requirements for drinking water		2	3	1	4	4	4	1	2.50	4
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		0.26	214.66	234.1	259.39	4	4	0.26	177.10	259.39
Silica	mg/l	0.01		No project standard			1.25	39.52	3.64		3	3	1.25	14.80	39.52
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water						0	0			
Organics and Oils															
TPH CWG - Aliphatics															
>C5-C6 #	mg/l	0.005		No project standard							0	0			
>C8-C10 #	mg/l	0.005		No project standard							0	0			
>C6-C8 #	mg/l	0.005		No project standard							0	0			
>C10-C12#	mg/l	0.005		No project standard							0	0			
>C12-C16#	mg/l	0.01		No project standard							0	0			
>C16-C21#	mg/l	0.01		No project standard							0	0			
>C21-C35#	mg/l	0.01		No project standard							0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard							0	0			
TPH CWG - Aromatics															
>C5-EC7 #	mg/l	0.005		No project standard							0	0			
>EC7-EC8 #	mg/l	0.005		No project standard							0	0			
>EC8-EC10 #	mg/l	0.005		No project standard							0	0			
>EC10-EC12#	mg/l	0.005		No project standard							0	0			
>EC12-EC16#	mg/l	0.01		No project standard							0	0			
>EC16-EC21#	mg/l	0.01		No project standard							0	0			
>EC21-EC35#	mg/l	0.01		No project standard							0	0			
Total aromatics C5-35	mg/l	0.01		No project standard							0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard			<0.01		0.61		2	1	0.61	0.61	0.61
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking wate		<0.01	<0.01	<0.01		3	0			
Toluene	mg/l	0.0005		0.7	WHO DWS		<0.01	<0.01	0.03		3	1	0.03	0.03	0.03
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS		<0.01	<0.01	<0.01		3	0			
Xylene (total)	mg/l			0.5	WHO DWS		<0.01				1	0			
m/p-Xylene	mg/l	not analysed		No project standard							0	0			
o-Xylene	mg/l	not analysed		No project standard							0	0			
Polyaromatic Hydrocarbons															
Naphthalene	mg/l	0.00001		No project standard			<0.01	<0.01	0.01	<0.01	4	1	0.01	0.01	0.01
Acenaphthylene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Acenaphthene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Fluorene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Phenanthrene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Anthracene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Fluoranthene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Pyrene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Chrysene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard			<0.01	<0.02	<0.02	<0.01	4	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS		<0.01	<0.01	<0.01	<0.01	4	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard			<0.01	<0.01	<0.01	<0.01	4	0			
Inorganics and Trace Metals															
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	0.08	<0.04	<0.05	4	1	0.08	0.08	0.08
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<	<	<	<0.01	4	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		<0.002	0.01	<0.002	0.02	4	2	0.01	0.02	0.02
Beryllium	mg/l	0.005		No project standard			<0.0003	<0.003	<0.003		3	0			
Boron	mg/l	0.002		2.4	WHO DWS		<0.005	0.09	<0.005	0.06	4	2	0.06	0.08	0.09
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water					0.35	1	1	0.35	0.35	0.35
Bromate as BrO3	mg/L	0.001		No project standard							0	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		<	<	<		3	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.007	<0.007	<0.007	<0.02	4	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.006	<0.006	<0.006	<0.01	4	0			
Cyanide	mg/l			0.07	KEBS requirements for drinking water						0	0			
Iron (Ferrous)	mg/l	0.00002		No project standard							0	0			
Iron (Feric)	mg/l	0.00002		No project standard							0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	<0.007	0.03	<0.02	4	1	0.03	0.03	0.03
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<	<	<	<0.004	4	0			
Lithium	mg/l	0.004		No project standard							0	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	0.01	<0.002	<0.01	4	1	0.01	0.01	0.01
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		<	<	<		3	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015	<0.015	<0.015		3	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01	4	0			
Vanadium	mg/l	0.0006		No project standard			<0.008	0.07	0.07		3	2	0.07	0.07	0.07
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.002	<0.002	0.03	<0.01	4	1	0.03	0.03	0.03
Strontium	mg/l	0.005		No project standard			<0.005	0.34	0.37	0.43	4	3	0.34	0.38	0.43
Sanitary															
BOD	mg/l	1		No project standard			2.58	22.46	27.9		3	3	2.58	17.65	27.9
COD	mg/l	7		No project standard			9.69	39.48	52.01		3	3	9.69	33.73	52.01
Total nitrogen	mg/l	0.5		No project standard			0.12	1.58	1.91		3	3	0.12	1.20	1.91
Total phosphorous	mg/l	0.5		No project standard			0.04	0.06	<0.01		3	2	0.04	0.05	0.06
Total coliform bacteria	MPN/100ml	not specified		No project standard			110	1600	7		3	3	7	572.33	1600
Fecal coliforms	MPN/100ml	not specified		No project standard			<	<	<		3	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Nakukulas 10	Number of Analyses	Number of Analyses with Numerical Result	Result		
			Min	Max	Source	Sample ID	Nakukulas 10	6		6-OCT-15	6/NOV/2015	4-DEC-15	AQ 49748	Kapese lab	SGS	SGS (03805.002)	SGS NK 10	0 (SGS MA18-00633	SGS MA18-02360.00	BH'(SGS MA18-0285	SGS MA18-04598.00	MA18-05094-010	MA18-05739.002	MA19-00061.003	MA21-01102.003			Min	Mean	Max
						Date	09/08/2014	28/07/2015	21/09/2015	27/10/2015	27/11/2015	30/12/2015	31/10/2016	01/02/2017	01/04/2017	16/08/2017	04/10/2017	09/02/2018	25/05/2018	27/06/2018	01/09/2018	01/10/2018	30/11/2018	01/12/2018	11/03/2021					
Major Ions																												
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		31.97	29.19	29.4	29.5	29.69	6.63	1.87		25.47	27.8	36.02	26.17	33.47	27.4	6.3	24.54	20.64	16.88	31.83	18	18	1.87	24.15	36.02
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		16.5	17.17	16.77	16.76	17.25	4.91	0.21		14.68	16.69	19.23	16.65	19.25	15.87	6.97	16.1	13.07	10.8	17.81	18	18	0.21	14.26	19.25
Potassium	mg/l	0.1		No project standard				1.95	1.57	1.59	1.62	1.16	1.54	0.8	1.41	1.46	1.68	1.33	1.53	1.46	1.77	1.5	1.25	1.05	1.9	18	18	0.8	1.48	1.95
Sodium	mg/l	0.1		50	WHO DWS			81.7	104.41	60.23	62.13	129.65	71.74		57.28	74.71	108.96	60.39	71.52	56.6	158.67	54.98	48.43	32.13	66.07	17	17	32.13	76.45	158.67
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		1.38	0.92	0.64	0.44	0.87	1	<	0.85	0.73	0.83	0.85	0.67	0.95	0.83	1.6	1.12	0.31	0.72	0.7876	19	18	0.31	0.86	1.6
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		5.4	7.41	6.8	3	5.35	18.9	7.15	1	14.84	57.62	8.83	7.82	7.2	7	29.22	6.79	8.44	23.67	8	19	19	1	12.34	57.62
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		9.15	19	9.64	11.32	9.43	26.59	11.79	5	8.66	17	10.81	7.23	4.63	3.86	59.56	10.21	34.03	12.76	10.77	19	19	3.86	14.81	59.56
Alkalinity (HCO3)	mg/l	1		No project standard																					148.54	1	1	148.54	148.54	148.54
Nutrients																												
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water			Nil	Not detected	Nil	Nil	Nil	1.07	0.18	<0.02	0.02	0.01	0.27	5.85	0.06	0.18	5.73	2	0.06	8.48	18	12	0.01	1.99	8.48
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (Water Quality Regulatio		7.7	1.8	49.5	5.1	11.8	<0.01	4.4		5.21	2.36	1.27	21.86	16.13	17.94	29.5	19.27	8.06	3.58	14.3	18	17	1.27	13.05	49.5
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			<	<	<	<	<	<0.01	Nil	Nil	0.11	0.2	Not detected	Not detected	Not detected	Not detected	0.02	0.037	Not detected	<0.01	18	4	0.02	0.09	0.2
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water		0.18	0.04	0.11	0.07	0.04	0.02	<0.001	0.04	0.03	0.13	0.04	0.03	0.03	12.29	0.39	0.21	2.03	<0.1		18	16	0.02	0.98	12.29
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water																					0	0			
Physico-chemical																												
Total Alkalinity as CaCO3	mg/l	1		No project standard				280	300	240	240	200	47.98	265	220	317.6	358.75	287	444.98	471.15	517.14	385.32	278.85	354.9	204.14	18	18	47.98	300.71	517.14
Electrical Conductivity	mS/cm	2		No project standard				0.583	1.38	0.512	0.511	0.476	0.51		0.718	0.623	0.594	0.661	1.212	0.742	1.357		0.701	0.789		15	15	0.476	0.76	1.38
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.95	7.82	7.66	7.55	7.63	7.83	7.65		7.9	7.4	7.71	7.7	8	7.17	8.04	7.51	7.47	7.29		17	17	7.17	7.66	8.04
Redox (Eh)	mV	not specified		No project standard																						0	0			
Temperature	°C	0.5		No project standard																						0	0			
Dissolved Oxygen	mg/l	1		No project standard																						0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		320	378.95	427.7	332.8	332.15	309.4	255		466.7	356	353	430	707	430	795	285	456	513	382	18	18	255	418.32	795
TSS	mg/l	10		0	KEBS requirements for drinking water			Detectable	Not detectable	Not detectable	Not detectable	Detectable	2		Not detected	Not detected	Not detected	Detectable	not detectable	not detectable	Detectable	Detectable	Not detected	Not detected	Not detected	17	1	2	2.00	2
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		147.78	143.59		142.69	145.17	36.74	5.55	170	124.06	138.7	169.14	133.92	162.83	133.76	44.44	127.56	105.33	86.61	152.82	18	18	5.55	120.59	170
Silica	mg/l	0.01		No project standard				18.29	17.43	24.09	2.51	2.1		0.02	2.36	13.76	29.3	24.31	27.68	22.12	20.37	24.48	19.28	15.9		16	16	0.02	16.50	29.3
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02	<0.02	0.04		<0.02	<0.02	<0.02	<0.02	absent	absent	Absent	Absent	<0.02	<0.02		16	1	0.04	0.04	0.04
Organics and Oils																												
TPH CWG - Aliphatics																												
>C5-C6 #	mg/l	0.005		No project standard																						0	0			
>C8-C10 #	mg/l	0.005		No project standard																						0	0			
>C6-C8 #	mg/l	0.005		No project standard																						0	0			
>C10-C12#	mg/l	0.005		No project standard																						0	0			
>C12-C16#	mg/l	0.01		No project standard																						0	0			
>C16-C21#	mg/l	0.01		No project standard																						0	0			
>C21-C35#	mg/l	0.01		No project standard																						0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard																						0	0			
TPH CWG - Aromatics																												
>C5-EC7 #	mg/l	0.005		No project standard																						0	0			
>EC7-EC8 #	mg/l	0.005		No project standard																						0	0			
>EC8-EC10 #	mg/l	0.005		No project standard																						0	0			
>EC10-EC12 #	mg/l	0.005		No project standard																						0	0			
>EC12-EC16 #	mg/l	0.01		No project standard																						0	0			
>EC16-EC21 #	mg/l	0.01		No project standard																						0	0			
>EC21-EC35 #	mg/l	0.01		No project standard																						0	0			
Total aromatics C5-35	mg/l	0.01		No project standard																						0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard																						0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water																					0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS																					0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS																					0	0			
Xylene (total)	mg/l			0.5	WHO DWS																					0	0			
m/p-Xylene	mg/l	not analysed		No project standard																						0	0			
o-Xylene	mg/l	not analysed		No project standard																						0	0			
Polyaromatic Hydrocarbons																												
Naphthalene	mg/l	0.00001		No project standard																						0	0			
Acenaphthylene	mg/l	0.00001		No project standard																						0	0			
Acenaphthene	mg/l	0.00001		No project standard																						0	0			
Fluorene	mg/l	0.00001		No project standard																						0	0			
Phenanthrene	mg/l	0.00001		No project standard																						0	0			
Anthracene	mg/l	0.00001		No project standard																						0	0			
Fluoranthene	mg/l	0.00001		No project standard																						0	0			
Pyrene	mg/l	0.00001		No project standard																						0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard																						0	0			
Chrysene	mg/l	0.00001		No project standard																						0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard																						0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS																					0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard																						0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard																						0	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard																						0	0			
Inorganics and Trace Metals																												
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water			<0.04	<0.04	<0.04	<0.04	<0.04	0.13	Nil	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	18	1	0.13	0.13	0.13
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<	<	<	<	<	<0.01	Nil	Not detected	<0.01	<0.01	<0.01	<0.001	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	18	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.06	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01		<0.004	<0.004	0.02	<0.004	<0.004	<0.004	<0.004	0.01	<0.004	<0.004	0.02	18	4	0.01	0.03	0.06
Beryllium	mg/l	0.005		No project standard																						0	0			
Boron	mg/l	0.002		2.4	WHO DWS										0.08			0.01							0.04	3	3	0.01	0.04	0.08
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			<0.005	0.03		0.05	0.17	<0.01	0.2	0.47	Not detected	Nil	0.07	Nil	Nil	Nil	Nil	Nil	Nil	0.21	17	7	0.03	0.17	0.47
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001	<0.001	<0.001		<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001					12	1	0.002	0.00	0.002
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			<	<	<	<	<	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	not detected	Not detected	Not detected	Not detected	Not detected		16	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.01	0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	18	2	0.01	0.02	0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regulatio			<0.006	<0.006	<0.006	<0.006	<0.006	<0.01	Nil	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	18	0			
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil	Nil	<0.001		Nil	Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		16	0			
Iron (Ferrous)	mg/l	0.00002		No project standard																						0	0			
Iron (Feric)	mg/l	0.00002		No project standard																						0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water			0.11	<0.007	0.02	<0.007	0.06	0.09	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	18	5	0.02	0.06	0.11
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<	<	<	<	<	<0.01		Not detected	<0.004	Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	17	0			
Lithium	mg/l	0.004		No project standard				<0.004	<0.002	<0.004	<0.004	<0.004	<0.001		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		16	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water			<0.002	<0.002	<0.002	<0.002	<0.002	0.04	0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	18	2	0.001	0.02	0.04
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			<	<	<	<	<	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected		16	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.01	Nil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		17	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		Not detected	Not detected	Not detected	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	17	0			
Vanadium	mg/l	0.0006		No project standard																						0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (Water Quality Regulatio			<0.002	0.01	<0.002	<0.002	0.04	0.07	0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	18	5	0.01	0.04	0.07
Strontium	mg/l	0.005		No project standard				0.46	0.46	0.45	<0.005	0.15	<0.01		0.44	0.43	0.51	0.43	0.49	0.43	0.18	0.44	0.38	0.33	0.52	17	15	0.15	0.41	0.52
Sanitary																												
BOD	mg/l	1		No project standard																						0	0			
COD	mg/l	7		No project standard																						0	0			
Total nitrogen	mg/l	0.5		No project standard																						0	0			
Total phosphorous	mg/l	0.5		No project standard																						0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard																						0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard																						0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Kaengakalalio C	Kaengakalalio C/Kaimegur B	Kaengakalalio C/Kaimegur B	Kaengakalalio C/Kaimegur B	Kaimegur B	Kaimegur B	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID	SGS (KAE-C)	KAN - C (SGS MA18-00633.007)	Kaimegur B(SGS MA18-02360.004)	Kaeng' BH C(SGS MA18-02852.005)	MA18-05094.008	MA18-05739.004			Min	Mean	Max
			Min	Max	Source	Date	17/10/2017	09/02/2018	25/05/2018	27/06/2018	01/10/2018	30/11/2018					
Major Ions																	
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		3.72	1.95	3.46	4.15	1.94	1.62	6	6	1.62	2.81	4.15
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		1.89	1.21	2.58	3.46	1.25	1.13	6	6	1.13	1.92	3.46
Potassium	mg/l	0.1		No project standard			7.15	2.87	5.15	3.89	3.36	3.17	6	6	2.87	4.27	7.15
Sodium	mg/l	0.1		50	WHO DWS		141.05	294.22	342.39	327.91	199.13	180.25	6	6	141.05	247.49	342.39
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		3.61	3.07	3.62	3.71	3.28	3.29	6	6	3.07	3.43	3.71
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		145.71	64.62	85.2	86.64	30.66	94.05	6	6	30.66	84.48	145.71
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		220.57	85.82	93.2	118.6	64.66	96.14	6	6	64.66	113.17	220.57
Alkalinity (HCO3)	mg/l	1		No project standard									0	0			
Nutrients																	
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		0.03	0.12	0.46	2.33	2.91	2.2	6	6	0.03	1.34	2.91
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		2.31	39.34	32.29	41.45	24.77	6.4	6	6	2.31	24.43	41.45
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		0.1	0.21	Not detected	0.151	Not detected	0.028	6	4	0.028	0.12	0.21
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water		0.2	0.04	0.02	<0.01	0.2	2.2	6	5	0.02	0.53	2.2
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water								0	0			
Physico-chemical																	
Total Alkalinity as CaCO3	mg/l	1		No project standard			809.75	666.25	889.95	942.3	648.96	659.1	6	6	648.96	769.39	942.3
Electrical Conductivity	mS/cm	2		No project standard			2.697	1.725	2.164	2.45	1.331	2.063	6	6	1.331	2.07	2.697
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		8.73	8.38	8.36	7.9	8.42	8.42	6	6	7.9	8.37	8.73
Redox (Eh)	mV	not specified		No project standard									0	0			
Temperature	ºC	0.5		No project standard									0	0			
Dissolved Oxygen	mg/l	1		No project standard									0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		1564	1121	1281	1419	774	1341	6	6	774	1250.00	1564
TSS	mg/l	10		0	KEBS requirements for drinking water		Detectable	Detectable	Detectable	Detectable	Detectable	Not detected	6	0			
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		17.8	502.25	19.28	24.73	9.97	8.68	6	6	8.68	97.12	502.25
Silica	mg/l	0.01		No project standard			26.42	21.21	25.54	20.76	21.89	17.17	6	6	17.17	22.17	26.42
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water		<0.02	<0.02	Absent	Absent	Absent	<0.02	6	0			
Organics and Oils																	
TPH CWG - Aliphatics																	
>C5-C6 #	mg/l	0.005		No project standard									0	0			
>C8-C10 #	mg/l	0.005		No project standard									0	0			
>C6-C8 #	mg/l	0.005		No project standard									0	0			
>C10-C12#	mg/l	0.005		No project standard									0	0			
>C12-C16#	mg/l	0.01		No project standard									0	0			
>C16-C21#	mg/l	0.01		No project standard									0	0			
>C21-C35#	mg/l	0.01		No project standard									0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard									0	0			
TPH CWG - Aromatics																	
>C5-EC7 #	mg/l	0.005		No project standard									0	0			
>EC7-EC8 #	mg/l	0.005		No project standard									0	0			
>EC8-EC10 #	mg/l	0.005		No project standard									0	0			
>EC10-EC12#	mg/l	0.005		No project standard									0	0			
>EC12-EC16#	mg/l	0.01		No project standard									0	0			
>EC16-EC21#	mg/l	0.01		No project standard									0	0			
>EC21-EC35#	mg/l	0.01		No project standard									0	0			
Total aromatics C5-35	mg/l	0.01		No project standard									0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard									0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water								0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS								0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS								0	0			
Xylene (total)	mg/l			0.5	WHO DWS								0	0			
m/p-Xylene	mg/l	not analysed		No project standard									0	0			
o-Xylene	mg/l	not analysed		No project standard									0	0			
Polyaromatic Hydrocarbons																	
Naphthalene	mg/l	0.00001		No project standard									0	0			
Acenaphthylene	mg/l	0.00001		No project standard									0	0			
Acenaphthene	mg/l	0.00001		No project standard									0	0			
Fluorene	mg/l	0.00001		No project standard									0	0			
Phenanthrene	mg/l	0.00001		No project standard									0	0			
Anthracene	mg/l	0.00001		No project standard									0	0			
Fluoranthene	mg/l	0.00001		No project standard									0	0			
Pyrene	mg/l	0.00001		No project standard									0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard									0	0			
Chrysene	mg/l	0.00001		No project standard									0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard									0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS								0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard									0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard									0	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard									0	0			
Inorganics and Trace Metals																	
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		1.93	<0.05	0.4	0.18	0.07	<0.05	6	4	0.07	0.65	1.93
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	6	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.01	<0.004	<0.004	<0.004	<0.004	<0.004	6	1	0.01	0.01	0.01
Beryllium	mg/l	0.005		No project standard									0	0			
Boron	mg/l	0.002		2.4	WHO DWS		0.06	0.11					2	2	0.06	0.09	0.11
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water		0.34	0.63	Nil	Nil	0.05	Nil	6	3	0.05	0.34	0.63
Bromate as BrO3	mg/L	0.001		No project standard			<2.5	<0.001	<0.001	<0.001			4	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	6	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	6	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6	0			
Cyanide	mg/l			0.07	KEBS requirements for drinking water		Nil	<0.001	<0.001	<0.001	<0.001	<0.001	6	0			
Iron (Ferrous)	mg/l	0.00002		No project standard									0	0			
Iron (Feric)	mg/l	0.00002		No project standard									0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		2.97	0.05	0.32	0.17	0.05	0.19	6	6	0.05	0.63	2.97
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	6	0			
Lithium	mg/l	0.004		No project standard			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	6	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6	0			
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	6	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	6	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6	0			
Vanadium	mg/l	0.0006		No project standard									0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.01	0.08	0.02	<0.01	<0.01	<0.01	6	2	0.02	0.05	0.08
Strontium	mg/l	0.005		No project standard			0.11	0.1	0.16	0.18	0.09	0.09	6	6	0.09	0.12	0.18
Sanitary																	
BOD	mg/l	1		No project standard									0	0			
COD	mg/l	7		No project standard									0	0			
Total nitrogen	mg/l	0.5		No project standard									0	0			
Total phosphorous	mg/l	0.5		No project standard									0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard									0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard									0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Kengomo 1	Number of Analyses	Number of Analyses with Numerical Result	Result		
			Min	Max	Source	Sample ID	K-1	1		1-OCT-15	3/NOV/2015	1-DEC-15	AQ 47835b	AQ 48469b	AQ 49001	AQ 49751	Kapese lab	SGS	SGS (03805.004)	SGS KG01	KE-01 (SGS MA18-00633.005)	MA18-02360.001	MA18-02852.001	(SGS MA18-04598.008)	MA18-05739.007			Min	Mean	Max
						Date	11/08/2014	27/07/2015	21/09/2015	27/10/2015	27/11/2015	30/12/2015	07/04/2016	21/06/2016	30/08/2016	31/10/2016	01/02/2017	01/04/2017	16/08/2017	04/10/2017	09/02/2018	01/05/2018	01/06/2018	01/09/2018	30/11/2018					
Major Ions																												
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		8.9	6.83	12.64	6.66	7.55	7.29	15.2	7.61	<0.001	0.45		5.5	6.14	7.86	5.42	8.05	7.01	7.08	5.36	18	17	0.45	7.39	15.2
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		8.3	7.03	7.12	7.25	8.25	7.87	6.64	1.96	2.47	0.93		6.49	7	8	6.19	8.46	7.55	11.4	6.79	18	18	0.93	6.65	11.4
Potassium	mg/l	0.1		No project standard			3.5	4.52	5.19	5.49	4.8	4.85	1.58	10.26	1.55	3.46	2.8	4.04	3.97	4.13	3.99	5.33	5.32	4.09	4.78	19	19	1.55	4.40	10.26
Sodium	mg/l	0.1		50	WHO DWS		702	690.33	491.51	789.61	599.89	632.09	413.5	5.98	573	52.29		395.27	746.13	534.54	492.89	534.76	506.9	433.35	356	18	18	5.98	497.22	789.61
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water			3.8	3.7	3.3	4.3	4	1.25	1.93	0.24	0.23	1.6	0.72	4.69	4.81	3.99	3.95	4.97	3.84	2.38	18	18	0.23	2.98	4.97
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		135	169.99	177	170.4	129.65	125.7	158	9.88	34.2	20.69	124	21.4	115.25	108.66	124.92	124.1	150.44	133.98	204.36	19	19	9.88	117.77	204.36
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		447	532.03	964.24	535.61	386.62	354.5	268	162.22	294.94	355.41	155	34.73	355.51	320.04	345.2	378	366.89	155.7	331.81	19	19	34.73	354.92	964.24
Alkalinity (HCO3)	mg/l	1		No project standard																						0	0			
Nutrients																														
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		<0.5	Nil	Not detected	Nil	Nil	Nil	<0.001	0.75	36.15	1.63	0.41	<0.02	0.04	0.01	0.12	0.06	0.09	0.09	1.53	19	11	0.01	3.72	36.15
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		86	25.6	12.6	17	32	34.85	1.25	10.62	22.26	63.84	3.8	3.99	3.01	4.68	121.25	86.74	84	69.04	9.75	19	19	1.25	36.44	121.25
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			Nil	Nil	Nil	Not detected	Not detected	<0.001	<0.001	<0.001	<0.001	Nil	Nil	0.1	0.3	Not detected	not detected	Not detected	Not detected	0.065	18	3	0.065	0.16	0.3
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.06	0.11	0.08	0.1	0.07	<0.001	<0.001	<0.001	<0.001	0.04	0.04	0.08	0.4	0.02	0.02	12.36	0.43	2.09	18	14	0.02	1.14	12.36
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water																					0	0			
Physico-chemical																														
Total Alkalinity as CaCO3	mg/l	1		No project standard				680	890	552	620	660	592	216	88	201.35	380	420	913.1	1168.5	809.75	1073.18	1099.35	1014	481.65	18	18	88	658.83	1168.5
Electrical Conductivity	mS/cm	2		No project standard				3.38	3.48	3.3	2.792	2.477	2.8	0.82	2.8	2.72		3.73	3.2	3.04	2.854	3.39	3.98	2.571	3.56	17	17	0.82	2.99	3.98
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		8.48	7.95	7.81	7.7	7.87	7.88	8.44	7.65	8.13	7.9		8.28	8.01	7.73	8.07	8.08	7.71	8.22	8	18	18	7.65	8.00	8.48
Redox (Eh)	mV	not specified		No project standard																						0	0			
Temperature	°C	0.5		No project standard																						0	0			
Dissolved Oxygen	mg/l	1		No project standard																						0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		2324	2197	2262	2145	1814.8	1610.05	1400	410	1400	1360		2424.5	1818	1739	1855	1983	2316	1483	2314	18	18	410	1825.30	2424.5
TSS	mg/l	10		0	KEBS requirements for drinking water			Not detectable	Detectable	Not detectable	Not detectable	Not detectable	Nil	Nil	Nil	12		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Detectable	Detectable	17	1	12	12.00	12
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water			46.01		46.47	52.81	50.63	48.56	27	10	4.96	50	40.45	44.13	52.6	39.03	54.95	48.62	64.62	41.34	17	17	4.96	42.48	64.62
Silica	mg/l	0.01		No project standard			41	23.07	22.52	31.54	3.74	5.21	4.62	<0.001	<0.001	4.3	0.16	3.65	20.69	44.11	38.44	41.93	34.37	33	29.63	19	17	0.16	22.47	44.11
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.14	0.016	0.03		<0.02	<0.02	<0.02	<0.02	absent	Absent	Absent	<0.02	17	4	0.016	0.05	0.14
Organics and Oils																														
TPH CWG - Aliphatics																														
>C5-C6 #	mg/l	0.005		No project standard																						0	0			
>C8-C10 #	mg/l	0.005		No project standard																						0	0			
>C6-C8 #	mg/l	0.005		No project standard																						0	0			
>C10-C12#	mg/l	0.005		No project standard																						0	0			
>C12-C16#	mg/l	0.01		No project standard																						0	0			
>C16-C21#	mg/l	0.01		No project standard																						0	0			
>C21-C35#	mg/l	0.01		No project standard																						0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard																						0	0			
TPH CWG - Aromatics																														
>C5-EC7 #	mg/l	0.005		No project standard																						0	0			
>EC7-EC8 #	mg/l	0.005		No project standard																						0	0			
>EC8-EC10 #	mg/l	0.005		No project standard																						0	0			
>EC10-EC12#	mg/l	0.005		No project standard																						0	0			
>EC12-EC16#	mg/l	0.01		No project standard																						0	0			
>EC16-EC21#	mg/l	0.01		No project standard																						0	0			
>EC21-EC35#	mg/l	0.01		No project standard																						0	0			
Total aromatics C5-35	mg/l	0.01		No project standard																						0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard																						0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water																					0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS																					0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS																					0	0			
Xylene (total)	mg/l			0.5	WHO DWS																					0	0			
m/p-Xylene	mg/l	not analysed		No project standard																						0	0			
o-Xylene	mg/l	not analysed		No project standard																						0	0			
Polyaromatic Hydrocarbons																														
Naphthalene	mg/l	0.00001		No project standard																						0	0			
Acenaphthylene	mg/l	0.00001		No project standard																						0	0			
Acenaphthene	mg/l	0.00001		No project standard																						0	0			
Fluorene	mg/l	0.00001		No project standard																						0	0			
Phenanthrene	mg/l	0.00001		No project standard																						0	0			
Anthracene	mg/l	0.00001		No project standard																						0	0			
Fluoranthene	mg/l	0.00001		No project standard																						0	0			
Pyrene	mg/l	0.00001		No project standard																						0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard																						0	0			
Chrysene	mg/l	0.00001		No project standard																						0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard																						0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS																					0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard																						0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard																						0	0			
Benzo(gh)perylene	mg/l	0.00001		No project standard																						0	0			
Inorganics and Trace Metals																														
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.3	<0.04	<0.04	<0.04	<0.04	<0.04	0.02	0.09	<0.001	0.09	Nil	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	19	3	0.02	0.07	0.09
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<	<	<	<	<	<0.001	<0.001	<0.001	<0.01	Nil	Not detected	<0.01	<0.01	<0.01	<0.001	<.01	<0.01	<0.01	18	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		<0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.01		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	18	0			
Beryllium	mg/l	0.005		No project standard																						0	0			
Boron	mg/l	0.002		2.4	WHO DWS													0.22			0.21					2	2	0.21	0.22	0.22
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water		<0.5	<0.005	0.19		0.18	0.4	<0.001	<0.001	<0.001	<0.001	0.65	1.24	2.4	0.61	1.2	0.69	0.25	Nil	Nil	18	10	0.18	0.78	2.4
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	0.003	<0.001	<0.001	<0.001			14	1	0.003	0.00	0.003
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			<	<	<	<	<	<0.001	<0.001	<0.001	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	17	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.001	<0.001	<0.001	<0.01	0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	18	1	0.01	0.01	0.01
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.2	<0.006	<0.006	<0.006	<0.006	<0.006	<0.001	0.52	<0.001	<0.01	Nil	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	19	1	0.52	0.52	0.52
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil	Nil	<0.001	<0.001	<0.001	<0.001		Nil	Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.001	17	0			
Iron (Ferrous)	mg/l	0.00002		No project standard																						0	0			
Iron (Feric)	mg/l	0.00002		No project standard																						0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.1	<0.007	<0.007	<0.007	<0.007	<0.007	0.008	0.24	0.38	0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.11	19	6	0.008	0.13	0.38
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<	<	<	<	<	<0.001	<0.001	<0.001	<0.01		Not detected	<0.004	Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	17	0			
Lithium	mg/l	0.004		No project standard			<0.05	<0.004	<0.004	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.001		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	18	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.05	<0.002	<0.002	<0.002	<0.002	<0.002	<0.001	0.45	0.2	0.06	Nil	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	19	3	0.06	0.24	0.45
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			<	<	<	<	<	<0.001	<0.001	<0.001	<0.01		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	not detected	17	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.001	<0.001	<0.001	<0.01	Nil	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	18	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	<0.01		Not detected	Not detected	Not detected	<0.01	0.03	<0.01	<0.01	<0.01	17	1	0.03	0.03	0.03
Vanadium	mg/l	0.0006		No project standard																						0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.05	<0.002	0.01	<0.002	<0.002	<0.002	0.01	<0.001	0.44	0.28	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<.01	<0.01	<0.01	19	5	0.01	0.16	0.44
Strontium	mg/l	0.005		No project standard			0.3	0.29	0.29	0.29	<0.005	0.3	<0.001	<0.001	<0.001	<0.01		0.26	0.25	0.28	0.23	0.29	0.29	0.36	0.25	18	13	0.23	0.28	0.36
Sanitary																														
BOD	mg/l	1		No project standard																						0	0			
COD	mg/l	7		No project standard																						0	0			
Total nitrogen	mg/l	0.5		No project standard																						0	0			
Total phosphorous	mg/l	0.5		No project standard																						0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard																						0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard																						0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Kengomo 2	Number of Analyses	Number of Analyses with Numerical Result	Result		
			Min	Max	Source	Sample ID	Kengomo 2	2		2-OCT-15	4/NOV/15	2-DEC-15	SGS	SGS	SGS MA18-04598.009	MA18-05739.008	MA19-00061.006			Min	Mean	Max
						Date	17/02/2015	27/07/2015	21/09/2015	27/10/2015	27/11/2015	30/12/2015	16/08/2017	01/05/2018	01/09/2018	30/11/2018	01/12/2018					
Major Ions																						
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		11.57	12.72	6.47	11.93	12.13	12.23	9.48	11.66	5.09	0.97	6.4	11	11	0.97	9.15	12.72
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		16.8	16.86	17.52	16.3	16.29	15.77	13.5	14.99	6.12	0.51	9.79	11	11	0.51	13.13	17.52
Potassium	mg/l	0.1		No project standard				5.34	5.98	6	5.49	5.69	4.47	5.4	4.23	1.38	3.83	10	10	1.38	4.78	6
Sodium	mg/l	0.1		50	WHO DWS			390.57	357.25	406.16	353.42	378.19	408.47	302.67	601.55	248	173.16	10	10	173.16	361.94	601.55
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		1.83	3.16	2.5	2.5	3	3.4	3.07	3.14	4.58	4.4		10	10	1.83	3.16	4.58
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		61	60.3	52.7	54	57.01	51.7	44.55	46.7	129.65	295.12	72.44	11	11	44.55	84.11	295.12
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		97.84	95.01	94.01	115.04	103.73	93.06	92.28	68.38	361.59	114.86	89.33	11	11	68.38	120.47	361.59
Alkalinity (HCO3)	mg/l	1		No project standard														0	0			
Nutrients																						
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water			Nil	Not detected	Nil	Nil	Nil	0.03	0.06	0.15	2.1	4.13	10	5	0.03	1.29	4.13
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (Water Quality Regu			14.3	3.14	12.4	16.4	16.8	3.46	49.57	80.38	11.93	15.85	10	10	3.14	22.42	80.38
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			Nil	Nil	Nil	Not detected	Not detected	0.152	Not detected	0.72	0.032	Not detected	10	3	0.032	0.30	0.72
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.04	0.07	0.06	0.08	0.27	0.04	0.05	0.47	2.09	<0.1	10	9	0.04	0.35	2.09
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water													0	0			
Physico-chemical																						
Total Alkalinity as CaCO3	mg/l	1		No project standard				690	660	548	590	570	680	889.95	1044.42	461.37	760.5	10	10	461.37	689.42	1044.42
Electrical Conductivity	mS/cm	2		No project standard				1.749	1.789	1.731	1.646	1.429	2.133	2.018	3.54	2.612	2.525	10	10	1.429	2.12	3.54
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.54	8	7.72	7.76	7.76	7.81	7.63	7.8	8.21	8.6	7.72	11	11	7.54	7.87	8.6
Redox (Eh)	mV	not specified		No project standard														0	0			
Temperature	°C	0.5		No project standard														0	0			
Dissolved Oxygen	mg/l	1		No project standard														0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		1190	1136.85	1162	1125.15	1069.9	928.85	1386.5	1179	2078	1698	1641	11	11	928.85	1326.84	2078
TSS	mg/l	10		0	KEBS requirements for drinking water			Not detectable	Not detectable	Not detectable	Not detectable	Not detectable	Not detected	Detectable	Detectable	Detectable	Not detected	10	0			
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		98.06	101.19		96.87	97.36	95.47	79.27	90.86	37.9	4.53	56.31	10	10	4.53	75.78	101.19
Silica	mg/l	0.01		No project standard				24.29	24.4	32.33	3.15	4.41	17.39	37.18	34.53	31	23.36	10	10	3.15	23.20	37.18
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	absent	Absent	<0.02	<0.02	10	0			
Organics and Oils																						
TPH CWG - Aliphatics																						
>C5-C6 #	mg/l	0.005		No project standard														0	0			
>C8-C10 #	mg/l	0.005		No project standard														0	0			
>C6-C8 #	mg/l	0.005		No project standard														0	0			
>C10-C12#	mg/l	0.005		No project standard														0	0			
>C12-C16#	mg/l	0.01		No project standard														0	0			
>C16-C21#	mg/l	0.01		No project standard														0	0			
>C21-C35#	mg/l	0.01		No project standard														0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard														0	0			
TPH CWG - Aromatics																						
>C5-EC7 #	mg/l	0.005		No project standard														0	0			
>EC7-EC8 #	mg/l	0.005		No project standard														0	0			
>EC8-EC10 #	mg/l	0.005		No project standard														0	0			
>EC10-EC12#	mg/l	0.005		No project standard														0	0			
>EC12-EC16#	mg/l	0.01		No project standard														0	0			
>EC16-EC21#	mg/l	0.01		No project standard														0	0			
>EC21-EC35#	mg/l	0.01		No project standard														0	0			
Total aromatics C5-35	mg/l	0.01		No project standard														0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard														0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water													0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS													0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS													0	0			
Xylene (total)	mg/l			0.5	WHO DWS													0	0			
m/p-Xylene	mg/l	not analysed		No project standard														0	0			
o-Xylene	mg/l	not analysed		No project standard														0	0			
Polyaromatic Hydrocarbons																						
Naphthalene	mg/l	0.00001		No project standard														0	0			
Acenaphthylene	mg/l	0.00001		No project standard														0	0			
Acenaphthene	mg/l	0.00001		No project standard														0	0			
Fluorene	mg/l	0.00001		No project standard														0	0			
Phenanthrene	mg/l	0.00001		No project standard														0	0			
Anthracene	mg/l	0.00001		No project standard														0	0			
Fluoranthene	mg/l	0.00001		No project standard														0	0			
Pyrene	mg/l	0.00001		No project standard														0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard														0	0			
Chrysene	mg/l	0.00001		No project standard														0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard														0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS													0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard														0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard														0	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard														0	0			
Inorganics and Trace Metals																						
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water			<0.04	<0.04	<0.04	<0.04	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	10	0			
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			Not detected	Not detected	Not detected	Not detected	Not detected	<0.01	<0.001	<0.01	<0.01	<0.01	10	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water			<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.004	<0.004	<0.004	<0.004	10	0			
Beryllium	mg/l	0.005		No project standard														0	0			
Boron	mg/l	0.002		2.4	WHO DWS													0	0			
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			<0.005	0.12		0.16	0.36	Not detected	Nil	Nil	Nil	Nil	9	3	0.12	0.21	0.36
Bromate as BrO3	mg/L	0.001		No project standard				<0.001	<0.001		<0.001	<0.001	<0.001	<0.001				6	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	10	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.007	<0.007	<0.007	<0.007	<0.007	<0.02	<0.02	<0.02	<0.02	<0.02	10	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regu			<0.006	<0.006	<0.006	<0.006	<0.006	<0.01	<0.01	<0.01	<0.01	<0.01	10	0			
Cyanide	mg/l			0.07	KEBS requirements for drinking water			Nil	Nil	Nil	Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.001	10	0			
Iron (Ferrous)	mg/l	0.00002		No project standard														0	0			
Iron (Feric)	mg/l	0.00002		No project standard														0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.02	0.06	<0.02	<0.02	<0.02	11	2	0.007	0.03	0.06
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			Not detected	Not detected	Not detected	Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	<0.004	10	0			
Lithium	mg/l	0.004		No project standard				<0.004	<0.002	<0.004	<0.004	<0.004	<0.004	<0.001	<0.004	<0.004	<0.004	10	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	11	1	0.002	0.00	0.002
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	10	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.015	<0.015	<0.015	<0.015	<0.015	<0.02	<0.02	<0.02	<0.02	<0.02	10	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.08	<0.01	<0.01	<0.01	10	2	0.02	0.05	0.08
Vanadium	mg/l	0.0006		No project standard														0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		0.04	0.03	0.16	<0.002	<0.002	0.04	<0.01	0.04	<0.01	<0.01	<0.01	11	5	0.03	0.06	0.16
Strontium	mg/l	0.005		No project standard				0.65	0.67	0.6	<0.005	0.59	0.41	0.51	0.24	0.03	0.38	10	9	0.03	0.45	0.67
Sanitary																						
BOD	mg/l	1		No project standard														0	0			
COD	mg/l	7		No project standard														0	0			
Total nitrogen	mg/l	0.5		No project standard														0	0			
Total phosphorous	mg/l	0.5		No project standard														0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard														0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard														0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Nabolei	Nabolei BH
						Sample ID		MA18-05739.009
			Min	Max	Source	Date	19/06/2014	30/11/2018
Major Ions								
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		7.11	6.68
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		1.74	9.88
Potassium	mg/l	0.1		No project standard				
Sodium	mg/l	0.1		50	WHO DWS			**182.66**
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		**2.07**	**2.84**
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		381.5	95.08
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		**1720**	125.49
Alkalinity (HCO3)	mg/l	1		No project standard				
Nutrients								
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water			2.2
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		**75.8**	9.35
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water			**0.887**
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water			**2.01**
Physico-chemical								
Total Alkalinity as CaCO3	mg/l	1		No project standard				55.77
Electrical Conductivity	mS/cm	2		No project standard				2.14
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.91	7.58
Redox (Eh)	mV	not specified		No project standard				
Temperature	°C	0.5		No project standard				
Dissolved Oxygen	mg/l	1		No project standard				
TDS	mg/l	35		1000	KEBS requirements for drinking water		**4150**	**1391**
TSS	mg/l	10		0	KEBS requirements for drinking water			**Detectable**
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		24.92	57.38
Silica	mg/l	0.01		No project standard				28..96
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			<0.02
Organics and Oils								
TPH CWG - Aliphatics								
>C5-C6 #	mg/l	0.005		No project standard				
>C8-C10 #	mg/l	0.005		No project standard				
>C6-C8 #	mg/l	0.005		No project standard				
>C10-C12#	mg/l	0.005		No project standard				
>C12-C16#	mg/l	0.01		No project standard				
>C16-C21#	mg/l	0.01		No project standard				
>C21-C35#	mg/l	0.01		No project standard				
Total aliphatics C5-35	mg/l	0.01		No project standard				
TPH CWG - Aromatics								
>C5-EC7 #	mg/l	0.005		No project standard				
>EC7-EC8 #	mg/l	0.005		No project standard				
>EC8-EC10 #	mg/l	0.005		No project standard				
>EC10-EC12#	mg/l	0.005		No project standard				
>EC12-EC16#	mg/l	0.01		No project standard				
>EC16-EC21#	mg/l	0.01		No project standard				
>EC21-EC35#	mg/l	0.01		No project standard				
Total aromatics C5-35	mg/l	0.01		No project standard				
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard				
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water			
Toluene	mg/l	0.0005		0.7	WHO DWS			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS			
Xylene (total)	mg/l			0.5	WHO DWS			
m/p-Xylene	mg/l	not analysed		No project standard				
o-Xylene	mg/l	not analysed		No project standard				
Polyaromatic Hydrocarbons								
Naphthalene	mg/l	0.00001		No project standard				
Acenaphthylene	mg/l	0.00001		No project standard				
Acenaphthene	mg/l	0.00001		No project standard				
Fluorene	mg/l	0.00001		No project standard				
Phenanthrene	mg/l	0.00001		No project standard				
Anthracene	mg/l	0.00001		No project standard				
Fluoranthene	mg/l	0.00001		No project standard				
Pyrene	mg/l	0.00001		No project standard				
Benzo(a)anthracene	mg/l	0.00001		No project standard				
Chrysene	mg/l	0.00001		No project standard				
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard				
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard				
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard				
Benzo(ghi)perylene	mg/l	0.00001		No project standard				
Inorganics and Trace Metals								
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water			<0.05
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<0.01
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water			<0.004
Beryllium	mg/l	0.005		No project standard				
Boron	mg/l	0.002		2.4	WHO DWS			
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			Nil
Bromate as BrO3	mg/L	0.001		No project standard				
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			Not detected
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			<0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regulat			<0.01
Cyanide	mg/l			0.07	KEBS requirements for drinking water			<0.001
Iron (Ferrous)	mg/l	0.00002		No project standard				
Iron (Feric)	mg/l	0.00002		No project standard				
Iron (total)	mg/l			0.3	KEBS requirements for drinking water			<0.02
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<0.004
Lithium	mg/l	0.004		No project standard				
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water			<0.01
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.02
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01
Vanadium	mg/l	0.0006		No project standard				
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (Water Quality Regulat			0.04
Strontium	mg/l	0.005		No project standard				0.34
Sanitary								
BOD	mg/l	1		No project standard				
COD	mg/l	7		No project standard				
Total nitrogen	mg/l	0.5		No project standard				
Total phosphorous	mg/l	0.5		No project standard				
Total coliform bacteria	MPN/100ml	not specified		No project standard				
Fecal coliforms	MPN/100ml	not specified		No project standard				

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	ACS Tank Lokichar	Kaimegur BH	Ngamia II	Katilu Hand pump
						Sample ID	SGS	SGS (KAIME)	Clear water pit	(SGS MA18-006
			Min	Max	Source	Date	01/04/2017	17/10/2017	05/10/2017	09/02/2018
Major Ions										
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		15.04	2.25		33.05
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		10.05	1.87		45.38
Potassium	mg/l	0.1		No project standard			4.61	2.74		13.19
Sodium	mg/l	0.1		50	WHO DWS		158.25	188.79		283.81
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.68	2.54		1.69
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		33.6	16.46		267.95
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		26.91	75.69		155.24
Alkalinity (HCO3)	mg/l	1		No project standard						
Nutrients										
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		<0.02	0.02		0.09
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordination Act (W		4.18	1.64		141.89
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		Nil	0.415		0.22
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water		0.02	0.1		0.03
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water					
Physico-chemical										
Total Alkalinity as CaCO3	mg/l	1		No project standard			120	533		625.25
Electrical Conductivity	mS/cm	2		No project standard			1.125	1.228		2.317
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmentall		7.74	8.65	8.5	7.49
Redox (Eh)	mV	not specified		No project standard						
Temperature	°C	0.5		No project standard						
Dissolved Oxygen	mg/l	1		No project standard						
TDS	mg/l	35		1000	KEBS requirements for drinking water		731.25	700		1506
TSS	mg/l	10		0	KEBS requirements for drinking water		Not detected	Detectable		Not detectable
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		78.92	13.81		269.4
Silica	mg/l	0.01		No project standard			2.3	21.9		25.06
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water		<0.02	<0.02		<0.02
Organics and Oils										
TPH CWG - Aliphatics										
>C5-C6 #	mg/l	0.005		No project standard						
>C8-C10 #	mg/l	0.005		No project standard						
>C6-C8 #	mg/l	0.005		No project standard						
>C10-C12#	mg/l	0.005		No project standard						
>C12-C16#	mg/l	0.01		No project standard						
>C16-C21#	mg/l	0.01		No project standard						
>C21-C35#	mg/l	0.01		No project standard						
Total aliphatics C5-35	mg/l	0.01		No project standard						
TPH CWG - Aromatics										
>C5-EC7 #	mg/l	0.005		No project standard						
>EC7-EC8 #	mg/l	0.005		No project standard						
>EC8-EC10 #	mg/l	0.005		No project standard						
>EC10-EC12#	mg/l	0.005		No project standard						
>EC12-EC16#	mg/l	0.01		No project standard						
>EC16-EC21#	mg/l	0.01		No project standard						
>EC21-EC35#	mg/l	0.01		No project standard						
Total aromatics C5-35	mg/l	0.01		No project standard						
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard						
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water					
Toluene	mg/l	0.0005		0.7	WHO DWS					
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS					
Xylene (total)	mg/l			0.5	WHO DWS					
m/p-Xylene	mg/l	not analysed		No project standard						
o-Xylene	mg/l	not analysed		No project standard						
Polyaromatic Hydrocarbons										
Naphthalene	mg/l	0.00001		No project standard						
Acenaphthylene	mg/l	0.00001		No project standard						
Acenaphthene	mg/l	0.00001		No project standard						
Fluorene	mg/l	0.00001		No project standard						
Phenanthrene	mg/l	0.00001		No project standard						
Anthracene	mg/l	0.00001		No project standard						
Fluoranthene	mg/l	0.00001		No project standard						
Pyrene	mg/l	0.00001		No project standard						
Benzo(a)anthracene	mg/l	0.00001		No project standard						
Chrysene	mg/l	0.00001		No project standard						
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard						
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS					
Indeno(123cd)pyrene	mg/l	0.00001		No project standard						
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard						
Benzo(ghi)perylene	mg/l	0.00001		No project standard						
Inorganics and Trace Metals										
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.05	<0.05		<0.05
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		Not detected	<0.01		<0.01
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.02	<0.004		0.04
Beryllium	mg/l	0.005		No project standard						
Boron	mg/l	0.002		2.4	WHO DWS		0.11	<0.05		0.13
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water		0.62	Nil		0.71
Bromate as BrO3	mg/L	0.001		No project standard			<0.001	<2.5		<0.001
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	Not detected		Not detected
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	<0.02		<0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.01	<0.01		<0.01
Cyanide	mg/l			0.07	KEBS requirements for drinking water		Nil	Nil		<0.001
Iron (Ferrous)	mg/l	0.00002		No project standard						
Iron (Feric)	mg/l	0.00002		No project standard						
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.02	0.05		<0.02
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected
Lithium	mg/l	0.004		No project standard			<0.004	<0.004		<0.004
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	<0.01		0.02
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected		Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.02	<0.02		<0.02
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		Not detected	<0.01		<0.01
Vanadium	mg/l	0.0006		No project standard						
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.01	<0.01		0.1
Strontium	mg/l	0.005		No project standard			0.28	0.06		1.02
Sanitary										
BOD	mg/l	1		No project standard						
COD	mg/l	7		No project standard						
Total nitrogen	mg/l	0.5		No project standard						
Total phosphorous	mg/l	0.5		No project standard						
Total coliform bacteria	MPN/100ml	not specified		No project standard						
Fecal coliforms	MPN/100ml	not specified		No project standard						

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Eliye Spring
						Sample ID	MA18-05094.006
			Min	Max	Source	Date	01/10/2018
Major Ions							
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		1.08
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		0.32
Potassium	mg/l	0.1		No project standard			1.01
Sodium	mg/l	0.1		50	WHO DWS		**84.14**
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		**2.9**
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		16.05
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		17.87
Alkalinity (HCO3)	mg/l	1		No project standard			162.24
Nutrients							
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		**6.68**
Nitrate as N03	mg/l	0.2		10	Environmental Management and Coordination Act (W		6.42
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		Not detected
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water		0.24
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water		
Physico-chemical							
Total Alkalinity as CaCO3	mg/l	1		No project standard			425.88
Electrical Conductivity	mS/cm	2		No project standard			0.5804
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		**9.08**
Redox (Eh)	mV	not specified		No project standard			
Temperature	^{o}C	0.5		No project standard			
Dissolved Oxygen	mg/l	1		No project standard			
TDS	mg/l	35		1000	KEBS requirements for drinking water		334
TSS	mg/l	10		0	KEBS requirements for drinking water		**Detectable**
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		4.03
Silica	mg/l	0.01		No project standard			10.61
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water		Absent
Organics and Oils							
TPH CWG - Aliphatics							
>C5-C6 #	mg/l	0.005		No project standard			
>C8-C10 #	mg/l	0.005		No project standard			
>C6-C8 #	mg/l	0.005		No project standard			
>C10-C12#	mg/l	0.005		No project standard			
>C12-C16#	mg/l	0.01		No project standard			
>C16-C21#	mg/l	0.01		No project standard			
>C21-C35#	mg/l	0.01		No project standard			
Total aliphatics C5-35	mg/l	0.01		No project standard			
TPH CWG - Aromatics							
>C5-EC7 #	mg/l	0.005		No project standard			
>EC7-EC8 #	mg/l	0.005		No project standard			
>EC8-EC10 #	mg/l	0.005		No project standard			
>EC10-EC12#	mg/l	0.005		No project standard			
>EC12-EC16#	mg/l	0.01		No project standard			
>EC16-EC21#	mg/l	0.01		No project standard			
>EC21-EC35#	mg/l	0.01		No project standard			
Total aromatics C5-35	mg/l	0.01		No project standard			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water		
Toluene	mg/l	0.0005		0.7	WHO DWS		
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS		
Xylene (total)	mg/l			0.5	WHO DWS		
m/p-Xylene	mg/l	not analysed		No project standard			
o-Xylene	mg/l	not analysed		No project standard			
Polyaromatic Hydrocarbons							
Naphthalene	mg/l	0.00001		No project standard			
Acenaphthylene	mg/l	0.00001		No project standard			
Acenaphthene	mg/l	0.00001		No project standard			
Fluorene	mg/l	0.00001		No project standard			
Phenanthrene	mg/l	0.00001		No project standard			
Anthracene	mg/l	0.00001		No project standard			
Fluoranthene	mg/l	0.00001		No project standard			
Pyrene	mg/l	0.00001		No project standard			
Benzo(a)anthracene	mg/l	0.00001		No project standard			
Chrysene	mg/l	0.00001		No project standard			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard			
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS		
Indeno(123cd)pyrene	mg/l	0.00001		No project standard			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard			
Benzo(ghi)perylene	mg/l	0.00001		No project standard			
Inorganics and Trace Metals							
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.05
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.01
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.01
Beryllium	mg/l	0.005		No project standard			
Boron	mg/l	0.002		2.4	WHO DWS		
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water		0.29
Bromate as BrO3	mg/L	0.001		No project standard			to follow
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.01
Cyanide	mg/l			0.07	KEBS requirements for drinking water		<0.001
Iron (Ferrous)	mg/l	0.00002		No project standard			
Iron (Feric)	mg/l	0.00002		No project standard			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.02
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<0.004
Lithium	mg/l	0.004		No project standard			<0.004
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.02
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		**0.03**
Vanadium	mg/l	0.0006		No project standard			

Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.01
Strontium	mg/l	0.005		No project standard			0.02
Sanitary							
BOD	mg/l	1		No project standard			
COD	mg/l	7		No project standard			
Total nitrogen	mg/l	0.5		No project standard			
Total phosphorous	mg/l	0.5		No project standard			
Total coliform bacteria	MPN/100ml	not specified		No project standard			
Fecal coliforms	MPN/100ml	not specified		No project standard			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Epir	Epir BH	Epir BH
						Sample ID		Epir BH	MA18-05739.01
			Min	Max	Source	Date	25/12/2014	07/09/2018	30/11/2018
Major Ions									
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		2.07	1.87	1.89
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water			1.55	1.57
Potassium	mg/l	0.1		No project standard			4.85	3.22	3.99
Sodium	mg/l	0.1		50	WHO DWS		971.97	822.95	629.98
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		2	3.24	2
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		48.86	1.23	91.17
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		850	999.69	650
Alkalinity (HCO3)	mg/l	1		No project standard					
Nutrients									
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water			0.12	2.4
Nitrate as N03	mg/l	0.2		10	Environmental Management and Coordination Act (W		44	4.21	1.86
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		0.03	Not detected	0.027
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			0.38	2.2
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water				
Physico-chemical									
Total Alkalinity as CaCO3	mg/l	1		No project standard			970	922.74	608.4
Electrical Conductivity	mS/cm	2		No project standard				6.28	6
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		Management a	8.33	8.05
Redox (Eh)	mV	not specified		No project standard					
Temperature	°C	0.5		No project standard					
Dissolved Oxygen	mg/l	1		No project standard					
TDS	mg/l	35		1000	KEBS requirements for drinking water		2766	3642	3900
TSS	mg/l	10		0	KEBS requirements for drinking water			Detectable	Detectable
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		17.21	11.05	11.16
Silica	mg/l	0.01		No project standard				10.88	10.34
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			Absent	<0.02
Organics and Oils									
TPH CWG - Aliphatics									
>C5-C6 #	mg/l	0.005		No project standard					
>C8-C10 #	mg/l	0.005		No project standard					
>C6-C8 #	mg/l	0.005		No project standard					
>C10-C12#	mg/l	0.005		No project standard					
>C12-C16#	mg/l	0.01		No project standard					
>C16-C21#	mg/l	0.01		No project standard					
>C21-C35#	mg/l	0.01		No project standard					
Total aliphatics C5-35	mg/l	0.01		No project standard					
TPH CWG - Aromatics									
>C5-EC7 #	mg/l	0.005		No project standard					
>EC7-EC8 #	mg/l	0.005		No project standard					
>EC8-EC10 #	mg/l	0.005		No project standard					
>EC10-EC12#	mg/l	0.005		No project standard					
>EC12-EC16#	mg/l	0.01		No project standard					
>EC16-EC21#	mg/l	0.01		No project standard					
>EC21-EC35#	mg/l	0.01		No project standard					
Total aromatics C5-35	mg/l	0.01		No project standard					
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard					
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water				
Toluene	mg/l	0.0005		0.7	WHO DWS				
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS				
Xylene (total)	mg/l			0.5	WHO DWS				
m/p-Xylene	mg/l	not analysed		No project standard					
o-Xylene	mg/l	not analysed		No project standard					
Polyaromatic Hydrocarbons									
Naphthalene	mg/l	0.00001		No project standard					
Acenaphthylene	mg/l	0.00001		No project standard					
Acenaphthene	mg/l	0.00001		No project standard					
Fluorene	mg/l	0.00001		No project standard					
Phenanthrene	mg/l	0.00001		No project standard					
Anthracene	mg/l	0.00001		No project standard					
Fluoranthene	mg/l	0.00001		No project standard					
Pyrene	mg/l	0.00001		No project standard					
Benzo(a)anthracene	mg/l	0.00001		No project standard					
Chrysene	mg/l	0.00001		No project standard					
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard					
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS				
Indeno(123cd)pyrene	mg/l	0.00001		No project standard					
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard					
Benzo(ghi)perylene	mg/l	0.00001		No project standard					
Inorganics and Trace Metals									
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water			<0.05	<0.05
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water			<0.01	<0.01
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.07	<0.004	3.78
Beryllium	mg/l	0.005		No project standard					
Boron	mg/l	0.002		2.4	WHO DWS		5.49		
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			Nil	21.66
Bromate as BrO3	mg/L	0.001		No project standard					
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water				
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water			Not detected	Not detected
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Re			<0.02	<0.02
Cyanide	mg/l			0.07	KEBS requirements for drinking water			<0.01	<0.01
Iron (Ferrous)	mg/l	0.00002		No project standard					
Iron (Feric)	mg/l	0.00002		No project standard					
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	1.57	0.22
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<0.004	<0.004
Lithium	mg/l	0.004		No project standard				<0.004	<0.004
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		0.01	<0.01	<0.01
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water			Not detected	Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water			<0.02	<0.02
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water			<0.01	<0.01
Vanadium	mg/l	0.0006		No project standard					
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (Water Quality Re			<0.01	<0.01
Strontium	mg/l	0.005		No project standard				0.13	0.13
Sanitary									
BOD	mg/l	1		No project standard					
COD	mg/l	7		No project standard					
Total nitrogen	mg/l	0.5		No project standard					
Total phosphorous	mg/l	0.5		No project standard					
Total coliform bacteria	MPN/100ml	not specified		No project standard					
Fecal coliforms	MPN/100ml	not specified		No project standard					

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Loreng'elup	Loreng'elup
						Sample ID		11-DEC-15
			Min	Max	Source	Date	27/07/2015	28/12/2015
Major Ions								
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		27.47	28.73
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		5.34	5.71
Potassium	mg/l	0.1		No project standard			4.58	4.03
Sodium	mg/l	0.1		50	WHO DWS		12.28	13.41
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		1.16	0.55
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		6.59	5.8
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		14.25	5.32
Alkalinity (HCO3)	mg/l	1		No project standard				
Nutrients								
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water			
Nitrate as N03	mg/l	0.2		10	Environmental Management and Coordination Act (W		5.8	7.95
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		Nil	Not detected
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water			
Physico-chemical								
Total Alkalinity as CaCO3	mg/l	1		No project standard			110	90
Electrical Conductivity	mS/cm	2		No project standard			0.2444	0.2012
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.3	7.63
Redox (Eh)	mV	not specified		No project standard				
Temperature	°C	0.5		No project standard				
Dissolved Oxygen	mg/l	1		No project standard				
TDS	mg/l	35		1000	KEBS requirements for drinking water		158.89	130.78
TSS	mg/l	10		0	KEBS requirements for drinking water			
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		90.55	95.26
Silica	mg/l	0.01		No project standard			4.37	0.75
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water			
Organics and Oils								
TPH CWG - Aliphatics								
>C5-C6 #	mg/l	0.005		No project standard				
>C8-C10 #	mg/l	0.005		No project standard				
>C6-C8 #	mg/l	0.005		No project standard				
>C10-C12#	mg/l	0.005		No project standard				
>C12-C16#	mg/l	0.01		No project standard				
>C16-C21#	mg/l	0.01		No project standard				
>C21-C35#	mg/l	0.01		No project standard				
Total aliphatics C5-35	mg/l	0.01		No project standard				
TPH CWG - Aromatics								
>C5-EC7 #	mg/l	0.005		No project standard				
>EC7-EC8 #	mg/l	0.005		No project standard				
>EC8-EC10 #	mg/l	0.005		No project standard				
>EC10-EC12#	mg/l	0.005		No project standard				
>EC12-EC16#	mg/l	0.01		No project standard				
>EC16-EC21#	mg/l	0.01		No project standard				
>EC21-EC35#	mg/l	0.01		No project standard				
Total aromatics C5-35	mg/l	0.01		No project standard				
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard				
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water			
Toluene	mg/l	0.0005		0.7	WHO DWS			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS			
Xylene (total)	mg/l			0.5	WHO DWS			
m/p-Xylene	mg/l	not analysed		No project standard				
o-Xylene	mg/l	not analysed		No project standard				
Polyaromatic Hydrocarbons								
Naphthalene	mg/l	0.00001		No project standard				
Acenaphthylene	mg/l	0.00001		No project standard				
Acenaphthene	mg/l	0.00001		No project standard				
Fluorene	mg/l	0.00001		No project standard				
Phenanthrene	mg/l	0.00001		No project standard				
Anthracene	mg/l	0.00001		No project standard				
Fluoranthene	mg/l	0.00001		No project standard				
Pyrene	mg/l	0.00001		No project standard				
Benzo(a)anthracene	mg/l	0.00001		No project standard				
Chrysene	mg/l	0.00001		No project standard				
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard				
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard				
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard				
Benzo(ghi)perylene	mg/l	0.00001		No project standard				
Inorganics and Trace Metals								
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	<0.04
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		Not detected	Not detected
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.08	0.06
Beryllium	mg/l	0.005		No project standard				
Boron	mg/l	0.002		2.4	WHO DWS		<0.005	<0.005
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water			
Bromate as BrO3	mg/L	0.001		No project standard				
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		Not detected	Not detected
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.007	<0.007
Cyanide	mg/l			0.07	KEBS requirements for drinking water		<0.006	<0.006
Iron (Ferrous)	mg/l	0.00002		No project standard				
Iron (Feric)	mg/l	0.00002		No project standard				
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	<0.007
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		Not detected	Not detected
Lithium	mg/l	0.004		No project standard				
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	<0.002
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015	<0.015
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01
Vanadium	mg/l	0.0006		No project standard				
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		0.01	0.01
Strontium	mg/l	0.005		No project standard			0.29	0.27
Sanitary								
BOD	mg/l	1		No project standard				
COD	mg/l	7		No project standard				
Total nitrogen	mg/l	0.5		No project standard				
Total phosphorous	mg/l	0.5		No project standard				
Total coliform bacteria	MPN/100ml	not specified		No project standard				
Fecal coliforms	MPN/100ml	not specified		No project standard				

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Ngierengo	Ngierengo	Ngierengo	Ngierengo
						Sample ID		14-OCT-15	12/NOV/2015	14-DEC-15
			Min	Max	Source	Date	09/08/2015	31/10/2015	03/12/2015	29/12/2015
Major Ions										
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		25.09	26.56	23.98	26.36
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		8.86	9.97	8.54	8.57
Potassium	mg/l	0.1		No project standard			4	3.99	3.86	3.81
Sodium	mg/l	0.1		50	WHO DWS		21.89	24.47	21.37	22.99
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.54	0.19	0.22	0.42
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		5.56	4.8	3.09	4.3
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		19	12.82	13.2	7.09
Alkalinity (HCO3)	mg/l	1		No project standard						
Nutrients										
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water					
Nitrate as N03	mg/l	0.2		10	Environmental Management and Coordination Act (W		5.6	23.9	1	9.72
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		Nil	Nil	Not detected	Not detected
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water					
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water					
Physico-chemical										
Total Alkalinity as CaCO3	mg/l	1		No project standard			150	174	150	110
Electrical Conductivity	mS/cm	2		No project standard			0.306	0.336	0.2778	0.2422
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		7.62	7.67	7.68	7.7
Redox (Eh)	mV	not specified		No project standard						
Temperature	°C	0.5		No project standard						
Dissolved Oxygen	mg/l	1		No project standard						
TDS	mg/l	35		1000	KEBS requirements for drinking water		198.9	218.4	180.57	157.43
TSS	mg/l	10		0	KEBS requirements for drinking water					
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		99.13	107.39	95.06	101.12
Silica	mg/l	0.01		No project standard			9.7	13.69	1.13	1.78
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water					
Organics and Oils										
TPH CWG - Aliphatics										
>C5-C6 #	mg/l	0.005		No project standard						
>C8-C10 #	mg/l	0.005		No project standard						
>C6-C8 #	mg/l	0.005		No project standard						
>C10-C12#	mg/l	0.005		No project standard						
>C12-C16#	mg/l	0.01		No project standard						
>C16-C21#	mg/l	0.01		No project standard						
>C21-C35#	mg/l	0.01		No project standard						
Total aliphatics C5-35	mg/l	0.01		No project standard						
TPH CWG - Aromatics										
>C5-EC7 #	mg/l	0.005		No project standard						
>EC7-EC8 #	mg/l	0.005		No project standard						
>EC8-EC10 #	mg/l	0.005		No project standard						
>EC10-EC12#	mg/l	0.005		No project standard						
>EC12-EC16#	mg/l	0.01		No project standard						
>EC16-EC21#	mg/l	0.01		No project standard						
>EC21-EC35#	mg/l	0.01		No project standard						
Total aromatics C5-35	mg/l	0.01		No project standard						
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard						
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water					
Toluene	mg/l	0.0005		0.7	WHO DWS					
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS					
Xylene (total)	mg/l			0.5	WHO DWS					
m/p-Xylene	mg/l	not analysed		No project standard						
o-Xylene	mg/l	not analysed		No project standard						
Polyaromatic Hydrocarbons										
Naphthalene	mg/l	0.00001		No project standard						
Acenaphthylene	mg/l	0.00001		No project standard						
Acenaphthene	mg/l	0.00001		No project standard						
Fluorene	mg/l	0.00001		No project standard						
Phenanthrene	mg/l	0.00001		No project standard						
Anthracene	mg/l	0.00001		No project standard						
Fluoranthene	mg/l	0.00001		No project standard						
Pyrene	mg/l	0.00001		No project standard						
Benzo(a)anthracene	mg/l	0.00001		No project standard						
Chrysene	mg/l	0.00001		No project standard						
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard						
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS					
Indeno(123cd)pyrene	mg/l	0.00001		No project standard						
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard						
Benzo(ghi)perylene	mg/l	0.00001		No project standard						
Inorganics and Trace Metals										
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	<0.04	<0.04	<0.04
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.01	0.01	0.01	0.01
Beryllium	mg/l	0.005		No project standard						
Boron	mg/l	0.002		2.4	WHO DWS		<0.005		0.03	<0.005
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water					
Bromate as BrO3	mg/L	0.001		No project standard						
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water					
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.007	<0.007	<0.007	<0.007
Cyanide	mg/l			0.07	KEBS requirements for drinking water		<0.006	<0.006	<0.006	<0.006
Iron (Ferrous)	mg/l	0.00002		No project standard						
Iron (Feric)	mg/l	0.00002		No project standard						
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	0.01	<0.007	<0.007
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected
Lithium	mg/l	0.004		No project standard						
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	<0.002	<0.002	<0.002
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015	<0.015	<0.015	<0.015
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01
Vanadium	mg/l	0.0006		No project standard						
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		0.03	0.17	0.05	0.03
Strontium	mg/l	0.005		No project standard			0.38	0.39	<0.005	0.35
Sanitary										
BOD	mg/l	1		No project standard						
COD	mg/l	7		No project standard						
Total nitrogen	mg/l	0.5		No project standard						
Total phosphorous	mg/l	0.5		No project standard						
Total coliform bacteria	MPN/100ml	not specified		No project standard						
Fecal coliforms	MPN/100ml	not specified		No project standard						

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Ewoi	Ekunyuk	Kaengakalalio A	Turkwel East BH	Artesian Well (Lodwar)	Turkwel East BH	Lokwii
						Sample ID	9	10	SGS	MA18-05094.002	MA18-05094.004	MA18-05739.011	
			Min	Max	Source	Date	27/07/2015	27/07/2015	16/08/2017	01/10/2018	01/10/2018	30/11/2018	13/09/2015
Major Ions													
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		0.41	2.81	3.53	7.34	38.58	4.52	1.59
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		0.05	3.18	4.86	2	52.44	1.55	0.48
Potassium	mg/l	0.1		No project standard			1.6	2.8	3.78	3.96	25.82	3.25	2.35
Sodium	mg/l	0.1		50	WHO DWS		486.08	747.27	187.23	9.97	395.38	8.49	134.08
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		4.2	4.4	6.37	0.87	0.61	0.47	1.7
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		166.49	221.03	21.78	0.82	135	5.76	16.3
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		209.01	323.02	53.42	6.81	230.57	8.51	77.14
Alkalinity (HCO3)	mg/l	1		No project standard									
Nutrients													
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water				0.42	2.76	3.1	1.78	
Nitrate as N03	mg/l	0.2		10	Environmental Management and Coordination Act (W		14.6	15.5	0.11	3.86	6.42	1.79	2.6
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		Nil	Nil	0.04	Not detected	Not detected	0.026	0.04
Ammonia as N	mg/l			0.5	KEBS requirements for drinking water				0.31	0.86	0.36	2.13	
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water								
Physico-chemical													
Total Alkalinity as CaCO3	mg/l	1		No project standard			550	1030	297	101.4	1064.7	283.92	230
Electrical Conductivity	mS/cm	2		No project standard			2.099	3.23	0.948	0.1362	2.6796	0.154	0.745
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Environmental		8.75	8.18	8.46	8.13	6.96	7.9	6.92
Redox (Eh)	mV	not specified		No project standard									
Temperature	°C	0.5		No project standard									
Dissolved Oxygen	mg/l	1		No project standard									
TDS	mg/l	35		1000	KEBS requirements for drinking water		1364.35	2099.5	616.2	80	1570	100	484.25
TSS	mg/l	10		0	KEBS requirements for drinking water				Detectable	Detectable	Detectable	not detected	
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		1.24	20.13	28.82	26.54	312.28	17.67	3.97
Silica	mg/l	0.01		No project standard			3.19	17.58	27.94	0.29	20.92	0.19	8.94
Residual Chlorine	mg/l	0.02		0.2	KEBS requirements for drinking water				<0.02	Absent	Absent	<0.02	
Organics and Oils													
TPH CWG - Aliphatics													
>C5-C6 #	mg/l	0.005		No project standard									
>C8-C10 #	mg/l	0.005		No project standard									
>C6-C8 #	mg/l	0.005		No project standard									
>C10-C12#	mg/l	0.005		No project standard									
>C12-C16#	mg/l	0.01		No project standard									
>C16-C21#	mg/l	0.01		No project standard									
>C21-C35#	mg/l	0.01		No project standard									
Total aliphatics C5-35	mg/l	0.01		No project standard									
TPH CWG - Aromatics													
>C5-EC7 #	mg/l	0.005		No project standard									
>EC7-EC8 #	mg/l	0.005		No project standard									
>EC8-EC10 #	mg/l	0.005		No project standard									
>EC10-EC12#	mg/l	0.005		No project standard									
>EC12-EC16#	mg/l	0.01		No project standard									
>EC16-EC21#	mg/l	0.01		No project standard									
>EC21-EC35#	mg/l	0.01		No project standard									
Total aromatics C5-35	mg/l	0.01		No project standard									
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard									
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water								
Toluene	mg/l	0.0005		0.7	WHO DWS								
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS								
Xylene (total)	mg/l			0.5	WHO DWS								
m/p-Xylene	mg/l	not analysed		No project standard									
o-Xylene	mg/l	not analysed		No project standard									
Polyaromatic Hydrocarbons													
Naphthalene	mg/l	0.00001		No project standard									
Acenaphthylene	mg/l	0.00001		No project standard									
Acenaphthene	mg/l	0.00001		No project standard									
Fluorene	mg/l	0.00001		No project standard									
Phenanthrene	mg/l	0.00001		No project standard									
Anthracene	mg/l	0.00001		No project standard									
Fluoranthene	mg/l	0.00001		No project standard									
Pyrene	mg/l	0.00001		No project standard									
Benzo(a)anthracene	mg/l	0.00001		No project standard									
Chrysene	mg/l	0.00001		No project standard									
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard									
Benzo(a)pyrene	mg/l	0.00001		0.0007	WHO DWS								
Indeno(123cd)pyrene	mg/l	0.00001		No project standard									
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard									
Benzo(ghi)perylene	mg/l	0.00001		No project standard									
Inorganics and Trace Metals													
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	<0.04	15.68	<0.05	<0.05	<0.05	<0.04
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		Not detected	Not detected	<0.01	<0.01	<0.01	<0.01	Not detected
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.08	0.02	<0.004	0.12	0.08	<0.004	<0.002
Beryllium	mg/l	0.005		No project standard									
Boron	mg/l	0.002		2.4	WHO DWS		<0.005	<0.005					0.04
Boron as boric acid	mg/L	0.001		0.3	KEBS requirements for drinking water				Not detected	Nil	0.39	Nil	
Bromate as BrO3	mg/L	0.001		No project standard					0.003	to follow	to follow		
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.007	<0.007	<0.02	<0.02	<0.02	<0.02	Not detected
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (W		<0.006	<0.006	<0.01	<0.01	<0.01	<0.01	<0.007
Cyanide	mg/l			0.07	KEBS requirements for drinking water		Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.006
Iron (Ferrous)	mg/l	0.00002		No project standard									
Iron (Feric)	mg/l	0.00002		No project standard									
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	<0.007	9.58	<0.02	0.13	<0.02	<0.007
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		Not detected	Not detected	<0.004	<0.01	<0.004	<0.004	Not detected
Lithium	mg/l	0.004		No project standard					<0.004	<0.004	<0.004	<0.004	
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	<0.002	0.21	<0.01	0.07	<0.01	<0.002
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015	<0.015	<0.02	<0.02	<0.02	<0.02	<0.015
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	0.02		0.02	<0.01	<0.01
Vanadium	mg/l	0.0006		No project standard									
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordination Act (W		<0.002	<0.002	<0.01	<0.01	<0.01	<0.01	<0.002
Strontium	mg/l	0.005		No project standard			0.06	0.32	0.08	0.22	1.81	0.17	0.03
Sanitary													
BOD	mg/l	1		No project standard									
COD	mg/l	7		No project standard									
Total nitrogen	mg/l	0.5		No project standard									
Total phosphorous	mg/l	0.5		No project standard									
Total coliform bacteria	MPN/100ml	not specified		No project standard									
Fecal coliforms	MPN/100ml	not specified		No project standard									

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for

Water Quality

C3

4 Surface water quality baseline data

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	SW1	SW1	SW2	SW3
						Sample ID		MA21-01102.002	MA21-01102.005	
			Min	Max	Source	Date	29/05/2016	11/03/2021	11/03/2021	28/05/2016
Major Ions										
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		77.74	34.75	53.06	35.3
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		10.15	3.96	6.74	4.41
Potassium	mg/l	0.1		No project standard			8.41	7.28	9.25	6.12
Sodium	mg/l	0.1		50	WHO DWS		22.69	37.41	12.22	20.09
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		1.65	0.61	0.1975	1.24
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		28.54	8.4	12.3	34.46
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		108.72	11.96	11.96	64.86
Alkalinity (HCO3)	mg/l	1		No project standard				91.18	48.29	
Nutrients										
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		1.86	0.53	2.28	1.89
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordinatio		2.54	38.26	58.24	4.18
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		<	3.296	1.242	<
Ammonia as N	mg/L			0.5	KEBS requirements for drinking water					
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water		1.16			1.78
Physico-chemical										
Total Alkalinity as CaCO3	mg/l	1		No project standard			140	121.52	103.89	35
Electrical Conductivity	mS/cm	2		No project standard			0.655			0.348
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water/Enviro		6.85			7.56
Redox (Eh)	mV	not specified		No project standard						
Temperature	°C	0.5		No project standard			25			24.8
Dissolved Oxygen	mg/l	1		No project standard			7.71			6.8
TDS	mg/l	35		1000	KEBS requirements for drinking water		429.16	266	275	226.2
TSS	mg/l	10		0	KEBS requirements for drinking water		4	5	6	345
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		235.9	103.07	160.24	106.3
Silica	mg/l	0.01		No project standard			10.87			8.52
Residual Chlorine	mg/L			0.2	KEBS requirements for drinking water					
Organics and Oils										
TPH CWG - Aliphatics										
>C5-C6 #	mg/l	0.005		No project standard						
>C8-C10 #	mg/l	0.005		No project standard						
>C6-C8 #	mg/l	0.005		No project standard						
>C10-C12#	mg/l	0.005		No project standard						
>C12-C16#	mg/l	0.01		No project standard						
>C16-C21#	mg/l	0.01		No project standard						
>C21-C35#	mg/l	0.01		No project standard						
Total aliphatics C5-35	mg/l	0.01		No project standard						
TPH CWG - Aromatics										
>C5-EC7 #	mg/l	0.005		No project standard						
>EC7-EC8 #	mg/l	0.005		No project standard						
>EC8-EC10 #	mg/l	0.005		No project standard						
>EC10-EC12#	mg/l	0.005		No project standard						
>EC12-EC16#	mg/l	0.01		No project standard						
>EC16-EC21#	mg/l	0.01		No project standard						
>EC21-EC35#	mg/l	0.01		No project standard						
Total aromatics C5-35	mg/l	0.01		No project standard						
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard						
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinki		<0.01			<0.01
Toluene	mg/l	0.0005		0.7	WHO DWS		<0.01			<0.01
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS		<0.01			<0.01
Xylene (total)	mg/l			0.5	WHO DWS					
m/p-Xylene	mg/l	0.001		No project standard						
o-Xylene	mg/l	0.001		No project standard						
Polyaromatic Hydrocarbons										
Naphthalene	mg/l	0.00001		No project standard			<0.01			4
Acenaphthylene	mg/l	0.00001		No project standard			<0.01			<0.01
Acenaphthene	mg/l	0.00001		No project standard			<0.01			<0.01
Fluorene	mg/l	0.00001		No project standard			<0.01			<0.01
Phenanthrene	mg/l	0.00001		No project standard			<0.01			<0.01
Anthracene	mg/l	0.00001		No project standard			<0.01			<0.01
Fluoranthene	mg/l	0.00001		No project standard			<0.01			<0.01
Pyrene	mg/l	0.00001		No project standard			0.03			<0.01
Benzo(a)anthracene	mg/l	0.00001		No project standard			<0.01			<0.01
Chrysene	mg/l	0.00001		No project standard			<0.01			<0.01
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard			<0.01			<0.02
Benzo(a)pyrene	mg/l	0.00001		0.0007			<0.01			<0.01
Indeno(123cd)pyrene	mg/l	0.00001		No project standard			<0.01			<0.01
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard			<0.01			<0.01
Benzo(ghi)perylene	mg/l	0.00001		No project standard			<0.01			<0.01
Inorganics and Trace Metals										
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		<0.04	<0.05	<0.05	<0.04
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<	<0.01	<0.01	<
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.07	0.03	0.09	0.02
Beryllium	mg/l	0.005		No project standard			<0.003			<0.003
Boron	mg/l	0.002		2.4	WHO DWS		0.1	0.05	0.07	0.08
Boron as boric acid	mg/L			0.3	KEBS requirements for drinking water			0.3	0.42	
Bromate as BrO3	mg/L			0.01	KEBS requirements for drinking water					
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		<			<
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.007	<0.02	<0.02	<0.007
Cyanide as CN	mg/L			0.07	KEBS requirements for drinking water					
Copper	mg/l	0.003		0.05	Environmental Management and Coordinatio		<0.006	<0.01	<0.01	<0.006
Iron (Ferrous)	mg/l	0.00002		No project standard						
Iron (Feric)	mg/l	0.00002		No project standard						
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		<0.007	<0.02	<0.02	<0.007
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<	<0.004	<0.004	<
Lithium	mg/L			No project standard						
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.002	<0.01	<0.01	0.01
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		<			<
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.015			<0.015
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01
Vanadium	mg/l	0.0006		No project standard			0.01			0.01
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordinatio		0.02	<0.01	<0.01	<0.002
Strontium	mg/l	0.005		No project standard			0.9	0.42	0.77	0.36
Sanitary										
BOD	mg/l	1		No project standard			36.54			54.98
COD	mg/l	7		No project standard			64.78			109.76
Total nitrogen	mg/l	0.5		No project standard			2.86			3.68
Total phosphorous	mg/l	0.5		No project standard			0.01			0.08
Total coliform bacteria	MPN/100ml	not specified		No project standard			>1800			>1800
Fecal coliforms	MPN/100ml	not specified		No project standard			>1800			>1800

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Turkwell Dam reservoir	Turkwell Dam reservoir	Turkwell Dam reservoir	Turkwell Dam reservoir	Turkwell Dam reservoir	Turkwell Dam	Turkwell Dam	Turkwell Dam	Turkwell Dam	Number of Analyses	Number of Analyses with Numerical Result	Result			
						Sample ID		TURKWEL DAM (SGS MA18-00633.004)	MA18-04598.005. Sample 05	MA18-05739.013	MA19-00061.007	MA19-00791.011	MA19-01267.005	MA19-01483.007	MA19-01946.002			Min	Mean	95th percentile	Max
			Min	Max	Source	Date	May-18	Jun-18	Sep-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19	Apr-19						
Major Ions																					
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		21.23	16.15	13.45	12.85	10.95	17.18	20.31	21.64	17	9	9	10.95	16.75	21.48	21.64
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		<0.01	4.51	4.37	4.16	3.7	5.3	6	6.4	5.42	9	8	3.7	4.98	6.26	6.4
Potassium	mg/l	0.1		No project standard			3.43	3.38	2.9	2.55	2.21	3.21	3.58	3.94	3.17	9	9	2.21	3.15	3.80	3.94
Sodium	mg/l	0.1		50	WHO DWS		7.07	6.51	6.04	5.23	4.9	7.68	9.1	8.99	7.45	9	9	4.9	7.00	9.06	9.1
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		absent	0.67	0.93	0.48	0.77	0.68	0.65	0.53	0.65	9	8	0.48	0.67	0.87	0.93
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		2.4	2.88	1.65	5.76	5.35	1.23	1.65	2.88	2.26	9	9	1.23	2.90	5.60	5.76
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		3.28	28.45	9.36	13.61	11.91	3.66	4.12	4.57	5.03	9	9	3.28	9.33	22.51	28.45
Alkalinity (HCO3)	mg/l	1	No project standard	No project standard												0	0				
Nutrients																					
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		3	5.61	0.09	0.19	Nil	<0.02	<0.02	<0.02	<0.02	9	4	0.09	2.22	5.22	5.61
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordir		3.41	6.07	2.03	1.89	4.48	<0.1	<0.1	<0.01	<0.1	9	5	1.89	3.58	5.75	6.07
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		3.41	Not detected	Not detected	0.146	Not detected	<0.01	<0.01	<0.01	<0.01	9	2	0.146	1.78	3.25	3.41
Ammonia as N	mg/L			0.5	KEBS requirements for drinking water		0.02	12.44	0.65	2.13	0.05	<0.03	<0.03	3.16	<0.03	9	6	0.02	3.08	10.12	12.44
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water											0	0				
Physico-chemical																					
Total Alkalinity as CaCO3	mg/l	1		No project standard			183.23	130.88	106.47	70.98	152.1	140.4	113.4	113.4	102.6	9	9	70.98	123.72	170.78	183.23
Electrical Conductivity	mS/cm	2		No project standard			0.2278	0.241	0.2623	0.2293	0.2627	0.2213	0.2509	0.2599	0.2442	9	9	0.2213	0.24	0.26	0.2627
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water		8.4	7.74	8.05	7.5	7.67	7.56	7.88	7.44	7.38	9	9	7.38	7.74	8.26	8.4
Redox (Eh)	mV	not specified		No project standard												0	0				
Temperature	°C	0.5		No project standard												0	0				
Dissolved Oxygen	mg/l	1		No project standard												0	0				
TDS	mg/l	35		1000	KEBS requirements for drinking water		136	136	151	149	171	129	163	169	142	9	9	129	149.56	170.20	171
TSS	mg/l	10		0	KEBS requirements for drinking water		Detectable	Detectable	Detectable	Detectable	Detected	Detectable	Detectable	Detectable	Detectable	9	0				
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		77.56	58.87	51.55	49.22	42.57	64.72	75.42	80.4	64.75	9	9	42.57	62.78	79.26	80.4
Silica	mg/l	0.01		No project standard			3.68	2.85	2.71	2.1	1.5	1.54	1.12	1.04	0.82	9	9	0.82	1.93	3.35	3.68
Residual Chlorine	mg/L			0.2	uirements for drinking water		Absent	Absent	Absent	<0.02	<0.02	Absent	<0.02	<0.02	<0.02	9	0				
Organics and Oils																					
TPH CWG - Aliphatics																					
>C5-C6 #	mg/l	0.005		No project standard												0	0				
>C8-C10 #	mg/l	0.005		No project standard												0	0				
>C6-C8 #	mg/l	0.005		No project standard												0	0				
>C10-C12 #	mg/l	0.005		No project standard												0	0				
>C12-C16 #	mg/l	0.01		No project standard												0	0				
>C16-C21 #	mg/l	0.01		No project standard												0	0				
>C21-C35 #	mg/l	0.01		No project standard												0	0				
Total aliphatics C5-35	mg/l	0.01		No project standard												0	0				
TPH CWG - Aromatics																					
>C5-EC7 #	mg/l	0.005		No project standard												0	0				
>EC7-EC8 #	mg/l	0.005		No project standard												0	0				
>EC8-EC10 #	mg/l	0.005		No project standard												0	0				
>EC10-EC12 #	mg/l	0.005		No project standard												0	0				
>EC12-EC16 #	mg/l	0.01		No project standard												0	0				
>EC16-EC21 #	mg/l	0.01		No project standard												0	0				
>EC21-EC35 #	mg/l	0.01		No project standard												0	0				
Total aromatics C5-35	mg/l	0.01		No project standard												0	0				
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard												0	0				
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water											0	0				
Toluene	mg/l	0.0005		0.7	WHO DWS											0	0				
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS											0	0				
Xylene (total)	mg/l			0.5	WHO DWS											0	0				
m/p-Xylene	mg/l	0.001		No project standard												0	0				
o-Xylene	mg/l	0.001		No project standard												0	0				
Polyaromatic Hydrocarbons																					
Naphthalene	mg/l	0.00001		No project standard												0	0				
Acenaphthylene	mg/l	0.00001		No project standard												0	0				
Acenaphthene	mg/l	0.00001		No project standard												0	0				
Fluorene	mg/l	0.00001		No project standard												0	0				
Phenanthrene	mg/l	0.00001		No project standard												0	0				
Anthracene	mg/l	0.00001		No project standard												0	0				
Fluoranthene	mg/l	0.00001		No project standard												0	0				
Pyrene	mg/l	0.00001		No project standard												0	0				
Benzo(a)anthracene	mg/l	0.00001		No project standard												0	0				
Chrysene	mg/l	0.00001		No project standard												0	0				
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard												0	0				
Benzo(a)pyrene	mg/l	0.00001		0.0007												0	0				
Indeno(123cd)pyrene	mg/l	0.00001		No project standard												0	0				
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard												0	0				
Benzo(ghi)perylene	mg/l	0.00001		No project standard												0	0				
Inorganics and Trace Metals																					
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		0.39	0.14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	9	2	0.14	0.27	0.38	0.39
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9	0				
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.08	<0.004	<0.004	<0.004	0.04	0.06	0.05	0.06	0.03	9	6	0.03	0.05	0.08	0.08
Beryllium	mg/l	0.005		No project standard												0	0				
Boron	mg/l	0.002		2.4	WHO DWS											0	0				
Boron as boric acid	mg/L			0.3	KEBS requirements for drinking water		Nil	Nil	Nil	Nil	Nil	13.66	0.07	0.03	1.72	9	4	0.03	3.87	11.87	13.66
Bromate as BrO3	mg/L			0.01	KEBS requirements for drinking water		<0.001		<0.001			<0.001	<0.001	to follow	<0.001	6	0				
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	9	0				
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	9	0				
Cyanide as CN	mg/L			0.07	KEBS requirements for drinking water		Nil	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	9	0				
Copper	mg/l	0.003		0.05	Environmental Management and Coordir		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9	0				
Iron (Ferrous)	mg/l	0.00002		No project standard												0	0				
Iron (Feric)	mg/l	0.00002		No project standard												0	0				
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		0.19	0.07	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	9	3	0.03	0.10	0.18	0.19
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	9	0				
Lithium	mg/L			No project standard			<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	9	0				
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9	0				
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	9	0				
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	9	0				
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		0.04	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9	1	0.04	0.04	0.04	0.04
Vanadium	mg/l	0.0006		No project standard												0	0				
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordir		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	9	1	0.04	0.04	0.04	0.04	
Strontium	mg/l	0.005		No project standard			0.1	0.17	0.17	0.16	0.14	0.19	0.21	0.22	0.19	9	9	0.1	0.17	0.22	0.22
Sanitary																					
BOD	mg/l	1		No project standard												0	0				
COD	mg/l	7		No project standard												0	0				
Total nitrogen	mg/l	0.5		No project standard												0	0				
Total phosphorous	mg/l	0.5		No project standard												0	0				
Total coliform bacteria	MPN/100ml	not specified		No project standard												0	0				
Fecal coliforms	MPN/100ml	not specified		No project standard												0	0				

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard		Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal (TURK 1 (SGS MA18-02852.003)	Tailrace Canal	Tailrace Canal (SGS MA18-04598.006)	Tailrace Canal	Tailrace Canal	Tailrace Canal	Tailrace Canal	Tailrace Canal	Tailrace Canal	Tailrace Canal	Tailrace Canal	Number of Analyses	Number of Analyses with Numerical Result	Result			
			Min	Max	TD1 Tailrace	TD2 Tailrace	17		08-Oct-15	11/NOV/2015	7-DEC-15	AQ 47599b	AQ 48994	AQ 49745	SGS	MA17-05350.001															Min	Mean	95th percentile	Max
					16/6/15	16/6/15	5/8/15	20/9/15	28/10/15	2/12/15	30/12/2015	30/03/2016	30/08/2016	16/10/2016	16/08/2017	08/11/2017	09/02/2018	27/06/2018	01/09/2018	01/10/2018	30/11/2018	12/12/2018	01/01/2019	01/01/2019	01/02/2019	01/03/2019	01/04/2019						
Major Ions																																
Calcium	mg/l	0.2		150	20.98	20.94	20.59	20.44	21.65	19.64	35.58	15.75	13.13	0.09	18.17	16.71	16.48	12.67	13.11	14.88	13.01	9.84	10.95	17.17	20.69	28.73	13.69	23	23	0.09	17.17	28.02	35.58
Magnesium	mg/l	0.1		100	6.32	6.27	6.62	6.49	6.81	6.69	33.53	4.56	4.11	0.07	5.77	4.68	4.99	3.76	4.12	4.76	4.13	3.42	3.69	5.33	6.06	10.56	4.13	23	23	0.07	6.39	10.19	33.53
Potassium	mg/l	0.1		No project standard	4.2	4.19	3.93	3.82	3.73	3.83	1.61	3.9	4.61	1.18	3.84	3.47	2.93	2.96	2.8	2.91	2.48	2.1	2.16	3.22	3.56	3.34	2.71	23	23	1.18	3.19	4.20	4.61
Sodium	mg/l	0.1		50	10.97	10.97	8.32	8.65	7.31	7.31	**217.13**	**70.19**	13.6	47.1	8.54	7.17	6.17	5.98	6.18	6.19	5.3	4.57	4.77	7.66	9.06	10.73	5.96	23	23	4.57	21.30	67.88	217.13
Fluoride	mg/l	0.3		1.5	0.84	0.96	0.96	0.53	0.27	0.69	**1.8**	1.25	0.12	Nil	0.66	0.36	0.49	0.56	0.93	0.89	0.47	0.47	0.55	0.67	0.61	0.17	0.62	23	22	0.12	0.68	1.24	1.8
Sulphate	mg/l	0.05		400	2.47	2.06	2.68	2.9	1.8	2.06	20.6	1.08	54.5	7.92	1.65	1.03	2.26	4.12	2.06	2.26	1.65	4.32	4.73	1.44	1.65	9.26	1.65	23	23	1.03	5.92	19.47	54.5
Chloride	mg/l	0.3		250	5.98	4.79	7.13	14.46	10.56	11.32	4.43	4.42	11.8	14.75	8.26	0.87	2.89	30.86	9.78	4.25	12.76	21.27	8.51	3.66	3.66	5.49	4.57	23	23	0.87	8.98	20.62	30.86
Alkalinity (HCO3)	mg/l	1	No project standard	No project standard																								0	0				
Nutrients																																
Ortho Phosphate as PO4	mg/l	0.03		2.2	0.04	Nil	Nil	Not detected	Nil	Nil	Nil	0.33	**4.89**	0.83	0.02	Nil	0.09	2.02	0.34	**2.54**	0.11	Nil	Nil	0.25	<0.02	0.36	<0.02	23	12	0.02	0.99	3.60	4.89
Nitrate as NO3	mg/l	0.2		10	2.1	1.8	6.1	Nil	Nil	**10.7**	0.8	0.57	0.16	**12.63**	**29.11**	1.24	1.06	9.12	7.17	3.55	6.69	1.96	2.33	3.64	<0.1	<0.01	2.21	0.27	23	20	0.16	5.16	13.45	29.11
Nitrite	mg/l	0.02		0.003	Not detected	Not detected	Nil	Nil	Nil	Not detected	Not detected	<0.001	<0.001	<0.001	**0.12**	Nil	Not detected	Not detected	Not detected	Not detected	**0.148**	Not detected	Not detected	Not detected	<0.01	<0.01	<0.01	<0.01	23	2	0.12	0.13	0.15	0.148
Ammonia as N	mg/L			0.5	0.11	0.11	0.05	0.1	0.08	0.31	0.01	0.19	0.001	<0.001	0.02	Nil	0.03	**12.39**	0.38	**1.06**	**2.1**	0.06	0.06	<0.03	<0.03	**2.93**	0.48	23	19	0.001	1.08	3.88	12.39
Ammonia as NH3	mg/l	0.07		0.5																								0	0				
Physico-chemical																																
Total Alkalinity as CaCO3	mg/l	1		No project standard	100	95	140	210	106	80	590	180.6	375	187.3	119.1	92.25	102.5	130.88	101.4	131.82	76.05	202.8	152.1	140.4	113.4	145	97.2	23	23	76.05	159.51	358.50	590
Electrical Conductivity	mS/cm	2		No project standard	0.2314	0.23	0.204	0.322	0.1964	0.1853	1.024	0.22	0.17	0.17	0.2095	0.2185	0.2278	0.1707	0.2695	0.184	0.2307	0.34	0.2569	0.2609	0.2246	0.2494	0.342	0.2428	23	23	0.17	0.26	0.34	1.024
pH (lab)	pH units	0.01	6.5	8.5	6.65	6.94	7.54	6.75	7.24	7.27	7.33	8.02	7.66	7.64	7.44	7.09	7.91	7.45	7.61	7.55	7.54	7.43	7.54	7.83	7.46	7.67	7.36	23	23	6.65	7.43	7.90	8.02
Redox (Eh)	mV	not specified		No project standard																								0	0				
Temperature	°C	0.5		No project standard																								0	0				
Dissolved Oxygen	mg/l	1		No project standard																								0	0				
TDS	mg/l	35		1000	150.41	149.5	132.6	209.3	127.66	120.45	665.6	110	85	85	118	142	148	97	157	107	132	167	170	130	162	222	142	23	23	85	162.15	220.73	665.6
TSS	mg/l	10		0	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	Not detectable	Not detectable	Nil	**2**	Nil	**Detectable**	Not detectable	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	**Detectable**	23	1	2	2.00	2.00	2
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	78.4	78.12	78.67		82.1	76.57	226.92	74	50	12.51	69.14	60.98	61.68	47.12	49.68	56.78	49.48	58.66	42.48	64.84	76.61	115.22	53.17	22	22	12.51	70.05	113.56	226.92
Silica	mg/l	0.01		No project standard	4.28	4.11	3.45	3.38	4.73	5.93	5.44	4.57	<0.001	3.5	4.22	6.58	4.23	8.83	4.18	3.46	2.2	1.72	1.58	1.72	1.53	12.13	1.76	23	22	1.53	4.25	8.72	12.13
Residual Chlorine	mg/L			0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.011	<0.01	<0.02	<0.02	<0.02	Absent	Absent	Absent	<0.02	<0.02	<0.02	Absent	<0.02	<0.02	0.02	23	3	0.011	0.03	0.05	0.05
Organics and Oils																																
TPH CWG - Aliphatics																																
>C5-C6 #	mg/l	0.005		No project standard																								0	0				
>C8-C10 #	mg/l	0.005		No project standard																								0	0				
>C6-C8 #	mg/l	0.005		No project standard																								0	0				
>C10-C12 #	mg/l	0.005		No project standard																								0	0				
>C12-C16 #	mg/l	0.01		No project standard																								0	0				
>C16-C21 #	mg/l	0.01		No project standard																								0	0				
>C21-C35 #	mg/l	0.01		No project standard																								0	0				
Total aliphatics CS-35	mg/l	0.01		No project standard																								0	0				
TPH CWG - Aromatics																																
>C5-EC7 #	mg/l	0.005		No project standard																								0	0				
>EC7-EC8 #	mg/l	0.005		No project standard																								0	0				
>EC8-EC10 #	mg/l	0.005		No project standard																								0	0				
>EC10-EC12 #	mg/l	0.005		No project standard																								0	0				
>EC12-EC16 #	mg/l	0.01		No project standard																								0	0				
>EC16-EC21 #	mg/l	0.01		No project standard																								0	0				
>EC21-EC35 #	mg/l	0.01		No project standard																								0	0				
Total aromatics CS-35	mg/l	0.01		No project standard																								0	0				
Total aliphatics and aromatics(CS-35)	mg/l	0.01		No project standard																								0	0				
Benzene	mg/l	0.0005		0.01																								0	0				
Toluene	mg/l	0.0005		0.7																								0	0				
Ethylbenzene	mg/l	0.0005		0.3																								0	0				
Xylene (total)	mg/l			0.5																								0	0				
m/p-Xylene	mg/l	0.001		No project standard																								0	0				
o-Xylene	mg/l	0.001		No project standard																								0	0				
Polyaromatic Hydrocarbons																																
Naphthalene	mg/l	0.00001		No project standard																								0	0				
Acenaphthylene	mg/l	0.00001		No project standard																								0	0				
Acenaphthene	mg/l	0.00001		No project standard																								0	0				
Fluorene	mg/l	0.00001		No project standard																								0	0				
Phenanthrene	mg/l	0.00001		No project standard																								0	0				
Anthracene	mg/l	0.00001		No project standard																								0	0				
Fluoranthene	mg/l	0.00001		No project standard																								0	0				
Pyrene	mg/l	0.00001		No project standard																								0	0				
Benzo(a)anthracene	mg/l	0.00001		No project standard																								0	0				
Chrysene	mg/l	0.00001		No project standard																								0	0				
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard																								0	0				
Benzo(a)pyrene	mg/l	0.00001		0.0007																								0	0				
Indeno[123cd]pyrene	mg/l	0.00001		No project standard																								0	0				
Dibenz(ah)anthracene	mg/l	0.00001		No project standard																								0	0				
Benzo(ghi)perylene	mg/l	0.00001		No project standard																								0	0				
Inorganics and Trace Metals																																
Aluminium	mg/l	0.2		0.1	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.001	<0.001	0.05	**2.08**	<0.05	0.07	**4.08**	<0.05	<0.05	<0.05	<0.05	0.07	0.06	<0.05	**0.57**	<0.05	23	7	0.05	1.00	3.48	4.08
Arsenic	mg/l	0.0009		0.01	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.004	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	22	0				
Barium	mg/l	0.003		0.7	0.09	0.09	0.08	0.07	0.09	0.09	<0.002	<0.001	<0.001	<0.001	0.07	0.05	0.05	<0.004	<0.004	0.05	<0.004	0.04	0.04	0.06	0.06	0.09	0.09	23	16	0.04	0.07	0.09	0.09
Beryllium	mg/l	0.005		No project standard																								0	0				
Boron	mg/l	0.002		2.4													0.05											1	1	0.05	0.05	0.05	0.05
Boron as boric acid	mg/L			0.3	<0.005	<0.005	<0.005	<0.002		0.02	0.18	<0.001	<0.001	<0.001	**2.4**	<0.005	**0.31**	Nil	Nil	Nil	Nil	Nil	Nil	**14.07**	0.07	0.09	**2.17**	22	8	0.02	2.41	9.99	14.07
Bromate as BrO3	mg/L			0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	0.001	<0.001					<0.001	<0.001	<0.001	<0.001	18	2	0.001	0.00	0.01	0.007
Cadmium	mg/l	0.00003		0.003	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	<0.001	<0.001	<0.001	Not detected	Not detected	Not detected	**12.67**	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	23	1	12.67	12.67	12.67	12.67
Chromium	mg/l	0.0002		0.05	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.001	<0.001	<0.001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	23	0				
Cyanide as CN	mg/L			0.07	Nil	Nil	Nil	Nil	Nil	Nil	Nil	<0.001	<0.001	<0.001	Nil	Nil	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	23	0				
Copper	mg/l	0.003		0.05	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	**0.11**	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23	1	0.11	0.11	0.11	0.11
Iron (Ferrous)	mg/l	0.00002		No project standard																								0	0				
Iron (Ferric)	mg/l	0.00002		No project standard																								0	0				
Iron (total)	mg/l			0.3	<0.007	<0.007	0.04	<0.007	0.06	**0.62**	**0.34**	<0.001	0.05	0.09	**1.22**	**0.93**	0.03	**2.56**	0.12	<0.02	<0.02	0.03	0.04	0.05	<0.02	**0.47**	0.14	23	16	0.03	0.42	1.56	2.56
Lead	mg/l	0.0004		0.01	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	<0.001	<0.001	<0.001	<0.004	Not detected	Not detected	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	23	0				
Lithium	mg/L			No project standard			<0.004	<0.002	<0.004	<0.004	<0.004	<0.001	<0.001	<0.001	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	21	0				
Manganese	mg/l	0.00002		0.5	<0.002	<0.002	<0.002	<0.002	<0.002	0.01	0.01	0.04	0.18	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.19	23	6	0.01	0.08	0.19	0.19
Mercury	mg/l	0.0005		0.001	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	<0.001	<0.001	<0.001	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	Not detected	23	0				
Nickel	mg/l	0.0002		0.02	Not detected	Not detected	<0.015	<0.015	<0.015	<0.015	<0.015	<0.001	<0.001	<0.001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	23	0				
Selenium	mg/l	0.0012		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.001	Not detected	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23	0				
Vanadium	mg/l	0.0006		No project standard																								0	0				
Zinc	mg/l	0.0015		1.5	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	0.13	0.12	<0.001	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	23	4	0.01	0.07	0.13	0.13
Strontium	mg/l	0.005		No project standard	<0.0005	<0.0005	0.23	0.22	0.23	<0.005	1.23	<0.001	<0.001	<0.001	0.19	0.18	0.18	0.14	0.17	0.18	0.16	0.13	0.14	0.19	0.21	0.2	0.16	23	17	0.13	0.24	0.43	1.23
Sanitary																																
BOD	mg/l	1		No project standard																								0	0				
COD	mg/l	7		No project standard																								0	0				
Total nitrogen	mg/l	0.5		No project standard																								0	0				
Total phosphorous	mg/l	0.5		No project standard																								0	0				
Total coliform bacteria	MPN/100ml	not specified		No project standard																								0	0				
Fecal coliforms	MPN/100ml	not specified		No project standard																								0	0				

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Malmalte River	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID	MA19-01403.001			Min	Mean	Max
			Min	Max	Source	Date	25/3/19					
Major Ions												
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		31.64	1	1	31.64	31.64	31.64
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		11.54	1	1	11.54	11.54	11.54
Potassium	mg/l	0.1		No project standard			2.94	1	1	2.94	2.94	2.94
Sodium	mg/l	0.1		50	WHO DWS		11.11	1	1	11.11	11.11	11.11
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.18	1	1	0.18	0.18	0.18
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		9.7	1	1	9.7	9.70	9.7
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		6.41	1	1	6.41	6.41	6.41
Alkalinity (HCO3)	mg/l	1	No project standard	No project standard			152.1	1	1	152.1	152.10	152.1
Nutrients												
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		1.15	1	1	1.15	1.15	1.15
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordi		5.49	1	1	5.49	5.49	5.49
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		<0.01	1	0			
Ammonia as N	mg/L			0.5	KEBS requirements for drinking water			0	0			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water		3.27	1	1	3.27	3.27	3.27
Physico-chemical												
Total Alkalinity as CaCO3	mg/l	1		No project standard			235.5	1	1	235.5	235.50	235.5
Electrical Conductivity	mS/cm	2		No project standard			567.69	1	1	567.69	567.69	567.69
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water		7.87	1	1	7.87	7.87	7.87
Redox (Eh)	mV	not specified		No project standard				0	0			
Temperature	^{o}C	0.5		No project standard				0	0			
Dissolved Oxygen	mg/l	1		No project standard			10.13	1	1	10.13	10.13	10.13
TDS	mg/l	35		1000	KEBS requirements for drinking water		369	1	1	369	369.00	369
TSS	mg/l	10		0	KEBS requirements for drinking water		6	1	1	6	6.00	6
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		126.51	1	1	126.51	126.51	126.51
Silica	mg/l	0.01		No project standard			12.84	1	1	12.84	12.84	12.84
Residual Chlorine	mg/L			0.2	uirements for drinking water			0	0			
Organics and Oils												
TPH CWG - Aliphatics												
>C5-C6 #	mg/l	0.005		No project standard				0	0			
>C8-C10 #	mg/l	0.005		No project standard				0	0			
>C6-C8 #	mg/l	0.005		No project standard				0	0			
>C10-C12#	mg/l	0.005		No project standard				0	0			
>C12-C16#	mg/l	0.01		No project standard				0	0			
>C16-C21#	mg/l	0.01		No project standard				0	0			
>C21-C35#	mg/l	0.01		No project standard				0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard				0	0			
TPH CWG - Aromatics												
>C5-EC7 #	mg/l	0.005		No project standard				0	0			
>EC7-EC8 #	mg/l	0.005		No project standard				0	0			
>EC8-EC10 #	mg/l	0.005		No project standard				0	0			
>EC10-EC12#	mg/l	0.005		No project standard				0	0			
>EC12-EC16#	mg/l	0.01		No project standard				0	0			
>EC16-EC21#	mg/l	0.01		No project standard				0	0			
>EC21-EC35#	mg/l	0.01		No project standard				0	0			
Total aromatics C5-35	mg/l	0.01		No project standard				0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard			<0.1	1	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS	requirements for d	<0.01	1	0			
Toluene	mg/l	0.0005		0.7	WHO DWS		<0.01	1	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS		<0.01	1	0			
Xylene (total)	mg/l			0.5	WHO DWS			0	0			
m/p-Xylene	mg/l	0.001		No project standard				0	0			
o-Xylene	mg/l	0.001		No project standard				0	0			
Polyaromatic Hydrocarbons												
Naphthalene	mg/l	0.00001		No project standard			<50	1	0			
Acenaphthylene	mg/l	0.00001		No project standard			<50	1	0			
Acenaphthene	mg/l	0.00001		No project standard			<50	1	0			
Fluorene	mg/l	0.00001		No project standard			<50	1	0			
Phenanthrene	mg/l	0.00001		No project standard			<50	1	0			
Anthracene	mg/l	0.00001		No project standard			<50	1	0			
Fluoranthene	mg/l	0.00001		No project standard			<50	1	0			
Pyrene	mg/l	0.00001		No project standard			<50	1	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard			<50	1	0			
Chrysene	mg/l	0.00001		No project standard			<50	1	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard			<100	1	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007			<50	1	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard			<50	1	0			

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Dibenzo(ah)anthracene	mg/l	0.00001		No project standard			<50	1	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard			<50	1	0			
Inorganics and Trace Metals												
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		**0.199**	1	1	0.199	0.20	0.199
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.01	1	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.09	1	1	0.09	0.09	0.09
Beryllium	mg/l	0.005		No project standard			<0.003	1	0			
Boron	mg/l	0.002		2.4	WHO DWS		<0.005	1	0			
Boron as boric acid	mg/L			0.3	KEBS requirements for drinking water			0	0			
Bromate as BrO3	mg/L			0.01	KEBS requirements for drinking water			0	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		<0.007	1	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	1	0			
Cyanide as CN	mg/L			0.07	KEBS requirements for drinking water			0	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordi		<0.01	1	0			
Iron (Ferrous)	mg/l	0.00002		No project standard				0	0			
Iron (Feric)	mg/l	0.00002		No project standard				0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		0.19	1	1	0.19	0.19	0.19
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<0.004	1	0			
Lithium	mg/L			No project standard				0	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	1	0			
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		<0.01	1	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.02	1	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	1	0			
Vanadium	mg/l	0.0006		No project standard				0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordi		<0.01	1	0			
Strontium	mg/l	0.005		No project standard			0.21	1	1	0.21	0.21	0.21
Sanitary												
BOD	mg/l	1		No project standard				0	0			
COD	mg/l	7		No project standard				0	0			
Total nitrogen	mg/l	0.5		No project standard				0	0			
Total phosphorous	mg/l	0.5		No project standard				0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard			33	1	1	33	33.00	33
Fecal coliforms	MPN/100ml	not specified		No project standard			13	1	1	13	13.00	13

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Lokicheda SW	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID						
			Min	Max	Source	Date	Apr-21			Min	Mean	Max
Major Ions												
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		107	1	1	107	107.00	107
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		13.37	1	1	13.37	13.37	13.37
Potassium	mg/l	0.1		No project standard			12	1	1	12	12.00	12
Sodium	mg/l	0.1		50	WHO DWS		97.06	1	1	97.06	97.06	97.06
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		0.61	1	1	0.61	0.61	0.61
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		11.4	1	1	11.4	11.40	11.4
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		2.38	1	1	2.38	2.38	2.38
Alkalinity (HCO3)	mg/l	1	No project standard	No project standard			181.44	1	1	181.44	181.44	181.44
Nutrients												
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		0.46	1	1	0.46	0.46	0.46
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordi		29.43	1	1	29.43	29.43	29.43
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		<0.01	1	0			
Ammonia as N	mg/L			0.5	KEBS requirements for drinking water		<0.03	1	0			
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water			0	0			
Physico-chemical												
Total Alkalinity as CaCO3	mg/l	1		No project standard			181.44	1	1	181.44	181.44	181.44
Electrical Conductivity	mS/cm	2		No project standard			0.551	1	1	0.551	0.55	0.551
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water		7.48	1	1	7.48	7.48	7.48
Redox (Eh)	mV	not specified		No project standard				0	0			
Temperature	°C	0.5		No project standard				0	0			
Dissolved Oxygen	mg/l	1		No project standard				0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		322	1	1	322	322.00	322
TSS	mg/l	10		0	KEBS requirements for drinking water		Detectable	1	0			
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		322	1	1	322	322.00	322
Silica	mg/l	0.01		No project standard			1.6	1	1	1.6	1.60	1.6
Residual Chlorine	mg/L			0.2	uirements for drinking water		<0.02	1	0			
Organics and Oils												
TPH CWG - Aliphatics												
>C5-C6 #	mg/l	0.005		No project standard				0	0			
>C8-C10 #	mg/l	0.005		No project standard				0	0			
>C6-C8 #	mg/l	0.005		No project standard				0	0			
>C10-C12#	mg/l	0.005		No project standard				0	0			
>C12-C16#	mg/l	0.01		No project standard				0	0			
>C16-C21#	mg/l	0.01		No project standard				0	0			
>C21-C35#	mg/l	0.01		No project standard				0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard				0	0			
TPH CWG - Aromatics												
>C5-EC7 #	mg/l	0.005		No project standard				0	0			
>EC7-EC8 #	mg/l	0.005		No project standard				0	0			
>EC8-EC10 #	mg/l	0.005		No project standard				0	0			
>EC10-EC12#	mg/l	0.005		No project standard				0	0			
>EC12-EC16#	mg/l	0.01		No project standard				0	0			
>EC16-EC21#	mg/l	0.01		No project standard				0	0			
>EC21-EC35#	mg/l	0.01		No project standard				0	0			
Total aromatics C5-35	mg/l	0.01		No project standard				0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard				0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water			0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS			0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS			0	0			
Xylene (total)	mg/l			0.5	WHO DWS			0	0			
m/p-Xylene	mg/l	0.001		No project standard				0	0			
o-Xylene	mg/l	0.001		No project standard				0	0			
Polyaromatic Hydrocarbons												
Naphthalene	mg/l	0.00001		No project standard				0	0			
Acenaphthylene	mg/l	0.00001		No project standard				0	0			
Acenaphthene	mg/l	0.00001		No project standard				0	0			
Fluorene	mg/l	0.00001		No project standard				0	0			
Phenanthrene	mg/l	0.00001		No project standard				0	0			
Anthracene	mg/l	0.00001		No project standard				0	0			
Fluoranthene	mg/l	0.00001		No project standard				0	0			
Pyrene	mg/l	0.00001		No project standard				0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard				0	0			
Chrysene	mg/l	0.00001		No project standard				0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard				0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007				0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard				0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard				0	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard				0	0			
Inorganics and Trace Metals												
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		0.12	1	1	0.12	0.12	0.12
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.01	1	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.12	1	1	0.12	0.12	0.12
Beryllium	mg/l	0.005		No project standard				0	0			
Boron	mg/l	0.002		2.4	WHO DWS			0	0			
Boron as boric acid	mg/L			0.3	KEBS requirements for drinking water		0.51	1	1	0.51	0.51	0.51
Bromate as BrO3	mg/L			0.01	KEBS requirements for drinking water		Nil	1	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	1	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	1	0			
Cyanide as CN	mg/L			0.07	KEBS requirements for drinking water		<0.001	1	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordi		<0.01	1	0			
Iron (Ferrous)	mg/l	0.00002		No project standard			0.07	1	1	0.07	0.07	0.07
Iron (Feric)	mg/l	0.00002		No project standard				0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water			0	0			
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water		<0.004	1	0			
Lithium	mg/L			No project standard			<0.004	1	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	1	0			
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		Not detected	1	0			
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		0.02	1	1	0.02	0.02	0.02
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	1	0			
Vanadium	mg/l	0.0006		No project standard				0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordi		<0.01	1	0			
Strontium	mg/l	0.005		No project standard			1.53	1	1	1.53	1.53	1.53
Sanitary												
BOD	mg/l	1		No project standard				0	0			
COD	mg/l	7		No project standard				0	0			
Total nitrogen	mg/l	0.5		No project standard				0	0			
Total phosphorous	mg/l	0.5		No project standard				0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard				0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard				0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Parameter	Units	Requested Detection Limit	Project Water Quality Standard			Location	Lake Turkana	L. Turkana (Lowarengak shore)	Eliye shore (Lake Turkana)	Number of Analyses	Number of Analyses with Numerical Result	Result		
						Sample ID		MA18-05094.003	MA18-05094.005			Min	Mean	Max
			Min	Max	Source	Date	01/05/2018	01/10/2018	01/10/2018					
Major Ions														
Calcium	mg/l	0.2		150	KEBS requirements for drinking water		6.05	5.71	4.45	3	3	4.45	5.40	6.05
Magnesium	mg/l	0.1		100	KEBS requirements for drinking water		14.99	3.17	2.33	3	3	2.33	6.83	14.99
Potassium	mg/l	0.1		No project standard			29.29	19.43	28.64	3	3	19.43	25.79	29.29
Sodium	mg/l	0.1		50	WHO DWS		662.47	264.02	495.39	3	3	264.02	473.96	662.47
Fluoride	mg/l	0.3		1.5	KEBS requirements for drinking water		11.2	6.19	9.15	3	3	6.19	8.85	11.2
Sulphate	mg/l	0.05		400	KEBS requirements for drinking water		36.8	32.52	36.02	3	3	32.52	35.11	36.8
Chloride	mg/l	0.3		250	KEBS requirements for drinking water		479.05	233.12	434.76	3	3	233.12	382.31	479.05
Alkalinity (HCO3)	mg/l	1	No project standard	No project standard						0	0			
Nutrients														
Ortho Phosphate as PO4	mg/l	0.03		2.2	KEBS requirements for drinking water		6.22	12.66	9.38	3	3	6.22	9.42	12.66
Nitrate as NO3	mg/l	0.2		10	Environmental Management and Coordi		2.32	7.07	9.26	3	3	2.32	6.22	9.26
Nitrite	mg/l	0.02		0.003	KEBS requirements for drinking water		0.17	0.1	Not detected	3	2	0.1	0.14	0.17
Ammonia as N	mg/L			0.5	KEBS requirements for drinking water		<0.03	0.77	0.28	3	2	0.28	0.53	0.77
Ammonia as NH3	mg/l	0.07		0.5	KEBS requirements for drinking water					0	0			
Physico-chemical														
Total Alkalinity as CaCO3	mg/l	1		No project standard			1256.4	679.38	1318.2	3	3	679.38	1084.66	1318.2
Electrical Conductivity	mS/cm	2		No project standard			4.02	1.8136	2.9064	3	3	1.8136	2.91	4.02
pH (lab)	pH units	0.01	6.5	8.5	KEBS requirements for drinking water		9.25	9.19	9.3	3	3	9.19	9.25	9.3
Redox (Eh)	mV	not specified		No project standard						0	0			
Temperature	°C	0.5		No project standard						0	0			
Dissolved Oxygen	mg/l	1		No project standard						0	0			
TDS	mg/l	35		1000	KEBS requirements for drinking water		2332	1052	1680	3	3	1052	1688.00	2332
TSS	mg/l	10		0	KEBS requirements for drinking water		Detectable	Detectable	Detectable	3	0			
Total Hardness Dissolved (as CaCO3)	mg/l	1		300	KEBS requirements for drinking water		25.3	27.3	20.71	3	3	20.71	24.44	27.3
Silica	mg/l	0.01		No project standard			13.45	30.9	0.09	3	3	0.09	14.81	30.9
Residual Chlorine	mg/L			0.2	uirements for drinking water		Absent	Absent	Absent	3	0			
Organics and Oils														
TPH CWG - Aliphatics														
>C5-C6 #	mg/l	0.005		No project standard						0	0			
>C8-C10 #	mg/l	0.005		No project standard						0	0			
>C6-C8 #	mg/l	0.005		No project standard						0	0			
>C10-C12#	mg/l	0.005		No project standard						0	0			
>C12-C16#	mg/l	0.01		No project standard						0	0			
>C16-C21#	mg/l	0.01		No project standard						0	0			
>C21-C35#	mg/l	0.01		No project standard						0	0			
Total aliphatics C5-35	mg/l	0.01		No project standard						0	0			
TPH CWG - Aromatics														
>C5-EC7 #	mg/l	0.005		No project standard						0	0			
>EC7-EC8 #	mg/l	0.005		No project standard						0	0			
>EC8-EC10 #	mg/l	0.005		No project standard						0	0			
>EC10-EC12#	mg/l	0.005		No project standard						0	0			
>EC12-EC16#	mg/l	0.01		No project standard						0	0			
>EC16-EC21#	mg/l	0.01		No project standard						0	0			
>EC21-EC35#	mg/l	0.01		No project standard						0	0			
Total aromatics C5-35	mg/l	0.01		No project standard						0	0			
Total aliphatics and aromatics(C5-35)	mg/l	0.01		No project standard						0	0			
Benzene	mg/l	0.0005		0.01	WHO DWS and KEBS requirements for drinking water					0	0			
Toluene	mg/l	0.0005		0.7	WHO DWS					0	0			
Ethylbenzene	mg/l	0.0005		0.3	WHO DWS					0	0			
Xylene (total)	mg/l			0.5	WHO DWS					0	0			
m/p-Xylene	mg/l	0.001		No project standard						0	0			
o-Xylene	mg/l	0.001		No project standard						0	0			
Polyaromatic Hydrocarbons														
Naphthalene	mg/l	0.00001		No project standard						0	0			
Acenaphthylene	mg/l	0.00001		No project standard						0	0			
Acenaphthene	mg/l	0.00001		No project standard						0	0			
Fluorene	mg/l	0.00001		No project standard						0	0			
Phenanthrene	mg/l	0.00001		No project standard						0	0			
Anthracene	mg/l	0.00001		No project standard						0	0			
Fluoranthene	mg/l	0.00001		No project standard						0	0			
Pyrene	mg/l	0.00001		No project standard						0	0			
Benzo(a)anthracene	mg/l	0.00001		No project standard						0	0			
Chrysene	mg/l	0.00001		No project standard						0	0			
Benzo(bk)fluoranthene	mg/l	0.00001		No project standard						0	0			
Benzo(a)pyrene	mg/l	0.00001		0.0007						0	0			
Indeno(123cd)pyrene	mg/l	0.00001		No project standard						0	0			
Dibenzo(ah)anthracene	mg/l	0.00001		No project standard						0	0			
Benzo(ghi)perylene	mg/l	0.00001		No project standard						0	0			
Inorganics and Trace Metals														
Aluminium	mg/l	0.2		0.1	KEBS requirements for drinking water		0.49	12.12	0.12	3	3	0.12	4.24	12.12
Arsenic	mg/l	0.0009		0.01	KEBS requirements for drinking water		<0.001	<0.01	<0.01	3	0			
Barium	mg/l	0.003		0.7	KEBS requirements for drinking water		0.02	0.04	0.02	3	3	0.02	0.03	0.04
Beryllium	mg/l	0.005		No project standard						0	0			
Boron	mg/l	0.002		2.4	WHO DWS					0	0			
Boron as boric acid	mg/L			0.3	KEBS requirements for drinking water		Nil	1.47	2.92	3	2	1.47	2.20	2.92
Bromate as BrO3	mg/L			0.01	KEBS requirements for drinking water		<0.001	to follow	to follow	3	0			
Cadmium	mg/l	0.00003		0.003	KEBS requirements for drinking water		Not detected	Not detected	Not detected	3	0			
Chromium	mg/l	0.0002		0.05	KEBS requirements for drinking water		<0.02	<0.02	<0.02	3	0			
Cyanide as CN	mg/L			0.07	KEBS requirements for drinking water		<0.001	<0.001	<0.001	3	0			
Copper	mg/l	0.003		0.05	Environmental Management and Coordination Act (Water Quality Regulat			<0.01	<0.01	2	0			
Iron (Ferrous)	mg/l	0.00002		No project standard						0	0			
Iron (Feric)	mg/l	0.00002		No project standard						0	0			
Iron (total)	mg/l			0.3	KEBS requirements for drinking water		0.25	7.9	0.05	3	3	0.05	2.73	7.9
Lead	mg/l	0.0004		0.01	KEBS requirements for drinking water			<0.004	<0.004	2	0			
Lithium	mg/L			No project standard			<0.004	<0.004	<0.004	3	0			
Manganese	mg/l	0.00002		0.5	KEBS requirements for drinking water		<0.01	0.09	<0.01	3	1	0.09	0.09	0.09
Mercury	mg/l	0.0005		0.001	KEBS requirements for drinking water		0.004	Not detected	Not detected	3	1	0.004	0.00	0.004
Nickel	mg/l	0.0002		0.02	KEBS requirements for drinking water		<0.002	<0.02	<0.02	3	0			
Selenium	mg/l	0.0012		0.01	KEBS requirements for drinking water		<0.01	0.07	<0.01	3	1	0.07	0.07	0.07
Vanadium	mg/l	0.0006		No project standard						0	0			
Zinc	mg/l	0.0015		1.5	Environmental Management and Coordi		0.04	0.02	<0.01	3	2	0.02	0.03	0.04
Strontium	mg/l	0.005		No project standard				0.09		1	1	0.09	0.09	0.09
Sanitary														
BOD	mg/l	1		No project standard						0	0			
COD	mg/l	7		No project standard						0	0			
Total nitrogen	mg/l	0.5		No project standard						0	0			
Total phosphorous	mg/l	0.5		No project standard						0	0			
Total coliform bacteria	MPN/100ml	not specified		No project standard						0	0			
Fecal coliforms	MPN/100ml	not specified		No project standard						0	0			

< *non detection and no detection limit provided*

Note - Results represent dissolved concentrations. Samples not filtered in the field. Unpreserved and lab filtered.

not analysed for (either not requested or missed by laboratory)

Water Quality

C3

5 Analysis parameters and detection limits

Major Ions	Units	Detection Limit
Calcium	mg/l	0.2
Magnesium	mg/l	0.1
Potassium	mg/l	0.1
Sodium	mg/l	0.1
Fluoride	mg/l	0.3
Sulphate	mg/l	0.05
Chloride	mg/l	0.3
Alkalinity (HCO3)	mg/l	1
Nutrients		
Ortho Phosphate as PO4	mg/l	0.03
Nitrate as N03	mg/l	0.2
Nitrite	mg/l	0.02
Ammonia as NH3	mg/l	0.07
Physico-chemical		
Total Alkalinity as CaCO3	mg/l	1
Electrical Conductivity	mS/cm	2
pH (lab)	pH units	0.01
Redox (Eh)	mV	
Temperature	^{o}C	0.5
Dissolved Oxygen	mg/l	1
TDS	mg/l	35
TSS	mg/l	10
Total Hardness Dissolved (as CaCO3)	mg/l	1
Silica	mg/l	0.01
Organics and Oils		
TPH CWG - Aliphatics		
>C5-C6 #	µg/l	<5
>C8-C10 #	µg/l	<5
>C6-C8 #	µg/l	<5
>C10-C12#	µg/l	<5
>C12-C16#	µg/l	<10
>C16-C21#	µg/l	<10
>C21-C35#	µg/l	<10
Total aliphatics C5-35	µg/l	<10
TPH CWG - Aromatics		
>C5-EC7 #	µg/l	<5
>EC7-EC8 #	µg/l	<5
>EC8-EC10 #	µg/l	<5
>EC10-EC12#	µg/l	<5
>EC12-EC16#	µg/l	<10
>EC16-EC21#	µg/l	<10
>EC21-EC35#	µg/l	<10
Total aromatics C5-35	µg/l	<10
Total aliphatics and aromatics(C5-35)	µg/l	<10
Benzene	µg/l	0.5
Toluene	µg/l	0.5
Ethylbenzene	µg/l	0.5
m/p-Xylene	µg/l	1
o-Xylene	µg/l	1
Polyaromatic Hydrocarbons		
Naphthalene	µg/l	0.01
Acenaphthylene	µg/l	0.01
Acenaphthene	µg/l	0.01
Fluorene	µg/l	0.01
Phenanthrene	µg/l	0.01
Anthracene	µg/l	0.01
Fluoranthene	µg/l	0.01
Pyrene	µg/l	0.01
Benzo(a)anthracene	µg/l	0.01
Chrysene	µg/l	0.01
Benzo(bk)fluoranthene	µg/l	0.01
Benzo(a)pyrene	µg/l	0.01
Indeno(123cd)pyrene	µg/l	0.01
Dibenzo(ah)anthracene	µg/l	0.01
Benzo(ghi)perylene	µg/l	0.01

Inorganics and Trace Metals	Units	Detection Limit
Aluminium	µg/l	200
Arsenic	µg/l	0.9
Barium	µg/l	3
Beryllium	µg/l	5
Boron	µg/l	2
Cadmium	µg/l	0.03
Chromium	µg/l	0.2
Copper	µg/l	3
Iron (Ferrous)	µg/l	0.02
Iron (Feric)	µg/l	0.02
Lead	µg/l	0.4
Manganese	µg/l	0.02
Mercury	µg/l	0.5
Nickel	µg/l	0.2
Selenium	µg/l	1.2
Vanadium	µg/l	0.6
Zinc	µg/l	1.5
Strontium	µg/l	5
Sanitary		
BOD	mg/l	1
COD	mg/l	7
Total nitrogen	mg/l	0.5
Total phosphorous	mg/l	0.5
Total coliform bacteria	MPN/100ml	
Fecal coliforms	MPN/100ml	

Water Quantity

C4

1 Groundwater elevation data

WATER QUANTITY BASELINE SUPPORTING INFORMATION

Figure 1: Dip to Water Level

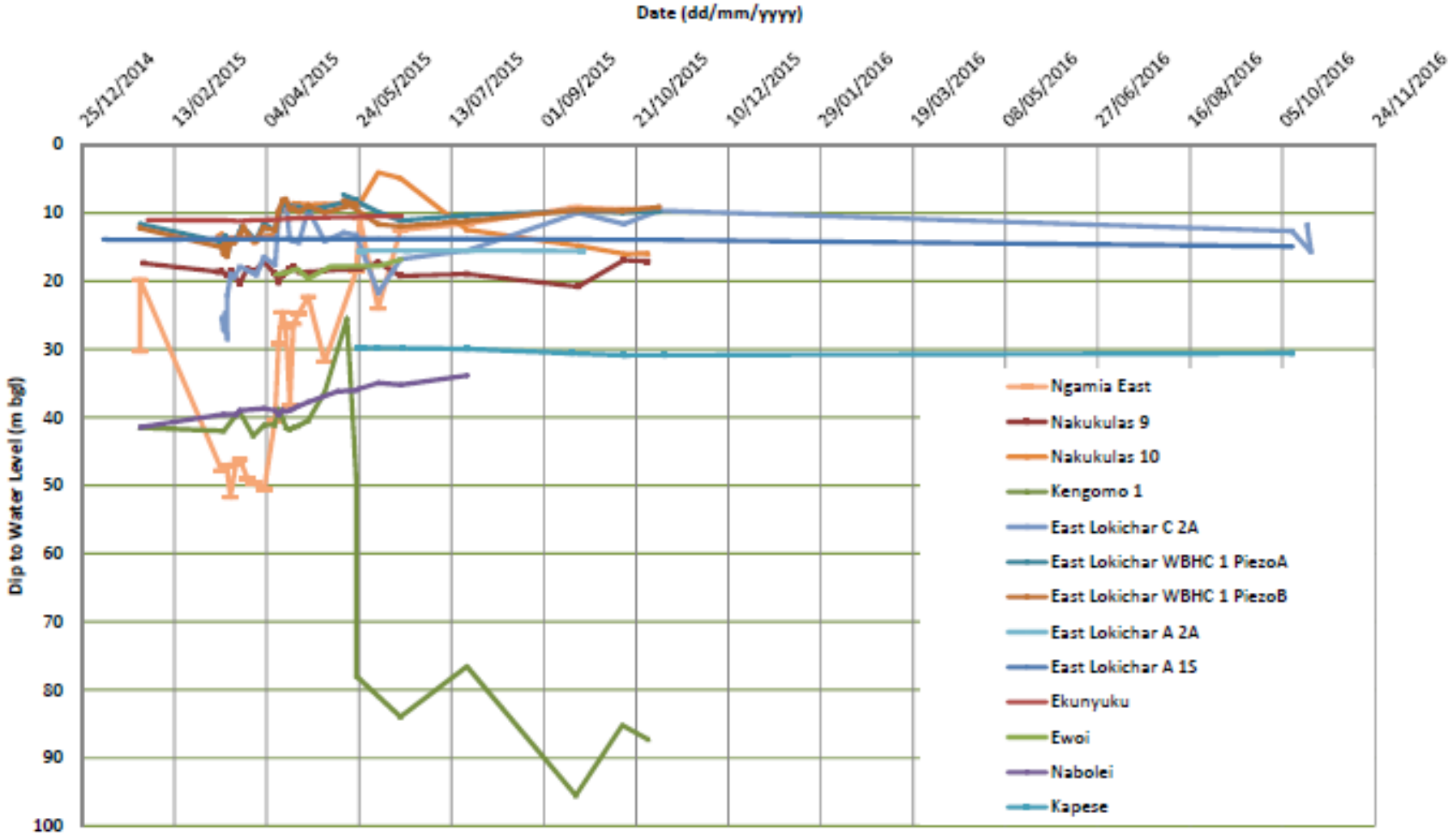


Figure 2: Groundwater Elevation

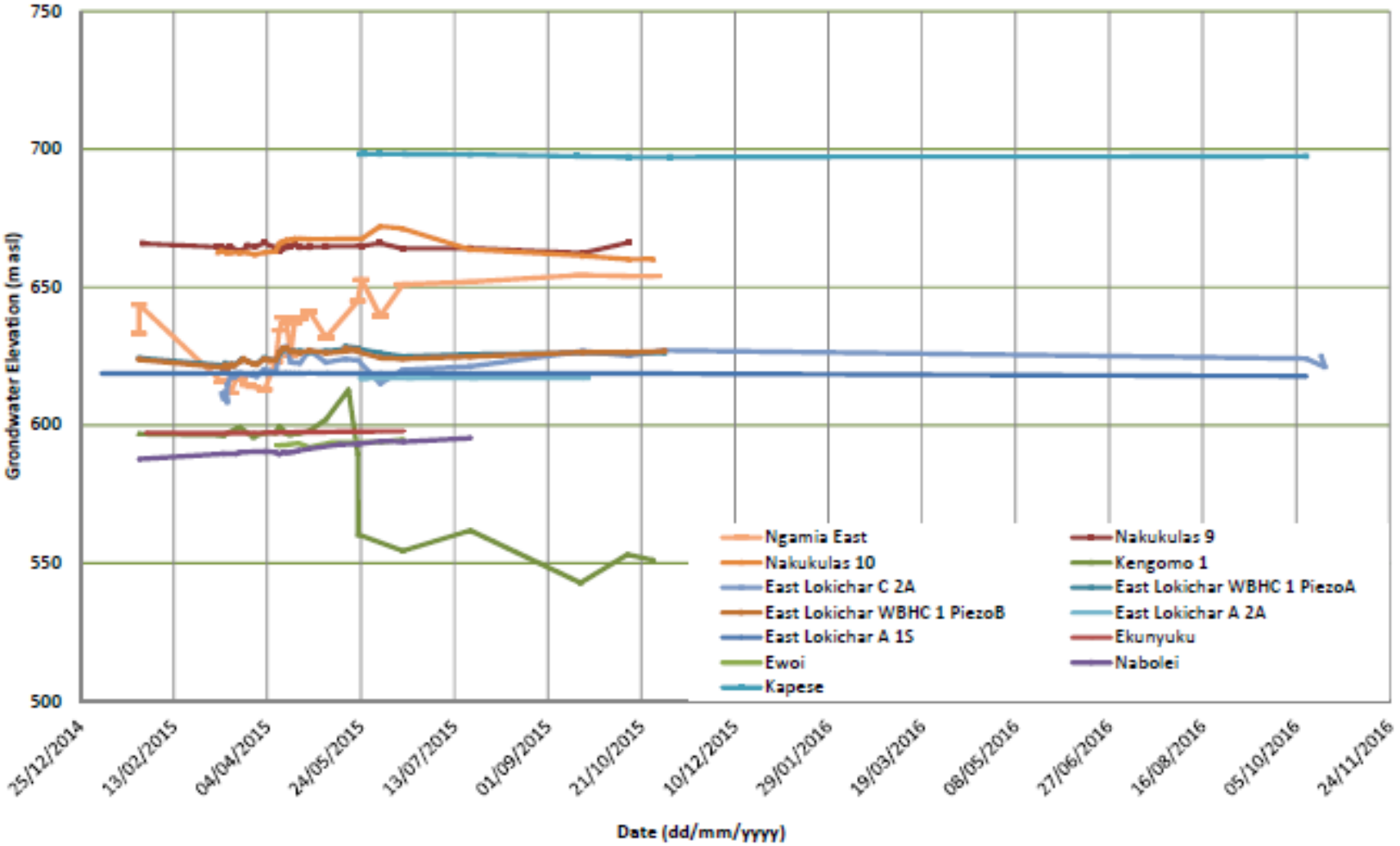
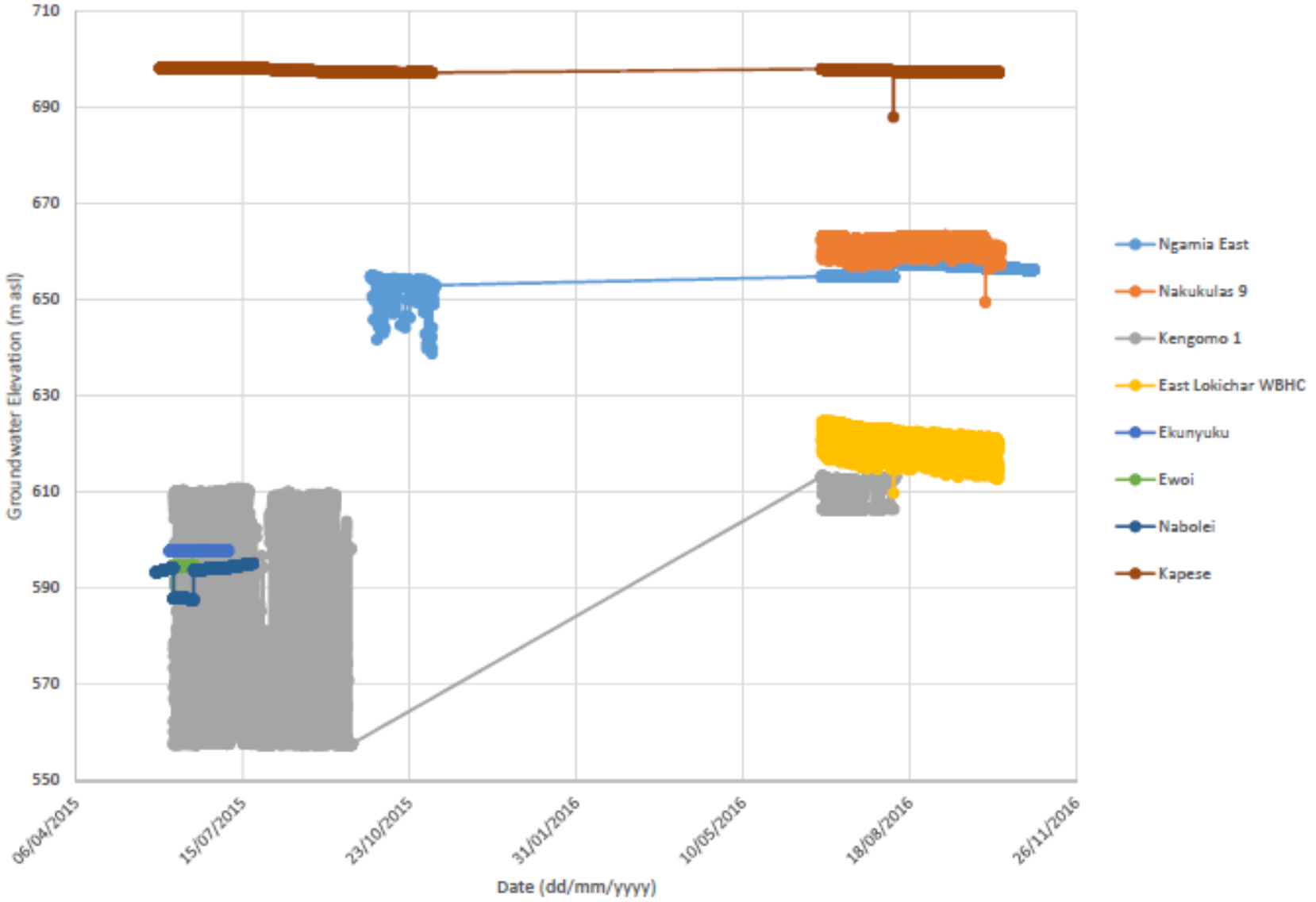


Figure 3: Groundwater Elevations from Level Logger Data



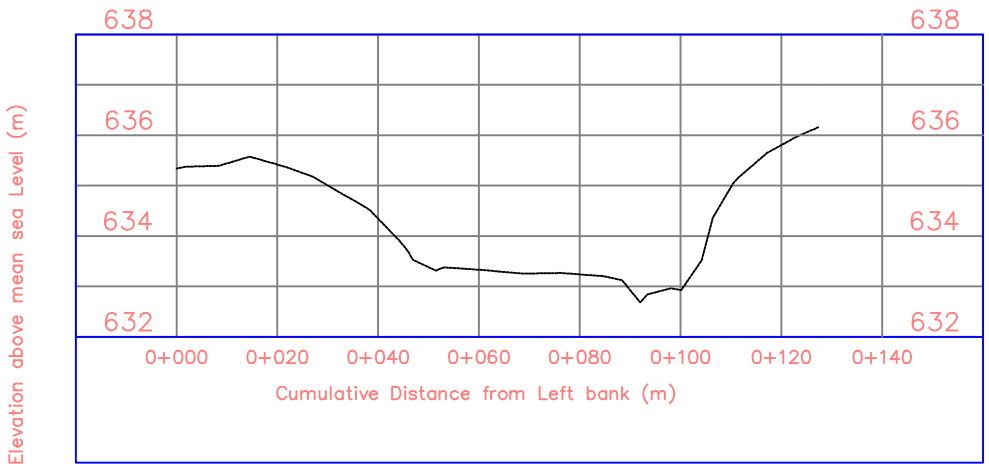
Water Quantity

C4

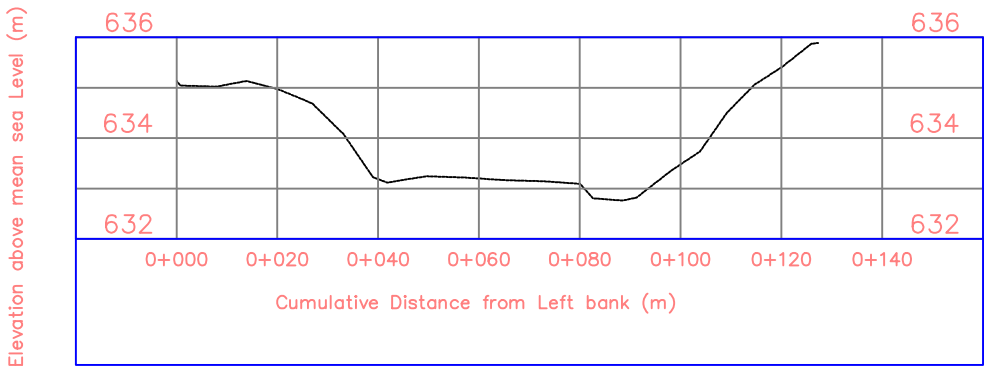
2 Surveyed lugga cross sections

SW 1

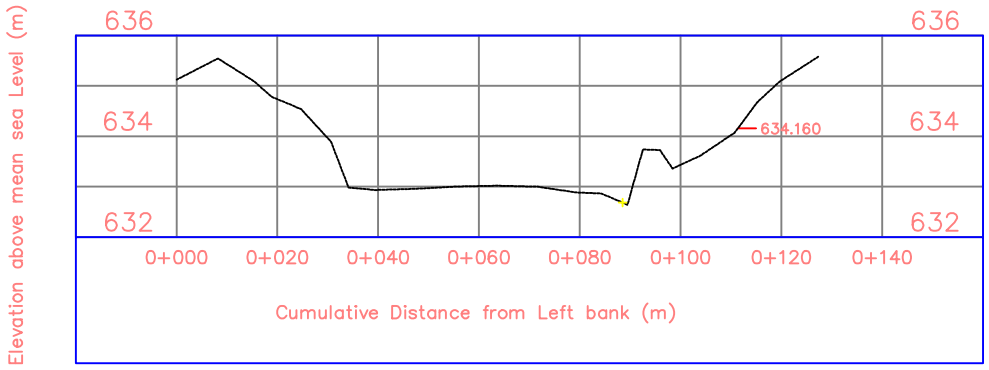
100m UPSTREAM



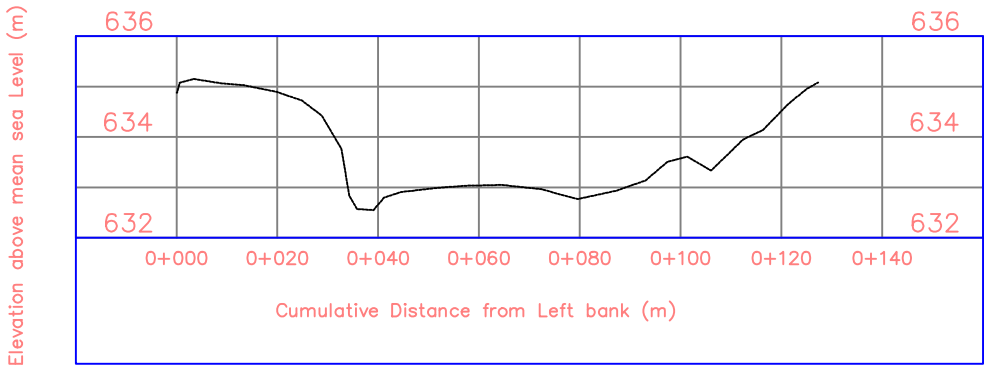
50m UPSTREAM



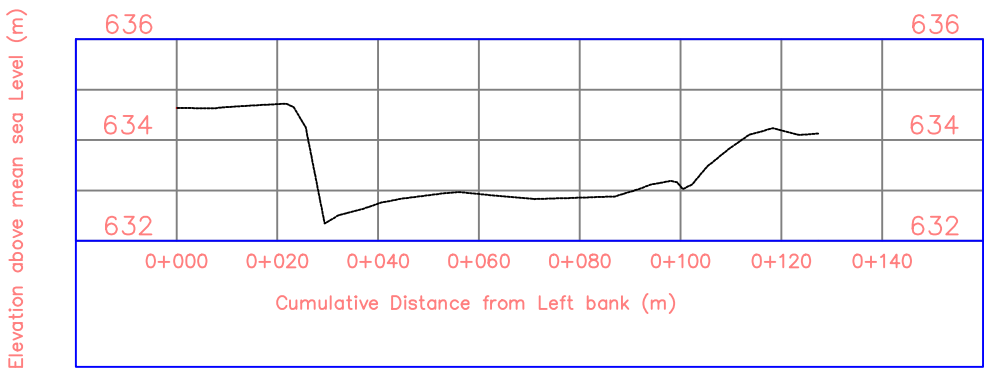
LOGGER SECTION



50m DOWNSTREAM



100m DOWNSTREAM



Logger

625.032 Flood debris elevation

Surveyed river profile

*Scale 1:1500 (printed on A3 paper)

*Coordinate System
UTM, WGS84, 36N

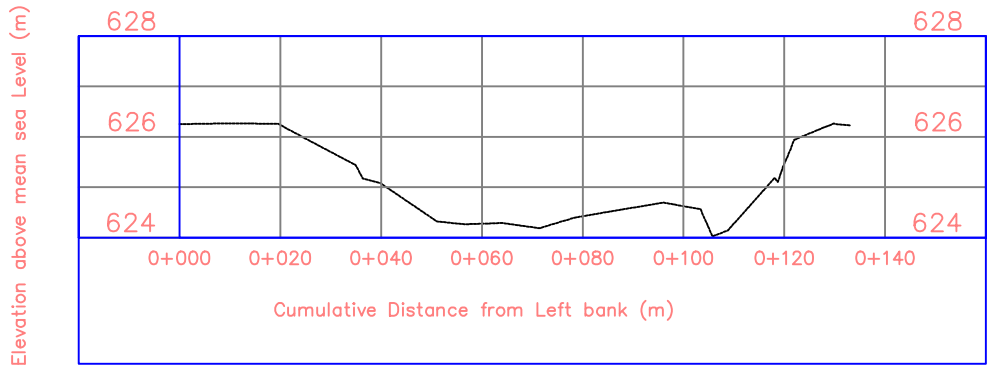
Logger Coordinates

Northing: 255385.86
Easting: 814142.20
Elevation: 632.684

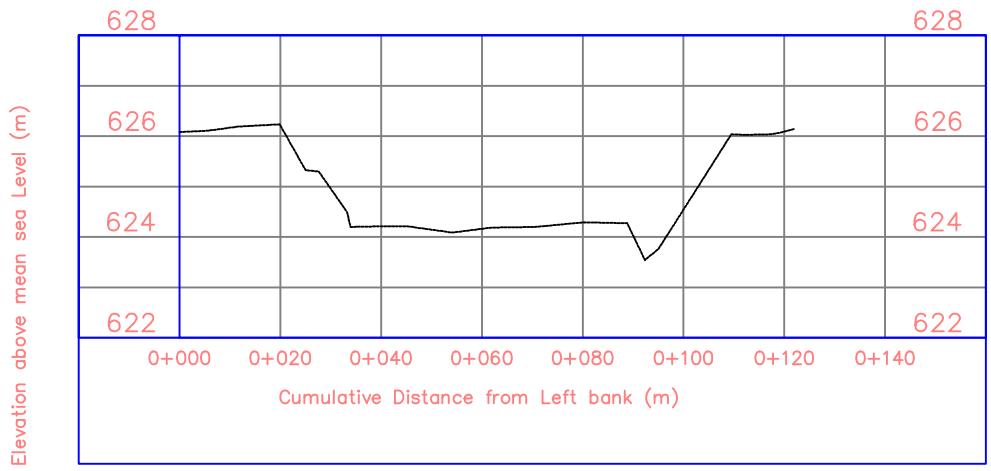
Surveyed & drawn by Erick Rapela

SW 2

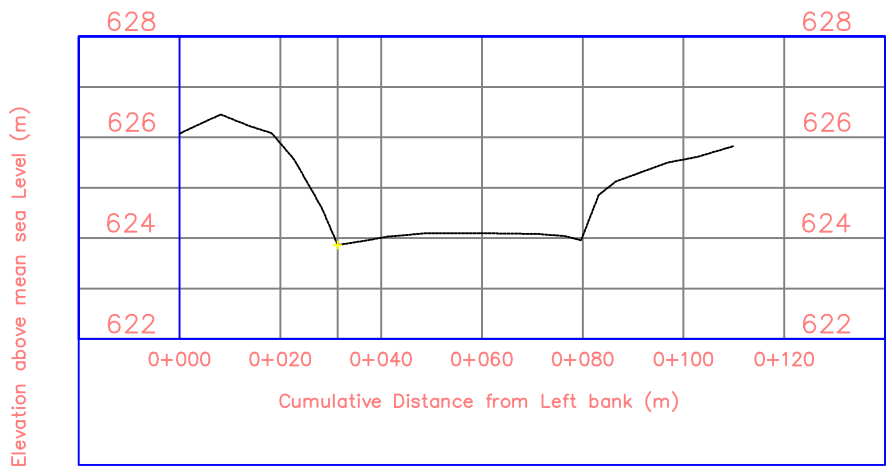
100m UPSTREAM



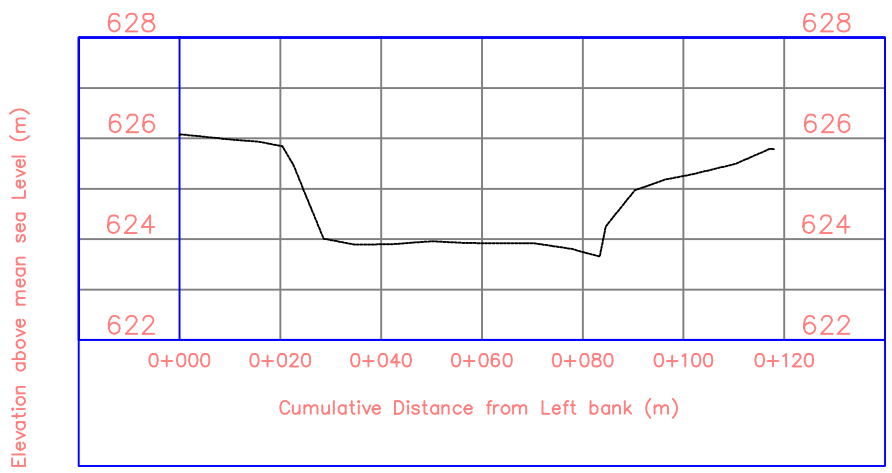
50m UPSTREAM



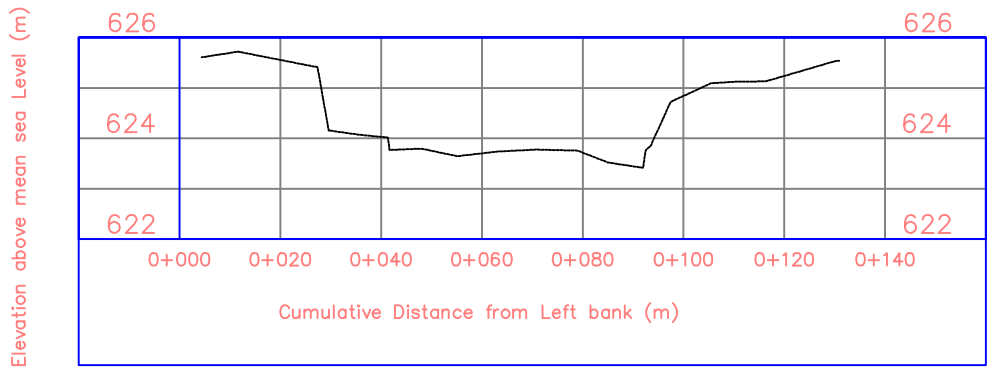
LOGGER SECTION



50m DOWNSTREAM



100m DOWNSTREAM



+ Logger

Surveyed river profile

*Scale 1:2000 (printed on A3 paper)

*Coordinate System
UTM, WGS84, 36N

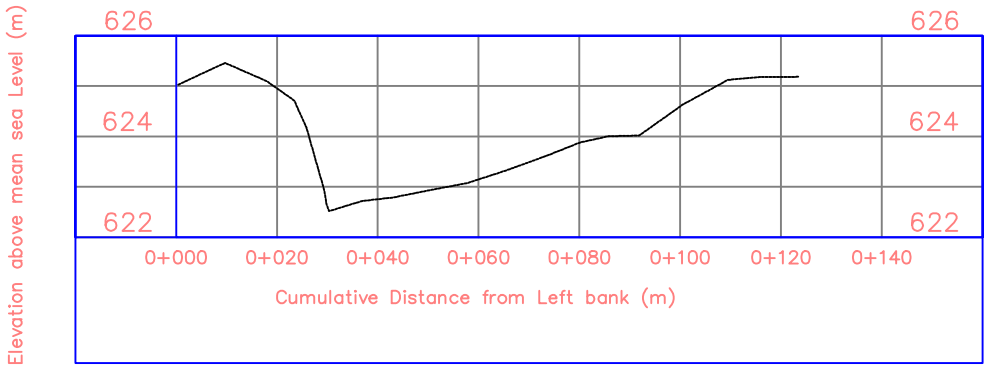
Logger Coordinates

Northing: 257717.81
Easting: 814446.54
Elevation: 623.863

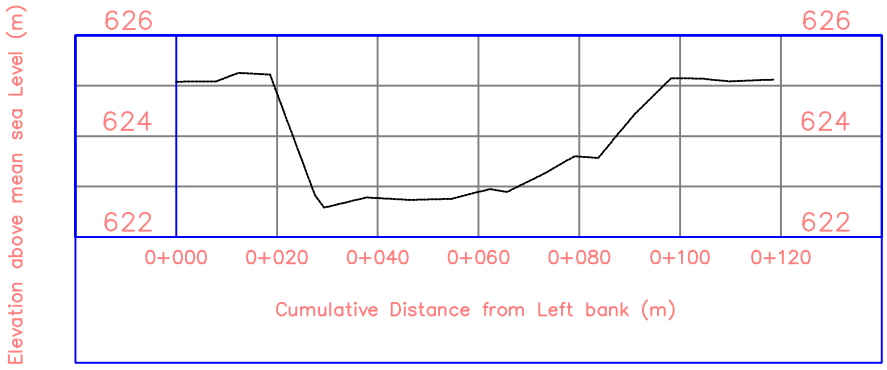
Surveyed & drawn by Erick Rapela

SW 3

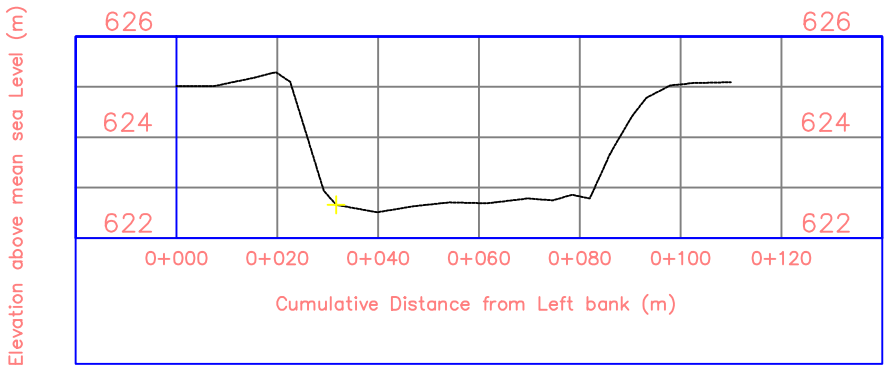
100m UPSTREAM



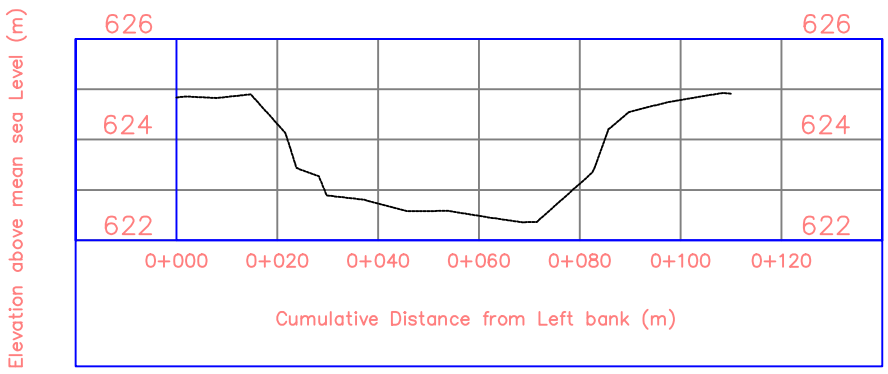
50m UPSTREAM



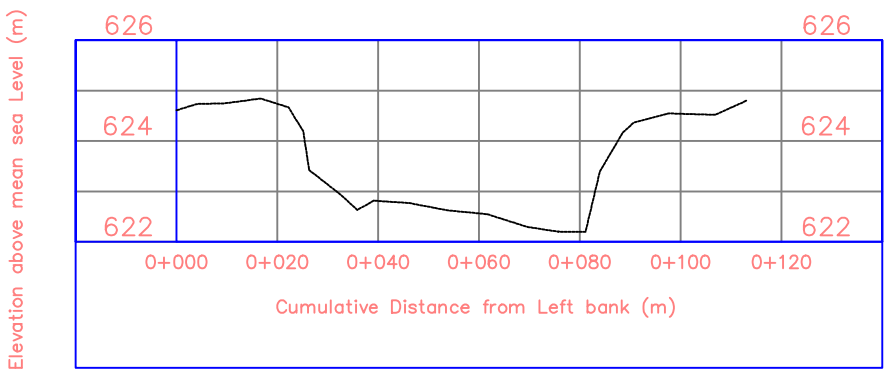
LOGGER SECTION



50m DOWNSTREAM



100m DOWNSTREAM



+ Logger

Surveyed river profile

*Scale 1:2000 (printed on A3 paper)

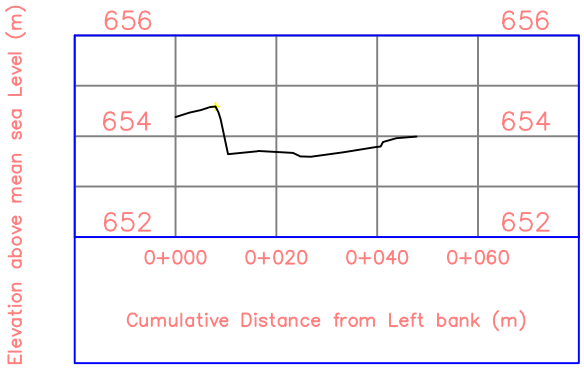
*Coordinate System
UTM, WGS84, 36N

Logger Coordinates

Northing: 257870.32
Easting: 814854.77
Elevation: 622.658

Surveyed & drawn by Erick Rapela

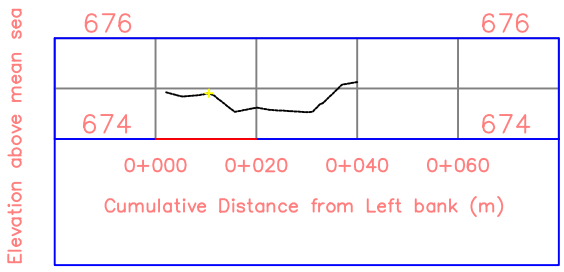
E1 PROFILE



Reference Mark Coordinates

Northing: 257488.30
Easting: 805594.154
Elevation: 654.592

N1 PROFILE



Reference Mark Coordinates

Northing: 246618.99
Easting: 810096.78
Elevation: 674.910

+ Reference mark

Surveyed river profile

*Scale 1:2000 (printed on A3 paper)

*Coordinate System
UTM, WGS84, 36N

Surveyed & drawn by Erick Rapela

Biodiversity

C5

1 Biodiveristy baseline data - Species of Conservation Concern

Column1	*Column2*	*Column3*	*Column4*	*Column5*	*Column6*	*Column7*	*Column8*	*Column9*	*Column10*
Scientific name	**Common Name**	**Conservation Status**						**Distribution and habitat**	**Likelihood of occurrence in Upstream RSA**
		Wildlife Conservation & Mgmt Act (2013)	**KWS Priority Species (2019)**	**IUCN (2019)**	**CMS (2019)**	**CITES (2019)**	**Other**		
Plants									
Aloe turkanensis			-	-	-	-	Restricted range	Range restricted GBIF (2017) holds two records of this species within the Upstream AOI.	Probable
Blepharis turkanae				VU				A dwarf shrub species occurring in Acacia bushland on rocky lava hills (Luke et al., 2015), its estimated AOO is 39.9Km^2	Probable
								GBIF holds no records of this species within the AOI, however this species is only known from Turkana County (Vollesen, 2008)	
Dalbergia melanoxylon	African Blackwood	-	-	LR/nt				Occurs in a range of woodland habitats throughout sub-Saharan Africa.	Unlikely
Dalbergia vacciniifolia		-	-	VU				This species is a climbing shrub occurring in patches of dry coastal forest at unusually high altitudes, in Kenya and Tanzania (Lovett & Clarke, 1998).	Unlikely
Delonix baccal	Poinciana	-	-	NT				Occurs throughout north-east Africa, in Commiphora-Acacia bushland/thicket or riverine woodland (Rivers, 2014).	Unlikely
Erianthemum occultum		-	-	VU			Restricted range	A small shrub parasitizing Commiphora, with an area of occupancy of 59.9136 km2 which includes Tsavo West and Tsavo East National Parks (IUCN SSC East African Plants Red List Authority, 2013).	Unlikely
Euphorbia turkanensis						II	Restricted range	Although not yet assessed by the IUCN, this species is listed in CITES Appendix II. It's type locality is 1.5 km south-west of Lokichar and the species is known from a limited distribution at a small area of north-west Kenya (Carter & Smith 1988). GBIF (2017) holds several records of this species near Lokichar and Kangetet within the Upstream AOI.	Probable
Juniperus procera	African Pencil Cedar		-	LC	-	-	-	Although this species has been logged in many areas resulting in localised declines, it is still common or abundant in many areas of its extensive range.	Unlikely
								Depletion of old growth forest groves of this species is a threat in in Kenya and Ethiopia (Farjon, 2013)	
								GBIF records of this species occur at Mt Kulal and Mt. Nyiru, outside the AOI	
Justicia brevipila		-	-	VU			Restricted range	A local species of the dry bushlands and woodlands of eastern Kenya, with an area of occupancy (AOO) of 190 km^2 (Luke et al., 2015).	Unlikely
Marsilea fadeniana		-	-	CR				An ephemeral herb of dry stream beds and seasonal waterholes, with an estimated AOO of 9.9 km^2 (IUCN SSC East African Plants Red List Authority, 2013)	Unlikely
Neuracanthus kenyensis	-	-	-	-	-	-	Restricted range	Only known from northern Kenya (MaAOlbit, Isiolo and Turkana), at Kora National Reserve and in the Gemu Gofa region of Ethiopia-Kenya border (Darbyshire et al., 2010)	Possible
								There are no GBIF (2017) records of this species occurring within the Upstream AOI	
Ocotea kenyensis	Camphor	VU	Y	VU	-	-	-	A timber species found in areas of moist forest, is heavily exploited for its hardwood through most of its range (WCMC, 1998).	Probable
								Last assessed by IUCN in 1998, no details on current population trends are available	
								GBIF records of this species occur at Kieni Forest within the Upstream AOI	
Prunus africana	Red Stinkwood	VU	Y	VU	-	-	-	Locally can be very common; threatened in some areas by harvest of bark for medicinal market.	Unlikely
								Last assessed by IUCN in 1998, no details on current population trends are available	
								Occurs in Montane forest, usually at about 1800-2200 m alt. (World Conservation Monitoring Centre 1998)	
								GBIF records of this species occur at Mt. Nyiru; there are no records of its occurrence within the AOI	
Xerophyta schnizleinia		-	-	VU				This species is known from the northern Frontier in Kenya, Karamoja in Uganda, Ethiopia, Somali republic and Nigeria (Smith & Ayensu 1975)	Possible
								There are no GBIF (2017) records of this species occurring within the Upstream AOI	
Invertebrates									
Belenois aurota	Brown-veined white butterfly	-	-	-			Migratory	NMK and GBIF (2017) hold records of this migratory butterfly species within the AOI.	Probable
								Has not yet been assessed by IUCN red list therefore status is uncertain	
Gabbiella rosea	Unnamed mud snail	-	-	NT	-	-	-	Endemic to the western shore of Lake Turkana - found on the littoral rocky bottom and soft muddy substrata to 5 m depth.	Possible
								Close to meeting Endangered B1 (triggering Criterion B) as it has an EOO of less than 20,000 km² based on the shallow waters of Lake Turkana.	
								It occurs at an unknown number of sites, and is therefore assessed as Near Threatened (Lange, 2010)	
Lachnocnema riffensis	Rift Valley Wooly Legs	-	-	DD				Known from just two records, one of which is the type record from Naivasha which was collected in open savannah in the Rift Valley (Larsen, 2011)	Possible
								No GBIF records of this species occur within the AOI (GBIF, 2017); however it may occur in suitable habitat.	
Samba turkana	New bee species	-	-	-	-	-	-	A new bee species recently discovered in the Turkana basin, in arid habitat with vegetation consisting of mixture of acacia woodland dominated by *Acacia tortilis* , and open semi-desert scrub (Packer and Martins, 2015)	Probable
								No GBIF records of this species occur within the AOI (GBIF, 2017); however it may occur in suitable habitat.	
Fish									
Aplocheilichthys sp. nov. 'Baringo'		-	-				Restricted range	This species occurs in the Lake Baringo drainage system, and is possibly endemic (Odhiambo & Hanssens, 2006)	Unlikely
								Its taxonomic status is uncertain and may be close to *Aplocheilichthys maculatus* (Odhiambo & Hanssens, 2006)	
Aplocheilichthys jeanneli	-	-	-	LC	-	-	-	Restricted to northern Kenya (Lake Turkana and Omo river), and Ethiopia, it inhabits small streams, swamps and shallows in the delta of the Omo River and shore regions of Lake Turkana	Possible
								Harvested for human consumption (Getahun & Hanssens, 2010).	
Aplocheilichthys rudolfianus	Lake Rudolf Lampeye	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana; occurs in shallow, quiet and weedy parts around Lake Turkana.	Unlikely
								EOO for this species is not defined, and thus may not trigger restricted range criterion of <20,000 km^2	
								Spawns in the littoral region and feeds on zooplankton and insects (Odhiambo, 2006)	
Bagrus docmak	Sudan catfish	-	-	LC	-	-	-	Widely distributed throughout western, central and eastern Africa , it inhabits lakes, swamps and rivers, and is probably associated with rocky bottoms/coarse substrates (Azeroul et al., 2010)	Possible
								Within eastern Africa there is heavy fishing pressure upon this species, as well as changes in inshore biotopes.	
								Competition for food and predation from introduced Nile Perch is a major threat, and has largely displaced the species from the inshore and open waters of many lakes in the region (Azeroul et al., 2010)	
Barbus intermedius	-	-	-	LC	-	-	-	Widespread distribution including Northern Ewaso Nyiro, Lake Baringo drainage, Lake Bogoria system (affluent rivers), Lake Turkana basin (Turkwell River system, Kerio River system), and Suguta drainage (Vreven, 2006).	Probable
								Information on its ecology is limited.	
Barbus neumayeri	-		-	LC	-	-	-	Widely distributed in Kenya and Tanzania - recorded from the Northern and southern Ewaso Nyiro drainge, Athi and Tana River systems, Lake Victoria basin and Lake Turkana system.	Probable
								Found in permanent and seasonal fast flowing streams, and probably also in shallow zones of the lakes (Hanseens et al., 2015).	
								Harvested for human consumption	
Barbus stigmatopygus	-	-	-	LC	-	-	-	Known from the Nile, Niger and Volta River systems, Chad and Bandama Rivers, and from rivers of Guinea-Buissau. It is also known from the Chad and Bandama Rivers (Awaiss et al., 2010). Synonyms include *B. werneri*	Unlikely
								Information on its ecology is limited.	
Barbus turkanae	-	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Confined to deeper waters below 10 m and spawns within the lake. Little information but not fished commercially (Odhiambo, 2006)	
Brycinus ferox	Large-toothed Lake Turkana Robber	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Occurs in the mid and open water but spawns in the open water (Akinyi, 2006).	
Brycinus minutus	Dwarf Lake Turkana Robber	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Occurs in the mid and open water but spawns in the open water (Akinyi, 2006).	
Distichodus niloticus	Nile Distichodus	-	-	LC	-	-	-	Known from the White Nile, and Lakes Albert and Turkana.	Probable
								Found in shallow inshore zones, especially in river deltas, but also sometimes in pelagic zones.	
								Harvested for human consumption and experiences heavy fishing pressure in E. Africa (Akinyi et al., 2010).	
Haplochromis macconnelli	-	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Confined to water more than 20 m deep spawns in deep waters of the main lake.	
								Not commercially important and therefore is not over-fished (Odhiambo & Hanssens, 2006)	
Haplochromis rudolfianus	-	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Apparently confined to the shallow and protected inshore areas of the lake and spawns in sheltered marginal areas of the lake.	
								Not fished commercially (Odhiambo & Hanssens, 2006)	
Haplochromis turkanae	-	-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Breeds within the lake (Odhiambo & Hanssens, 2006). Population and major threats unknown	
Labeo brunellii	-	-	-	DD	-	-	-	Currently known only from the type locality of Lake Abaya, but likely to be more widespread within the region (Getahun, 2010). More information is needed on the species distribution and threats.	Unlikely
Lates longispinis	Rudolf Lates	-	-	DD	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Occurs both in mid-waters and in deep waters and spawns in the open lake (Akinyi, 2006).	
Lates niloticus	Nile Perch	-	-	LC	-	-	-	Widely distributed in the rivers and lakes of tropical Africa, occurring commonly in all major river basins including the Nile, Chad, Senegal, Volta and Congo.	Unlikely
								The species is commercially fished and is declining due to overfishing and pollution in some parts of its distribution. (Azeroul et al., 2010)	
Malapterurus electricus	African Electric Catfish	-	-	LC	-	-	-	This species has a wide distribution, with no known major widespread threats	Possible
								Although marketable when caught it is of minor commercial importance; nonetheless it is threatened by overfishing in eastern Africa (Azeroul et al., 2010b).	
Mormyrus kannume	Bottlenose	-	-	LC	-	-	-	Widespread distribution in eastern Africa including the Lake Victoria drainage, Lake Turkana basin, Lake Kamnarok (Kerio system), River Turkwell, Omo delta, Northern Ewaso Nyiro), Middle and Lower Akagera, Lakes Edward, George, Albert and Kyoga systems, and the entire Nile system as far as the delta (Victoria, Murchison and Albert Niles	Probable
								It is a commercial species (Azeroul et al., 2010a)	
Neobola stellae		-	-	LC	-	-	Restricted range	Endemic to Lake Turkana (approx. 70,000 km^2); however EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	Unlikely
								Spawns in the open lake (Odhiambo, 2006).	
Oreochromis niloticus	Nile Tilapia	-	-	-	-	-	-	Widespread throughout northern, central and eastern Africa, including Omo River system and Lake Turkana (Fishbase, 2015)	Possible
Amphibians									
Amietia wittei		-	-	DD	-	-	-	Restricted to the central highlands of Kenya on the Mau Escarpment, the Aberdare Mountains, Mount Kenya and the Cherangani Hills, Arusha and Mount Meru in northern Tanzania between 2,080 and 3,100 m asl; its extent of occurrence is 1,226 km^2 (IBAT, 2016). There are no records of its occurrence within the AOI (GBIF, 2017)	Unlikely

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
								It is presumably associated with streams in montane grassland, and perhaps also forest, but it has also been found in a town (Lötters et al., 2004)	
Sclerophrys turkanae	Lake Turkana Toad	-	Y	DD	-			Known from two localities in north-central Kenya: Loiengalani on the south-eastern shores of Lake Turkana, and Uaso Nyiro River in the Samburu Game Reserve; presumably occurs more widely (IUCN SSC Amphibian Specialist Group, 2016)	Probable
								Its EOO is 14 km2 (IBAT, 2017). GBIF (2017) holds no records of this species occurrence within the AOI.	
Poyntonophrynus lughensis		-	-	LC	-	-	-	Occurs in arid lowlands from Somalia, through eastern and southern Ethiopia, extreme southeastern South Sudan, to northern and eastern Kenya as far south as the Ngulia Hills in Tsavo West National Park. It has not been recorded within the AOI (GBIF, 2017).	Unlikely
								It lives in very dry savannah where it apparently breeds in temporarily flooded hollows, including roadside ditches, immediately after the beginning of the rains(IUCN SSC Amphibian Specialist Group 2013)	
Phrynobatrachus zavattarii		-	-	LC	-	-	-	This form almost certainly consists of a number of cryptic species (Rödel 2000), including one endemic to Lake Turkana freshwater ecoregion (IUCN SSC Amphibian Specialist Group 2013)	Probable
								Typically associated with herbaceous vegetation along the margins of shallow marshes, lakes, rivers, streams and pools, both permanent and temporary, and breeds in temporary water bodies (IUCN SSC Amphibian Specialist Group 2013)	
Reptiles									
Boulengerula taitana	Taita Hills Caecilian	-	-	EN	-	-		This species occurs in moist forest on the Taitana Hills (IUCN SSC ASG, 2013c);	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Chamaleo dilepsis	Flap-neck Chameleon	Protected	Y	LC	-	-		This species is widespread in coastal thicket and forest, wet and dry savanna (Spawls et al., 2017)	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Eryx colubrinus	Kenya Sand Boa	Protected	Y	-	-	II		A widely distributed species, preferring desert, semi-desert and dry savannah habitats (Spawls et al. 2004)	Probable
								GBIF holds no records for this species within the AOI (GBIF, 2017); however it is distributed widely throughout Kenya and the horn of Africa	
Hemidactylus barbierii	Barnier's Gecko	-	-	DD	-	-		This species is known from two localities on the eastern border of Lake Turkana in Kenya (Sindaco et al. 2007). The eastern shore of Lake Turkana forms the western range limit of a number of Somali-arid zone Hemidactylus taxa (Sindaco et al. 2007)	Possible
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Kinyongia boehmei	Taita Blade-horned Chameleon	-	-	NT	-	II		This species prefers temperate forest of the Taita Hills (Tolley, 2014), which lie within the AOI;	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Kinyongia excubitor	Mount Kenya Hornless Chameleon		-	VU		II	Restricted range	GBIF holds no records for this species within the AOI (GBIF, 2017).	Unlikely
								Has recently been discovered in forests towards the southern end of the Aberdares (Spawls et al., 2017)	
Kinyongia tavetana	Kilimanjaro Blade-horned Chameleon	-	-	NT	-	II		This species occurs in Afro-temperate forest (Tolley and Menegon, 2014)	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017), and its known distribution does not coincide with the AOI	
Lygodactylus scheffleri	Scheffler's Dwarf Gecko	-	-	DD	-	-		This species is known from the Chuyulu Hills in Tsavo National Park (Spawls et al., 2014), which lie within the AOI	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Malacochersus tornieri	Softshell Tortoise	Threatened	Y	VU	-	-	-	Native to Kenya and Tanzania; terrestrial systems (Tortoise & Freshwater Turtle Specialist Group, 1996b)	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017); however NMK (2017) have a record of this species at Mtkinud and Mtito within the Midstream AOI	
Naja ashei	Large Brown Spitting Cobra	Protected	Y	-	-	-		Occurs sporadically on the coast and in the dry country of eastern and northern Kenya, up to altitudes of 1 500 m in the Mt Kenya foothills	Unlikely
								GBIF holds a single record of this species within the AOI near Marieh Pass (GBIF, 2017); its known distribution includes the coastal extent of the Midstream AOI	
Naja nigricollis	Black-necked Spitting Cobra	Protected	Y	-	-	-		Occurs mostly in the south-west, in well-watered savannah in medium altitude areas, but also known from the Chyulu Hills, Nairobi NP, and surrounds	Unlikely
								GBIF holds a single record of this species within the AOI in Nairobi (GBIF, 2017); its known distribution overlaps the Midstream AOI	
Pelusios broadleyi	Lake Turkana Hinged Terrapin	Threatened	Y	VU	-	-	-	Apparently confined to Lake Turkana (Tortoise & Freshwater Turtle Specialist Group, 1996a); GBIF holds no records for this species within the AOI (GBIF, 2017).	Possible
								However, EOO for this species is not defined and thus may not trigger restricted range criterion of <20,000 km^2	
Philochortus rudolfensis	Southern Shield-backed Lizard			DD			Restricted range	Occurs in Acacia-Commiphora dry bushland or semi-desert scrub, known only from five localites in northern Kenya	Possible
								GBIF holds no records for this species within the AOI (GBIF, 2017); however NMK (2017) have a record of this species at Lake Turkana within the Upstream AOI	
Python sebae	Rock Python	CR	Y	-	-	II		Occurs across a wide variety of habitats, throughout sub-Saharan Africa	Possible
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Rieppeleon kersteni	Kenya Pygmy-Chameleon	-	-	-		-		Occurs in coastal woodland and thicket, and moist and dry savanna. Inland records occur throughout Kenya, concentrated south-east Kenya particularly parts of Tsavo National Park (Spawls et al., 2017)	Unlikely
								GBIF holds no records for this species within the AOI (GBIF, 2017).	
Birds									
Acrocephalus griseldis	Basra Reed-warbler	EN	Y	EN	I/II	-	-	Winters in Sudan, South Sudan, Ethiopia, south Somalia, south-east Kenya, east Tanzania, south Malawi (few records) and Mozambique.	Possible
								Breeds in aquatic vegetation in or around shallow fresh or brackish water, still or flowing (BirdLife International 2012a)	
Ardea cinerea	Grey Heron	-		LC		-	-	This species is a generalist in its habitat use, it inhabits any kind of shallow water, fresh, brackish or saline, either standing or flowing, and shows a preference for areas with trees as it is commonly an arboreal rooster and nester. (BirdLife International 2012e).	Unlikely
Ardea purpurea	Purple Heron	-		LC	II	-	-	This species is a wetland habitat generalist inhabiting densely vegetated swamps, shore lines and artificial water bodies (BirdLife International 2017).	Possible
								Indications are that the populations are decreasing (BirdLife International 2017).	
Ardeotis kori	Kori Bustard	-		NT		II	-	A trigger species for Nairobi National Park IBA, it has been recorded frequently there, as well as at Lake Nakuru National Park and Tsavo East and West National Parks, within the Midstream AOI (GBIF, 2017)	Probable
								Occurs in flat, arid, mostly open country such as grassland, bushveld, thornveld, scrubland and savanna, and may move into woodland during the dry season in Kenya (BirdLife International, 2017).	
Apalis karamojae	Karamoja Apalis	VU	Y	VU	-	-	-	Occurs mainly in north-east Uganda and northern Tanzania; an individual was recorded in southern Kenya in August 2004.	Unlikely
								Suitable habitat occurs in riverine areas, along seasonal watercourses and in seasonally inundated land (BirdLife International 2017)	
Aquila heliaca	Eastern Imperial Eagle	VU	Y	VU	I/II	I	-	On passage and in winter, birds are found in the Middle East, east Africa south to Tanzania, the Arabian peninsula, the Indian Subcontinent and south and east Asia.	Possible
								Wetlands are apparently preferred on the wintering grounds (BirdLife International, 2013a)	
								This species has been recorded in Nairobi National Park (GBIF 2017), with the most recent record being from 2003	
Aquila nipalensis	Steppe Eagle	-		EN	II	II	-	A migratory species, wintering in south-east Africa and breeding in north-eastern Europe (BirdLife International, 2017)	Possible
Ardeola idae	Madagascar Pond-heron	EN	Y	EN	I/II	-	-	Non-breeding range includes Kenya; in its non-breeding range it is commonly found along the banks of small streams, including those inside forest (BirdLife International 2012c)	Possible
Balearica pavonina	Black Crowned-crane	NT	-	VU	-	II	-	Breeds July to January in East Africa (subject to local seasonal variation), nesting in single pairs in territories. During the dry (non-breeding) season it is more congregatory, forming large flocks of up to several hundred individuals.	Unlikely
								Found in wet and dry open habitats, but prefers freshwater marshes, wet grasslands, and the peripheries of water-bodies (BirdLife International 2012e)	
Balearica regulorum	Grey Crowned-crane	Protected	-	EN	-	II	-	Inhabits wetlands such as marshes, pans and dams with tall emergent vegetation, riverbanks, open riverine woodland, shallowly flooded plains and temporary pools with adjacent grasslands, open savannas, croplands, pastures, fallow fields and irrigated areas (BirdLife International, 2013b)	Possible
Bucorvus leadbeateri	Southern Ground-hornbill	-	-	VU	-	-	-	Population data for range countries other than South Africa is lacking	Unlikely
								It inhabits woodland and savanna, also frequenting grassland adjoining patches of forest up to 3,000 m asl. in parts of its range in eastern Africa (BirdLife International 2012f).	
Buteo oreophilus	Mountain Buzzard	-		NR	II	II		A trigger species for the Kikuyu Escarpment, Mau Forest, Kinangop Grasslands and Lake Elmenteita IBAs (BirdLife International, 2017)	Unlikely
Calidris ferruginea	Curlew Sandpiper	-	-	NT	II	-	Annex II Bern Convention (EU Birds Directive)	A Palearctic migrant, wintering in sub-Saharan Africa, south-east Asia and Australasia. During wintering it occurs on muddy edges of inland waterbodies (BirdLife International, 2017)	Possible
Calidris minuta	Little Stint	-	-	LC	II	-	-	Over 100,000 (7% of global popn. of min. 1.4 million) have been recorded at Lake Turkana (Bennun & Njoroge 1999).	Possible
Charadrius hiaticula	Common ringed plover	-	-	LC	II	-	-	Winters in coastal habitats and inland aquatic habitats such as mudbanks or sandbanks along rivers and lakes, lagoons, saltmarshes, short grassland, farmland, flooded fields, gravel pits, reservoirs, sewage works and saltpans (Birdlife International. 2017).	Possible
								Small congregations have been recorded at Lake Turkana, within the AOI (Peck, 2013).	
Charadrius asiaticus	Caspian plover		-	LC	-	-	-	Winters in the a range of habitats including recently burnt or heavily grazed grassland, dry floodplains, ploughed cultivated land, coastal dunes, and dried mud of lake shores (Birdlife International, 2017).	Possible
Charadrius pecuarius	Kittlitz's plover	-	-	LC	II	-	-	Small congregations have been recorded at Lake Turkana, within the Upstream AOI (Peck, 2013); however GBIF (2017) holds no records of this species within the Upstream AOI	Possible
								Primarily inhabits flat, open, dry ground with very short grass or dried mud, often near the margins of lakes, reservoirs and rivers, or on small permanent and temporary pools, flood plains, dry sandy riverbeds and marshes (Birdlife International. 2015).	
Chlidonias leucopterus	White-winged Tern	-	-	LC	II	_	_	Small congregations have been recorded at Lake Turkana, within the AOI (Peck, 2013); however no records are available for the Upstream AOI (GBIF, 2017)	Possible
								This species primarily inhabits freshwater lakes, swampy standing water, rivers and shallow naturally flooded grassland (BirdLife International 2012j).	
Circus macrourus	Pallid Harrier	NT	-	NT	II	II	-	The populations of this species are stable (BirdLife International 2012j).	
								The global population is estimated at 9,000-15,000 pairs.	Possible
								Most birds winter in sub-Saharan Africa or south-east Asia, where they occur in Semi-desert, scrub, savanna and wetlands (BirdLife International, 2013c)	
Clanga clanga	Greater Spotted Eagle	VU	Y	VU	_	_	-	A migratory species, breeding in northern Europe and wintering in SE Europe, Middle East, S Asia and NE Africa (Mayberg et al., 2017)	Possible
Coracias garrulus	European Roller	NT	-	NT	I	-	-	Overwinters in two distinct regions of Africa, from Senegal east to Cameroon and from Ethiopia west to Congo and south to South Africa.	Possible
								Winters primarily in dry wooded savanna and bushy plains (BirdLife International 2012g).	
Crex crex	Corncrake	NT	-	LC	II	-	-	Winters in sub-Saharan Africa; in the wintering grounds dry grassland and savanna are preferred with birds also occurring in rank grass near rivers, sewage ponds and pools and in relatively short grass in wetter areas, moist sedgebeds and reedbeds and in tall grass within young conifer plantations (Birdlife International. 2015)	Unlikely
Ephippiorhynchus senegalensis	Saddle-billed Stork	Protected	-	LC	-	-	-	Tends to prefer wetlands and the margins of water bodies (BirdLife International 2012d).	Possible

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
								This species has an extremely large range. Its population trend appears to be decreasing (BirdLife International 2012d).	
Falco cherrug	Saker Falcon	EN	Y	EN	I/II	II	-	· Migrant birds winter in East Africa, Southern Europe and southern Asia.	Possible
								· Specialises on mid-sized diurnal terrestrial rodents (especially ground squirrels Citellus, which were observed during the Scoping Site visit (ref. Scoping Report)) of open grassy landscapes such as desert edge, semi-desert, steppes and arid montane areas (BirdLife International, 2013d)	
								· Distribution overlaps the AOI; however this species has not been recorded in the AOI (GBIF 2017)	
Falco concolor	Sooty Falcon	NT	-	NT	II	II	-	It is a migratory species, breeding throughout north east Africa and wintering in Madagascar (BirdLife International, 2017)	Possible
Falco fasciinucha	Taita Falcon	NT	-	VU	-	II	-	The species' range, distribution and population are poorly known. It occurs at gorges and escarpments, using the cliffs for nesting. It is thought to occur at low densities throughout Kenya (Birdlife International, 2017).	Unlikely
Falco naumanni	Lesser Kestrel	VU	Y	LC	I/II	II	-	· Birds winter in southern Spain, southern Turkey, Malta and across much of Africa, particularly South Africa (BirdLife International, 2017).	Probable
								· It has been recorded in the Upstream AOI (NMK, 2015) and is a trigger species for Lake Nakuru and Tsavo East IBAs.	
Falco vespertinus	Red-footed Falcon	NT	-	NT	I/II	II	-	· It winters in southern Africa, from South Africa northwards to southern Kenya.	Possible
								· No information on its wintering habitat preferences is evident but in breeding areas it prefers open lowlands with trees and plenty of insects, on which it feeds, including steppe and forest-steppe, open woodland, cultivation and pastureland (Birdlife International, 2017).	
Ficedula semitorquata	Semi-collared Flycatcher	NT	-	NT	II	-	-	· It winters in a comparatively small region of East Africa, from Sudan and South Sudan through western Kenya, eastern Democratic Republic of Congo, Uganda, Rwanda and Burundi to Tanzania (BirdLife International 2012j)	Unlikely
								Frequents forest edge, gallery forest, light woodland, gardens and open country with leafy trees e.g. Brachystegia woodland and Acacia savanna/woodland (Taylor et al., 2017)	
Gallinago media	Great Snipe	NT	-	NT	II	-	-	· Migrates through central Asia, central and south-eastern Europe Tunisia and Egypt, with birds gathering in wet high-plateau grasslands in Ethiopia. When these dry out in October, birds follow the rains south and west to sub-Saharan countries including Kenya (Van Gils et al., 2017)	Possible
								· Distribution overlaps the AOI; however this species has not been recorded in the AOI (GBIF 2017)	
Glareola nordmanni	Black-winged pratincole	-	-	NT	II	-	-	· Migrates through southern Africa	Unlikely
								· During the non-breeding season it occupies seasonally wet grasslands, savannas, and sandbanks along large rivers	
								· Has not been recorded in the AOI (GBIF, 2017)	
Glareola pratincola	Collared Pratincole	-	-	LC	II	-	-	This species has an extremely large range, and the populations in northern Africa are nomadic or migratory. Their population trend appears to be decreasing (BirdLife International 2012c).	Unlikely
Gyps africanus	White-backed Vulture	NT	-	CR	II	II	-	· The most widespread and common vulture in Africa, although now undergoing rapid declines.	Possible
								· A lowland species of open wooded savanna, particularly areas of *Acacia*. It requires tall trees for nesting. A gregarious species congregating at carcasses, in thermals and at roost sites. It nests in loose colonies (Birdlife International, 2015)	
Gyps rueppelli	Ruepell's Vulture	NT	-	CR	II	II	-	· Occurs across Sahel region of Africa from Senegal, Gambia and Mali in the west to Sudan, South Sudan and Ethiopia in the east. Also south through the savanna regions of East Africa in Kenya, Tanzania and Mozambique.	Possible
								· Largely restricted to protected areas within its range; frequents open areas of *Acacia* woodland, grassland and montane regions, and it is gregarious, congregating at carrion, soaring together in flocks and breeding mainly in colonies on cliff faces and escarpments at a broad range of elevations (Birdlife International, 2015)	
Hieraaetus ayresii	Ayres's Hawk-Eagle	-	-	LC	-	-	-	It prefers woodland and forest (Stevenson and Fanshawe 2002), particularly well wooded savanna areas, riparian forest, and forest patches and may also enter cities and exotic plantations after breeding (Irwin 1981)	Possible
								This species has an extremely large range. Its population trend appears to be stable (BirdLife International 2017)	
Himantopus himantopus	Black-winged Stilt	-	-	LC	II	-	-	Prefers freshwater sites, including marshes and swamps, lake edges, riverbeds, sewage ponds and flooded fields, but also saltpans and coastal saltmarshes (Pierce et al., 2017)	Possible
Hirundo atrocaerulea	Blue Swallow	VU	Y	VU	I/II	-	-	· Non-breeding visitor to north-east DRC, south Uganda and west Kenya. In its non-breeding range it favours open grassland, often with bushes and trees and marshy areas (Birdlife International, 2012m)	Unlikely
								· This species has not been recorded in the AOI (GBIF 2017)	
Laniarius mufumbiri	Papyrus Gonolek	NT	-	NT	-	-	-	· Locally distributed in north-eastern Democratic Republic of Congo (DRC), Uganda, eastern Rwanda, Burundi, north-western Tanzania and western Kenya (Lake Victoria).	Unlikely
								· Confined to papyrus *Cyperus papyrus* swamps and beds, in meandering river valleys and along lake-shores; locally common in Kenya in this habitat (Birdlife International, 2015)	
Lanius dorsalis	Taita Fiscal	Protected	-	LC	-	-	-	Found in dry open bush, acacia (Acacia) woodland and other dry open woodland (Yosef & International Shrike Working Group 2017)	Unlikely
Limosa limosa	Black-tailed Godwit	NT	-	NT	II	-	-	· Wintering populations occur across Europe, Africa, the Middle East and Australasia	Unlikely
Melierax poliopterus	Eastern Chanting-Goshawk	-	-	LC	II	II	-	This species has been recorded in the AOI (GBIF,2017)	Probable
Merops oreobates	Cinnamon-chested Bee-eater	-	-	LC	-	-	-	This species prefers wooded hillsides and forest edges (Stevenson and Fanshawe 2002).	Possible
								Their population trend is unknown (BirdLife International 2012q).	
Mirafra pulpa	Friedmann's Lark	-	-	DD	-	-	-	A poorly known and rare species, it may prefer dense grassland, and could be at least partially migratory (BirdLife International, 2017)	Unlikely
Necrosyrtes monachus	Hooded Vulture	-	-	EN	II	II	-	· Widespread in sub-Saharan Africa; often associated with human settlements, but is also found in open grassland, forest edge, wooded savanna, desert and along coasts (Birdlife International, 2012o)	Possible
Nectarinia erythrocerca	*Red-chested Sunbird*	-	-	LC	-	-	-	This species prefers associated with wooded hillsides and forest edges (Stevenson and Fanshawe 2002).	Unlikely
								Their population trend appears to be stable (BirdLife International 2012s).	
Neophron percnopterus	Egyptian Vulture	Endangered	Y	EN	I/II	II	-	· Bulk of the resident population occurs in Ethiopia and East Africa.	Possible
								· Typically nests on ledges or in caves on cliffs, crags and rocky outcrops, but occasionally also in large trees; forages in lowland and montane regions over open, often arid, country. Also scavenges at human settlements (Birdlife International, 2012p)	
								· This species has been recorded in the AOI (GBIF, 2014)	
Neotis denhami	Denham's Bustard	NT	-	NT		II	-	· Very widely distributed across Africa, however it has suffered population declines through much, if not all, of its range.	Possible
								· Inhabits grasslands, grassy Acacia-studded dunes, fairly dense shrubland, light woodland, farmland, crops, dried marsh and arid scrub plains.	
								· There are now probably fewer than 300 in all of Kenya and its range has contracted in this country (Birdlife International, 2014)	
Numenius arquata	Eurasian Curlew	NT	-	NT	II	-	EU Birds directive II	· Winters around the coasts of north-west Europe, the Mediterranean, Africa, the Middle East, the Indian Subcontinent, South-East Asia, Japan and the Sundas.	Unlikely
								· It has a large global population estimated to number 765,000-1,065,000 individuals (Birdlife International, 2012o)	
Oxyura maccoa	Maccoa Duck	NT	-	NT	II	-	-	During breeding it prefers shallow, nutrient-rich, small inland freshwater lakes with extensive emergent vegetation. Outside the breeding season it also occurs on larger lakes and brackish lagoons (BirdLife International, 2017)	Possible
Pelecanus onocrotalus	Great White Pelican	-		LC	I/II	-	-	Associated with relatively large, warm, shallow fresh, brackish, alkaline or saline lakes, lagoons (Elliot et al., 2017)	Unlikely
Phoeniconaias minor	Lesser Flamingo	NT	-	NT	II	II	-	· The Asian and southern African populations are partially migratory, with many making regular movements from their breeding sites inland to coastal wetlands when not breeding.	Unlikely
								· The species breeds in huge colonies of many thousands of pairs often mixed with Greater Flamingo *Phoenicopterus roseus* (Birdlife International, 2012r)	
Platalea alba	African Spoonbill	_	-	LC	II		-	Typically occurs at lakes, reservoirs, marshes, shallow inland watercourses (Matheu et al., 2017)	Possible
Ploceus spekeoides	Fox's Weaver	-	-	NT	-	-	-	· A poorly recorded species known from a restricted area of seasonally flooded wetlands in northern Uganda. The species has been recorded at two Important Bird Areas, Lake Bisina (250 km2) and Lake Opeta (570 km2), and is found in the marshland habitat stretching between these lakes (BirdLife International, 2017)	Unlikely
Poicephalus rufiventris	Red-bellied Parrot	_	-	LC		II	-	Prefers Commiphora bush with baobabs, lowland Acacia short-grass savanna and Acacia-Commiphora thorn bush, riverine forest and bushland. Where sympatric with P. meyeri, uses open savanna (Collar & Kirwan, 2017)	Unlikely
Polemaetus bellicosus	Martial Eagle	Protected	-	VU	II	-	-	· This species has an extensive range across much of sub-Saharan Africa, and typically occurs in open woodland, wooded savanna, bushy grassland, thornbush (BirdLife International, 2013a)	Possible
Psalidoprocne albiceps	White-headed Saw-wing	-	-	LC	-	-	Biome restricted	This species prefers Savannah, woodland, scrub and forest in upland areas, including miombo woodland and montane areas (Stevenson and Fanshawe 2002).	Unlikely
								Their population trend appears to be stable (BirdLife International 2012u).	
Recurvirostra avosetta	Pied Avocet	_	-	LC	II	-	-	Favours shallow saline lakes, lagoons, pools, saltpans and estuaries with sparse vegetation for breeding; outside breeding season also frequents muddy tidal flats; infrequently found on freshwater lakes and rivers	Possible
Rynchops flavirostris	African Skimmer	NT	-	NT	II	-	-	· Non-breeding flocks of at least 1,000 individuals have been recorded in Tanzania and Kenya; widespread in sub-Saharan Africa	Possible
								· In the non-breeding season, disperses to rivers, lakes and coasts (Birdlife International, 2012s).	
Sagittarius serpentarius	Secretarybird	Protected	-	VU	-	II	-	· Occurs throughout sub-Saharan Africa, inhabiting grasslands, ranging from open plains to lightly wooded savanna, but is also found in agricultural areas and sub-desert (BirdLife International 2013c).	Possible
Scleroptila streptophora	Ring-necked Francolin	-	-	NT	-	-	-	· Disjunct distribution with populations in Burundi, Cameroon, Kenya, Rwanda, Tanzania and Uganda.	Unlikely
								· Recorded sporadically in western Kenya; inhabits stony hillsides with sparse grass and shrub cover, and wooded grasslands at 600-1,800 m (Birdlife International, 2012t)	
Scotopelia peli	Pel's Fishing-owl	-	-	LC	-	-	-	It preferred habitat is around forested edges of lowland perennial rivers, swamps and lakes, and estuaries; favours large riparian trees with deep cover and shade (Holt et al., 2017)	Unlikely

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
								Their population trend appears to be decreasing (BirdLife International 2012ae).	
Gelochelidon nilotica	Gull-billed Tern	-	-	NR	II		-	GBIF (2018) has no records of this species in the Upstream AOI	Unlikely
Struthio molybdophanes	Somali Ostrich	-	-	VU	-	-	-	It is found in a variety of habitats including semi-arid and arid grassland, dense thornbush and woodland (BirdLife International, 2017)	Unlikely
Tauraco hartlaubi	Hartlaub's Turaco	_	-	LC		II	-	No GBIF (2018) records of this species in the Upstream AOI	Unlikely
Terathopius ecaudatus	Bateleur	-	-	NT	II	II	-	Extensive range across much of sub-Saharan Africa, inhabiting open country, including grasslands, savanna and subdesert thornbush. The nest is built in the canopy of a large tree (Birdlife International, 2012u)	Possible
Torgos tracheliotos	Lappet-faced Vulture	VU	Y	EN	II	II	-	Inhabits dry savannah, arid plains, deserts and open mountain slopes up to 3,500 m.	Possible
								builds solitary nests (usually containing just one egg), often in *Acacia* , but also in *Balanites* and *Terminalia* (Birdlife International. 2012v).	
								Acacia sp. and *Balanites* sp. trees were observed within the study area during the scoping site visit	
Trichoelaema lacrymosa	Spot-flanked Barbet	-	-	LC	-	-	-	Inhabits wet woodland, wetter areas in dry woodland, also riverine woods, patches of forest (Stevenson and Fanshawe 2002).	Possible
								Their population trend appears to be stable (BirdLife International 2012y).	
Trigonoceps occipitalis	White-headed Vulture	VU	Y	CR	II	II	-	Extremely large range in sub-Saharan Africa; prefers mixed, dry woodland at low altitudes, avoiding semi-arid thorn-belt areas.	Possible
								It generally avoids human habitation (Birdlife International, 2012w).	
Tringa hypoleucos	Common Sandpiper	-	-	LC	II	-	-	Non-breeding migrants frequent a wide variety of habitats, such as small pools, ditches, riverbanks, streams, lake shores, marshy areas (BirdLife International 2012z).	Possible
								The populations of this species are decreasing (BirdLife International 2012z).	
Vanellus spinosus	Spur-winged lapwing	-	-	LC	II	-	-	Frequents a wide range of habitats including dry ground close to fresh or saline pools, lakes, rivers, lagoons or marshes as well as burnt grassland, cultivated, flooded or irrigated fields (Birdlife International, 2015)	Possible
								Small congregations have been recorded at Lake Turkana (Peck, 2013)	
Mammals									
Acinonyx jubatus	Cheetah	EN	Y	VU	-	I	-	The number of known resident cheetahs in Eastern Africa (Ethiopia, southern Sudan, Uganda, Kenya and Tanzania) is estimated at 2,572 adults and independent adolescents	Possible
								Less than half of the estimated cheetah population inhabits protected areas; in addition, approximately half lives in habitat blocks which are trans-boundary, requiring international cooperation for conservation of the population.	
								Cheetahs possibly occur over an area which is several times as large as the range of the known population (Anon. 2007).	
								Primarily found in open grassy habitats, but also make use of dry forest, savanna woodland, semi-desert and scrub, being absent from tropical rainforest (Durant et al., 2008).	
Aonyx capensis	African Clawless Otter	-	-	NT	-	-	-	This species is widely distributed across sub-Saharan Africa,	Probable
								It typically occurs in association with freshwater riparian systems, and occasionally in rocky shore coastal environments (Jaques et al., 2015)	
Bdeogale jacksoni	Jackson's Mongoose	VU	-	NT	-	-	Restricted range	Known only from central and southern Kenya, south-eastern Uganda, and from the Udzungwa Mountains in Tanzania; recorded to montane elevations in the Aberdares, Mt. Kenya and Mt. Elgon up to 3,300 m asl (Van Rompaey et al., 2008).	Unlikely
Canis aureus	Golden Jackal	-	-	LC	-	II	-	Widespread in North and north-east Africa and fairly common throughout its range (Jhala & Moehlman, 2008)	Unlikely
Ceratotherium simum	White Rhinoceros	EN	Y	NT	-	I	-	Kenya has not been a White Rhino range state in the last two hundred years; however evidence from fossils and cave paintings in Kenya and northern Tanzania suggests that the White Rhinoceros was widespread and a part of the East African savanna fauna until 3,000 years ago or less, when it was probably displaced by pastoralists.	Unlikely
								White Rhino as a species but not C. s. simum as a subspecies has probably been reintroduced to Kenya (with the latter being an introduction of a probable out of range subspecies) (Emslie, 2012).	
								This species has not been recorded in the AOI (GBIF 2017).	
Crocuta crocuta	Spotted Hyena	VU	-	LC	-	-	-	A widespread species in sub-Saharan Africa, present in all habitats (Bohm & Honer, 2015)	Probable
								There are no GBIF (2017) records of this species occurring within the Upstream or Midstream AOI	
Damaliscus lunatus (ssp tiang/ssp topi)	Topi / Tiang	-	-	LC	-	-	-	About one-quarter of ssp. tiang occur in protected areas, including Sibiloi National Park in Kenya (East 1999). 90% of ssp. Topi occur in protected areas.	Unlikely
								Topi (subspecies uncertain) has been recorded within the Upstream AOI (NMK, 2015).	
Diceros bicornis	Black Rhinoceros	CR	Y	CR	-	I	-	Range includes South Africa, Namibia, Zimbabwe and Kenya (Emslie, 2012). It occurs in a wide variety of habitats from desert areas in Namibia to wetter forested areas; highest densities of black rhino are found in savannas on nutrient-rich soils and in succulent valley bushveld areas.	Unlikely
								As with White Rhinos, four range states (South Africa, Namibia, Zimbabwe and Kenya) currently conserve the majority (96.1%) of remaining wild Black Rhino (Emslie, 2012). Black Rhino is an EDGE-identified species (ZSL, 2013).	
								This species has not been recorded in the AOI (GBIF 2017).	
Eidolon helvum	African Straw-coloured Fruit-bat	-	-	NT	-	-	-	This species is in significant decline because it is being seriously over-harvested for food and 'medicine'. It forms large colonies of thousands to even millions of individuals.	Unlikely
								Colonies may show extreme roost-site fidelity. A well-known colony in Kampala (Uganda) declined in numbers over a forty-year period from ca. 250,000 animals to 40,000 in 2007 (Monadjem et al. 2007).	
								Eidolon helvum is the most heavily harvested bat for bushmeat in West and Central Africa (Mickelburgh et al., 2008), and this is believed to be a major factor in reported population declines (Mickelburgh et al., 2008)	
Equus grevyi	Grevy's Zebra	EN	Y	EN	-	I	-	Confined to the Horn of Africa, specifically Ethiopia and Kenya, and may persist in South Sudan.	Unlikely
								Has a discontinuous range, and are found from the eastern side of the Rift Valley in Kenya to the Tana River. There is a small, isolated population in the Alledegfi Plains northeast of Awash N.P. in Ethiopia. From Lake Ch'ew Bahir in southern Ethiopia, the population extends to just north of Mt. Kenya although a few animals are found further southeast along the Tana River. A small introduced population survives in and around Tsavo East N.P. in Kenya. (Moehlman et al., 2013)	
								This species has not been recorded in the AOI (GBIF 2017)	
Eudorcas thomsonii	Thomson's Gazelle	-	-	NT	-	-	-	This species occurs in the short grasslands of Kenya and Tanzania; there is evidence that several populations have undergone declines (IUCN SSC Antelope Specialist Group, 2008)	Unlikely
Gerbillus cosensis	Cosens's Gerbil	-	-	DD	-	-	-	Occurs in Kenya and northeastern Uganda, especially around Lake Turkana (Gerrie & Kennerley, 2016)	Probable
								Very little is known about its status and habitat requirements. This is a semi-desert species found in areas of open, sandy, gravel plains with sparse vegetation	
								This species has not been recorded in the AOI to date (GBIF 2017).	
Giraffa camelopardalis rothschild	Rothschild's Giraffe	EN	Y	VU	-	-		Occur in Uganda and introduced to central and southwest Kenya. The sub-species was categorized by the IUCN Red List as Endangered (Fennessy and Brenneman 2010); now the IUCN considers all sub-species under Giraffa camelopardalis as VU (Muller et al., 2016)	Unlikely
Hippopotamus amphibius	Hippopotamus	VU	-	VU	-	II	-	Several thousand occur in Kenya, in most of the many suitable habitats throughout the country (Lewison & Oliver, 2008).	Probable
								Within the AOI, it is present in Lake Turkana, and has also been recorded in Nairobi National park and the Athi River (GBIF, 2017)	
Hyaena hyaena	Striped Hyaena	EN	Y	NT		III	-	Very large, albeit patchy distribution, extending from Africa, north of and including the Sahel, and including much of East and North-east Africa south to about central Tanzania, through the Middle East and Arabian Peninsula, Turkey, the Caucasus, Central Asia, and the Indian subcontinent.	Probable
								Global population size is estimated to be below 10,000 mature individuals, and experiences ongoing deliberate and incidental persecution (Arumugam et al., 2008)	
								Has been recorded within the AOI (NMK, 2015).	
Litocranius walleri	Gerenuk	-	-	NT	-	-	-	Still widespread throughout its range, except in parts of Somalia where it has been severely reduced. Inhabits bushland, thickets, semi-arid and arid thornbush (below 1,600 m), avoiding dense woodlands and very open grass-dominated habitats. One of the most exclusive browsers, Gerenuk are largely independent of water (IUCN SSC Antelope Specialist Group 2008)	Unlikely
								This species has not been recorded in the AOI (GBIF 2017)	
Loxodonta africana	African Elephant	EN	Y	VU	II	I/II	-	Present in Nasolot and South Turkana reserves (Blanc, 2008) within the AOI.	Probable
								Found in a wide variety of habitats ranging from dense forest, open and closed savanna, and grassland, to arid deserts mountain slopes and oceanic beaches (Blanc, 2008).	
Lycaon pictus	African Wild Dog	EN	Y	EN	-	-	-	In 2003, the minimum estimated population size was 150 wild dogs in 11 packs in northern Kenya (Woodroffe, 2012).	Possible
								This species has been recorded in the AOI in South Turkana Reserve	
Madoqua kirkii	Dik-dik	-	-	LC	-	-	-	Molecular evidence suggests that Madoqua kirkii is a complex of species, comprising what may effectively represent four distinct species – once recognised as separate species, IUCN reassessment may reassign status of this species (IUCN SSC Antelope Specialist Group, 2008)	Possible
								This species has been recorded in the AOI (NMK, 2015, GBIF, 2017)	
Miniopterus sp.	Bent-wing Bat	-	-	LC - NT	App. II	-	Congregatory	Bent-wing, or long-fingered bats are obligate cave roosters, and they can form enormous colonies (Dietz et al. 2009, Happold 2013b) (for example, *M. natalensis* is known to form roosting colonies of upwards of 260,000 individuals in de Hoop Guano cave (Monadjem et al. 2010)).	Possible
								These bats are also known migratory species, with species migrating from winter hibernacula to maternity roosts, which may be separated by up to 150 km (Monadjem et al. 2010).	
								Lesser Long-fingered Bat (M. fraterculus), Greater Long-fingered Bat (M. inflatus), African Long-fingered bat (M. africanus), Natal Long-fingered Bat (M. natalensis) and Schreiber's Bent-winged Bat (M. schreibersii - NT) have been recorded within the AOI (GBIF, 2017)	
Neoromicia helios	Samburu Pipistrelle bat	-	-	DD	-	-	-	Recorded from Djibouti, southern Somalia, southern Sudan, northeastern Uganda, Kenya and northern Tanzania. There is little information about the natural history of this bat, in part because it has often been confused with *Neoromicia nana* (Jacobs et al., 2014)	Unlikely
Oryx beisa	Beisa Oryx	-	-	NT	-	-	-	Occurs quite widely in areas of Ethiopia, northern and eastern Kenya and north-eastern Tanzania where human and livestock densities are low, with most remaining populations occurring outside protected areas.	Probable
								GBIF (2017) holds a single record of this species occurring in Tsavo West National Park within the AOI	
								It is also present in the unprotected northern rangelands of Kenya (IUCN SSC Antelope Specialist Group 2008).	
Otomops martiensseni	Large-eared Free-tailed Bat	VU	-	NT	-	-	Congregatory	Although this bat was once considered to be rare, with gaps in distribution, additional collecting has demonstrated local abundance in several areas; for example, it is common around Durban in KwaZulu Natal Province of South Africa (Fenton et al. 2002).	Unlikely
								However, major colonies of this species (consisting of hundreds of bats) from caves in East Africa have declined severely and now have few or no bats (Hutson et al. 2001).	
Otomys barbouri	Barbour's Vlei Rat	EN	Y	EN	-	-	Restricted range	Extent of occurrence less than 5,000 km²	Unlikely
								Restricted to high elevations of Mount Elgon , and the burning of the species' habitat causes large fluctuations in the species' area of occupancy and the number of mature individuals.	
								Inhabits stony hillsides with sparse grass and shrub cover, and wooded grasslands at 600-1,800 m (Taylor & Maree, 2008)	
								This species has not been recorded in the AOI (GBIF 2017).	
Panthera leo	African Lion	EN	Y	VU	-	II	-	This species has a high habitat tolerance, and can survive in very arid environments as they can obtain their water requirements from prey and even plants (Bauer et al., 2016)	Probable
								GBIF (2017) holds records of this species of its occurrence in South Turkana Reserve and it is known to occur in Nasolot National Reserve	

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Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10
Panthera pardus	Leopard	EN	Y	NT	-	II	-	· Has the widest habitat tolerance of any Old World felid, ranging from rainforest to desert.	Probable
								· In Africa, they are most successful in woodland, grassland savanna and forest but also occur widely in mountain habitats, coastal scrub, swampy areas, shrubland, semi-desert and desert.	
								· They range from sea level to as much as 4,600 m on Mt Kenya (Henschel et al., 2008)	
Papio anubis	Olive baboon	-	-	LC	-	II	-	· The most extensively distributed baboon in Africa	Probable
								· Very widespread and abundant, no major threats resulting in population declines have been observed to date (Kingdon *et al.*, 2008)	
								· Has been recorded within the AOI (NMK, 2015; GBIF, 2017).	
Scotoecus albofuscus	Light-winged Lesser House Bat	-	-	DD	-	-	Congregatory	· Patchily recorded over much of West Africa and East Africa, with some records from Central Africa; occurs in woodlands and dry savannah (Jacobs, 2008)	Unlikely
								· This species has not been recorded in the AOI (GBIF 2017).	
Smutsia temminckii	Temminck's Ground Pangolin			VU		I		The most widespread pangolin species in Africa, inhabiting mainly savanna woodland in low-lying regions with moderate to dense scrub (Pietersen et al., 2014)	Possible
								· This species has not been recorded in the AOI (GBIF 2017).	
Tadarida ventralis	African Giant Free-tailed Bat	-	-	DD	-	-	Congregatory	· Widely distributed in East and Southern Africa. Typically associated with savanna areas containing rocky crevices and gorges; however Cotterill (1996) reports that a specimen was collected in 1964 from a high rise building in Harare, Zimbabwe (Mickleburgh et al., 2008).	Possible
								· This species has been recorded in the Upstream AOI (GBIF 2017).	
Taphozous hamiltoni	Hamilton's Tomb Bat	VU	-	DD	-	-	Congregatory	· Known mainly from east African savanna, and from mountainous areas, but very little is known. It might be be a cave-dependent species (Mickleburgh et al., 2008)	Possible
Tragelaphus imberbis	Lesser Kudu	VU	-	NT	-	-	-	· Occupies semi-arid areas of north-eastern Africa, commonly known as the Somali-Masai Arid Zone of Ethiopia, Somalia, Kenya and Tanzania.	Probable
								· Closely associated with *Acacia-Commiphora* thornbush in semi-arid areas of north-eastern Africa; it generally avoids open spaces and long grass.	
								· About one-third of the estimated total population occurs in protected areas, but it occurs in larger numbers outside protected areas (IUCN SSC Antelope Specialist Group 2008).	
								· It has been recorded within Tsavo West National park within the AOI (GBIF, 2017)	

Biodiversity

C5

2 Biodiveristy baseline data - Species per vegetation community

Plant species recorded during the FSD Baseline surveys conducted during wet and dry seasons in Acacia / commiphora bushland and thicket (ACB), *Acacia tortilis* riparian woodland (ARW), Ephemeral stream woodland (ESW), *Acacia reficiens* low woodland / bushland on plains (ALW), Faidherbia / celtis riparian forest (FCR), Acacia / sansevieria bushland / thicket mosaic (ASB) and Acacia / boswellia shrubland on steep rocky hillslopes (ABS) vegetation communities

Family	Taxon	ACB	ESW	ARW	ALW	FCR	ASB	ABS
Acanthaceae	*Neuracanthus keniensis*	x						
Acanthaceae	*Blepharis turkanae*	x						
Acanthaceae	*Barleria acanthoides*	x						
Acanthaceae	*Blepharis edulis*	x						
Acanthaceae	*Justicia calyculata*	x	x					
Acanthaceae	*Justicia caerulea*	x	x	x				
Acanthaceae	*Megalochlamys revoluta ssp. revolute*			x				
Acanthaceae	*Ruellia patula*	x						
Acanthaceae	*Barleria sp.*	x			x			
Acanthaceae	*Blepharis sp.*				x			
Acanthaceae	*Dicliptera paniculata*					x		
Acanthaceae	*Dicliptera spinulosa*					x		
Acanthaceae	*Duosperma longicalyx*				x			
Acanthaceae	*Justicia flava*			x		x		
Acanthaceae	*Justicia odora*	x						
Actiniopteridaceae	*Actiniopteris radiata*	x						
Agavaceae	*Agave americana* *				x		x	
Aizoaceae	*Corbichonia decumbens*	x	x					
Aizoaceae	*Gisekia pharnaceoides* var. *pseudoponiculata*	x	x					
Aizoaceae	*Limeum viscosum*		x	x				
Aizoaceae	*Zaleya pentandra*		x	x				
Aloaceae	*Aloe sp.*	x						
Aloaceae	*Aloe deserti*	x						
Amaranthaceae	*Achyranthes aspera*		x	x				
Amaranthaceae	*Aerva lanata*	x						
Amaranthaceae	*Amaranthus sp.*	x	x	x				
Amaranthaceae	*Dasysphaera prostrate*		x	x				
Amaranthaceae	*Digera muricata*		x	x				
Amaranthaceae	*Pupalia lappacea*	x	x	x				
Amaranthaceae	*Sericocomopsis hildebrandtii*	x	x	x				
Amaranthaceae	*Achyranthes aspera*					x		
Amaranthaceae	*Sericocomopsis hildebrandtii*				x			
Amaryllidaceae	*Crinum macowanii*	x						
Anacardiaceae	*Searsia natalensis*			x				
Apocynaceae	*Blyttia fruticulosum*	x	x					
Apocynaceae	*Calotropis procera*		x	x				
Apocynaceae	*Caralluma acutangula*	x		x				
Apocynaceae	*Leptadenia hastata*	x						
Apocynaceae	*Pentatropis nivalis*			x				
Apocynaceae	*Pergularia daemia*		x					
Apocynaceae	*Adenium obesum*	x						
Apocynaceae	*Calotropis procera* *			x	x		x	
Apocynaceae	*Caralluma dicapuae*	x						
Apocynaceae	*Cynanchum viminale*	x			x			
Apocynaceae	*Desmidorchis retrospiciens*	x			x			
Apocynaceae	*Leptadenia hastata*				x			
Arecaceae	*Hyphaene compressa*			x		x		
Arecaceae	*Hyphaene compressa*			x		x		
Aristolochiaceae	*Aristolochia bracteolata*			x				
Asparagaceae	*Asparagus buchananii*	x						
Asparagaceae	*Asparagus sp.*						x	
Asparagaceae	*Sansevieria ehrenbergii*						x	
Asparagaceae	*Sansevieria frequens*					x	x	
Asphodelaceae	*Aloe secundiflora*							x
Asphodelaceae	*Aloe sp.*						x	
Asphodelaceae	*Aloe turkanensis*	x			x			
Asteraceae	*Emilia discifolia*		x	x				
Asteraceae	*Geigeria acaulis*	x						
Asteraceae	*Geigeria alata*	x						

Family	Taxon	ACB	ESW	ARW	ALW	FCR	ASB	ABS
Asteraceae	*Helichrysum glumaceum*	x						
Asteraceae	*Kleinia squarrosa*						x	
Asteraceae	*Xanthium strumarium* *			x				
Balanitaceae	*Balanites aegyptiaca*	x		x	x		x	
Balanitaceae	*Balanites rotundifolia*				x			
Boraginaceae	*Cordia sinensis Lam.*		x	x				
Boraginaceae	*Heliotropium simile*	x	x					
Boraginaceae	*Heliotropium strigosum*	x						
Boraginaceae	*Heliotropium rariflorum*		x					
Boraginaceae	*Cordia sinensis*					x		
Burseraceae	*Boswellia neglecta*	x						
Burseraceae	*Commiphora edulis*	x						
Burseraceae	*Commiphora kataf*	x						
Burseraceae	*Commiphora kua*	x						
Burseraceae	*Commiphora africana*	x						
Burseraceae	*Boswellia neglecta*	x						x
Burseraceae	*Commiphora africana*	x			x		x	x
Burseraceae	*Commiphora edulis subsp. boiviniana*							x
Burseraceae	*Commiphora kataf*	x			x			x
Cactaceae	*Opuntia sp.*	x						
Cactaceae	*Opuntia ficus-indica* *				x			x
Capparaceae	*Boscia coriacea*	x	x	x	x		x	x
Capparaceae	*Boscia angustifolia*	x						x
Capparaceae	*Cadaba gynandra*	x	x					
Capparaceae	*Cadaba rotundifolia*	x						
Capparaceae	*Cadaba ruspolii*	x						
Capparaceae	*Cadaba scaposa*	x		x				
Capparaceae	*Cadaba tenella*	x	x	x				
Capparaceae	*Cadaba farinosa*	x			x		x	
Capparaceae	*Cleome allamani*	x	x					
Capparaceae	*Capparis tomentosa*					x	x	
Capparaceae	*Maerua crassifolia*	x			x		x	
Capparaceae	*Maerua triphylla*					x		
Celastraceae	*Gymnosporia senegalensis*					x	x	
Colchicaceae	*Gloriosa superba* var. *graminifolia*	x						
Combretaceae	*Combretum aculeatum*	x		x		x		
Combretaceae	*Combretum hereroense*	x						
Combretaceae	*Terminilia spinosa*	x						
Commelinaceae	*Commelina sp.*	x						
Convolvulaceae	*Cuscuta hyalina*		x	x				
Convolvulaceae	*Hildebrandtia sepalosa*	x						
Convolvulaceae	*Ipomoea mombassana*		x	x				
Convolvulaceae	*Merremia ampelophylla*		x					
Convolvulaceae	*Seddera hirsuta*	x						
Convolvulaceae	*Ipomoea sp.*			x				
Cucurbitaceae	*Citrullus colocynthis*		x	x				
Cucurbitaceae	*Coccinia grandis*		x	x				
Cucurbitaceae	*Cucumis dipsaceus*	x	x	x				
Cucurbitaceae	*Zehneria sp.*		x					
Cucurbitaceae	*Cucumis metuliferus*						x	
Cyperaceae	*Kyllinga microstyla*	x						
Cyperaceae	*Kyllinga alba*	x						
Ebenaceae	*Diospyros scabra*	x						x
Euphorbiaceae	*Acalypha indica*		x	x				
Euphorbiaceae	*Euphorbia inaequilatera* var. *dentata*	x						
Euphorbiaceae	*Euphorbia prostrata*	x						
Euphorbiaceae	*Euphorbia tescorum*	x						
Euphorbiaceae	*Euphorbia turkanae*	x			x			
Euphorbiaceae	*Euphorbia cuneata*	x			x			
Euphorbiaceae	*Jatropha pelargoniifolia*	x			x			
Euphorbiaceae	*Jatropha ellenbeckii*	x						
Euphorbiaceae	*Phyllanthus maderaspatensis*		x					
Euphorbiaceae	*Acalypha fruticosa*					x		
Euphorbiaceae	*Euphorbia gossypina*				x			
Euphorbiaceae	*Euphorbia sp.*						x	
Euphorbiaceae	*Ricinis communis* *			x				

Family	Taxon	ACB	ESW	ARW	ALW	FCR	ASB	ABS
Fabaceae (Caesalpinioideae)	*Delonix elata*	x	x	x		x		
Fabaceae (Caesalpinioideae)	*Senna longiracemosa*		x					
Fabaceae (Caesalpinioideae)	*Senna obtusifolia* *			x		x		
Fabaceae (Caesalpinioideae)	*Senna sp. (photos)*			x				
Fabaceae (Faboideae)	*Crotalaria saltiana*	x						
Fabaceae (Faboideae)	*Indigofera spinosa*	x						
Fabaceae (Faboideae)	*Indigofera arrecta*		x					
Fabaceae (Faboideae)	*Indigofera schimperi*	x	x					
Fabaceae (Faboideae)	*Vatovaea pseudolablab*	x						
Fabaceae (Mimosoideae)	*Acacia horrida*	x						
Fabaceae (Mimosoideae)	*Acacia mellifera*	x						x
Fabaceae (Mimosoideae)	*Acacia reficiens*	x			x		x	x
Fabaceae (Mimosoideae)	*Acacia senegal*	x						
Fabaceae (Mimosoideae)	*Acacia tortilis*	x	x	x				
Fabaceae (Mimosoideae)	*Acacia elatior*	x	x	x		x		
Fabaceae (Mimosoideae)	*Prosopis procera*	x						
Fabaceae (Mimosoideae)	*Acacia etbaica*				x			
Fabaceae (Mimosoideae)	*Acacia nilotica*							
Fabaceae (Mimosoideae)	*Acacia paolii*				x			
Fabaceae (Mimosoideae)	*Acacia senegal* var. *kerensis*	x			x		x	
Fabaceae (Mimosoideae)	*Acacia tortilis* subsp. *spirocarpa*			x	x	x		x
Fabaceae (Mimosoideae)	*Prosopis juliflora* *			x		x		
Fabaceae (Papilionoideae)	*Indigofera spinosa*	x			x		x	
Hyacinthaceae	*Albuca abyssinica*	x						
Labiatae	*Leucas tomentosa*	x						
Labiatae	*Leucas glabrata*		x					
Lamiaceae	*Leucas cf. glabrata*	x						
Lamiaceae	*Plectranthus sp.*							x
Loranthaceae	*Plicosepalus sagittifolius*	x	x	x				
Lythraceae	*Lawsonia inermis*							x
Malvaceae	*Abutilon figarianum*	x						
Malvaceae	*Hermannia rhabdotospermus*		x					
Malvaceae	*Hermannia kirkii*	x						
Malvaceae	*Hibiscus micranthus*	x						
Malvaceae	*Pavonia patens*	x						
Malvaceae	*Abutilon cf. angulatum*			x		x		
Malvaceae	*Grewia cf. similis*				x		x	
Malvaceae	*Grewia fallax*	x			x		x	
Malvaceae	*Grewia tenax*	x					x	x
Malvaceae	*Grewia villosa*						x	
Malvaceae	*Sterculia stenocarpa*	x						x
Meliaceae	*Azadirachta indica* *					x		
Menispermaceae	*Cocculus pendulus*	x	x	x				
Moraceae	*Ficus cordata*							x
Moraceae	*Ficus sycomorus*					x		
Myrtaceae	*Psidium guajava* *					x		
Nyctaginaceae	*Boerhavia repens*	x	x	x				
Nyctaginaceae	*Commicarpus helenae*			x				
Olacaceae	*Ximenia americana*					x	x	
Orobanchaceae	*Cistanche tubulosa*		x					
Passifloraceae	*Adenia venenata*	x						x
Passifloraceae	*Adenia volkensii*		x	x				
Passifloraceae	*Basananthe hanningtoniana*		x					
Pedaliaceae	*Pterodiscus ruspolii*	x	x					
Pedaliaceae	*Sesamothamnus busseanus*	x	x					
Pedaliaceae	*Sesamum alatum*	x						
Pedaliaceae	*Sesamothamnus rivae*	x						
Poaceae	*Aristida kenyensis*	x						
Poaceae	*Aristida mutabilis*	x			x		x	
Poaceae	*Aristida adscensionsis*	x		x				
Poaceae	*Brachiaria leersioides*	x						
Poaceae	*Cenchrus ciliaris*			x				
Poaceae	*Dactyloctenium aegyptium*	x	x					
Poaceae	*Digitaria velutina*		x	x				
Poaceae	*Enneapogon cenchroides*	x						
Poaceae	*Eragrostis aethiopica*		x	x				

Family	Taxon	ACB	ESW	ARW	ALW	FCR	ASB	ABS
Poaceae	*Eragrostis cilianensis*		x	x				
Poaceae	*Eragrostis ciliaris*		x	x				
Poaceae	*Leptochloa obtusiflora*	x						
Poaceae	*Leptothrium senegalense*	x						
Poaceae	*Oropetium minimum*	x						
Poaceae	*Panicum sp.*		x	x				
Poaceae	*Setaria spicatus*		x	x				
Poaceae	*Setaria verticillata*		x	x		x		
Poaceae	*Sporobolus rangei*			x				
Poaceae	*Stipagrostis hirtigluma*	x						
Poaceae	*Tetrapogon cenchriformis*	x						
Poaceae	*Tragus berteronianus Schult.*	x						
Poaceae	*Tricholaena teneriffae*	x	x	x				
Poaceae	*Aristida cf. congesta*				x		x	
Poaceae	*Eragrostis sp.*	x						x
Poaceae	*Heteropogon contortus*						x	x
Poaceae	*Panicum maximum*			x		x		
Poaceae	*Setaria sulcata*					x		
Polygalaceae	*Polygala erioptera*	x						
Portulacaceae	*Portulaca oleracea*	x						
Rhamnaceae	*Ziziphus mauritiana*		x	x		x		
Rhamnaceae	*Ziziphus mucronata*					x		
Rubiaceae	*Kohautia sp.*		x					
Rubiaceae	*Vangueria cf. apiculata*					x		
Salvadoraceae	*Dobera glabra*		x					
Salvadoraceae	*Salvadora persica*	x	x	x	x		x	
Sapindaceae	*Allophylus rubifolius*					x		
Sapindaceae	*Cardiospermum grandiflorum* *					x		
Scrophulariaceae	*Striga gesnerioides*		x					
Selaginellaceae	*Selaginella sp.*							x
Solanaceae	*Datura inoxia*			x				
Solanaceae	*Lycium europaeum*	x	x					
Solanaceae	*Solanum somalense*	x	x	x				
Solanaceae	*Solanum coagulans*							
Solanaceae	*Physalis peruviana* *			x				
Solanaceae	*Solanum campylacanthum*			x				
Solanaceae	*Withania somnifera*			x				
Sterculiaceae	*Hermannia kirkii*	x	x	x				
Tiliaceae	*Corchorus tridens*		x	x				
Tiliaceae	*Grewia villosa*	x						
Tiliaceae	*Grewia tenax*	x						
Velloziaceae	*Xerophyta schnizleinia*	x						
Verbenaceae	*Premna resinosa*	x						
Verbenaceae	*Lantana camara* *					x		
Vitaceae	*Cissus rotundifolia*	x	x	x	x		x	x
Vitaceae	*Cissus quadrangularis*		x	x	x		x	x
Zygophyllaceae	*Balanites rotundifolia*	x						
Zygophyllaceae	*Tribulus terrestris*	x	x	x	x		x	

*** Alien invasive species**

Biodiversity

C5

3 Biodiveristy baseline data - Invertebrate species data

Taxa	*Acacia tortilis* Riparian Forest	Acacia/ Commiphora deciduous bushland and thicket	Acacia/ Commiphora/ Euphorbia stunted bushland/ thicket	Acacia/ Commiphora/ Indigofera stunted bushland	Mixed Acacia/ Hyphaene Riparian Forest	Semi-desert shrubland	Wooded Ephemeral Streams	Total
Araneae	**26**	**3**					**19**	**48**
(blank)	26	3					19	48
Blattodea	**1**				**1**		**1**	**3**
Blatellidae							1	1
Blattidae	1				1			2
Chilopoda	**4**						**2**	**6**
Lithobiidae	3							3
Scolopendridae							1	1
(blank)	1						1	2
Coleoptera	**1337**	**3**	**26**	**7**	**1238**	**4**	**562**	**3177**
Bostrychidae							1	1
Buprestidae	1		1			1	1	4
Carabidae	6		1		13		24	44
Cerambycidae			1	2	12		19	34
Chrysomelidae					2			2
Cicindelidae					2		1	3
Cleridae					1		1	2
Coccinelidae						1		1
Curculionidae	1				2		1	4
Dascilidae							2	2
Dryopidae					2			2
Elateridae	2		1		13		8	24
Erotylidae							1	1
Hybosoridae	2				67		17	86
Meloidae	1						3	4
Scarabaeidae	9		1	1	614		143	768
Staphylinidae					341		3	344
Tenebrionidae	1313	3	21	4	109	2	322	1774
Trogidae	2							2
(blank)					60		15	75
Diplopoda	**1**		**1**					**2**
(blank)	1		1					2
Diptera	**49**		**5**		**5**		**133**	**192**
Asilidae					1		8	9
Bombylidae							1	1
Diopsidae					1			1
Dolichopodidae							1	1
Drosophilidae	5						25	30
Muscidae	39		5		3		97	144
Sarcophagidae							1	1
Tachinidae	5							5
Hemiptera	**15**		**19**		**25**	**2**	**26**	**87**
Cicadellidae							15	15
Cicadidae					1			1
Cydnidae							1	1
Lygaeidae	8				1		5	14
Notonectidae					18			18
Pentatomidae					5		3	8
Pyrrhocoridae	7		18			2	1	28

Taxa	*Acacia tortilis* Riparian Forest	Acacia/ Commiphora deciduous bushland and thicket	Acacia/ Commiphora/ Euphorbia stunted bushland/ thicket	Acacia/ Commiphora/ Indigofera stunted bushland	Mixed Acacia/ Hyphaene Riparian Forest	Semi-desert shrubland	Wooded Ephemeral Streams	Total
Reduviidae							1	1
Scutelleriidae			1					1
Hymenoptera	**348**	**21**	**106**	**21**	**7**	**1**	**573**	**1077**
Anthophoridae	1				2		2	5
Anthoporidae							2	2
Apidae			94				33	127
Braconidae			3	1				4
Chalcididae	29					1	175	205
Eumenidae							1	1
Formicidae	315	1	8	20			355	699
Halictidae	1				2		4	7
Ichneumonidae					1			1
Mutilidae			1					1
Mutiliidae	2							2
Scoliidae					1		1	2
Sphecidae					1			1
Tetramorium		20						20
Isopoda							**1**	**1**
Cylistidae							1	1
Isoptera	**1**	**0**	**6**				**0**	**7**
Termitidae	1	0	6				0	7
Lepidoptera	**182**	**15**	**81**	**118**	**40**	**44**	**269**	**749**
Hesperiidae	3						9	12
Lycaenidae	121			4			2	127
Nymphalidae	1				2	3		6
Pieridae	57	15	81	114	4	41	258	570
(blank)					34			34
Mantodea		**1**					**2**	**3**
Tarachodidae							1	1
(blank)		1					1	2
Mecoptera						**2**		**2**
(blank)						2		2
Neuroptera			**5**					**5**
(blank)			5					5
Odonata			**1**				**2**	**3**
Coenagridae							1	1
Libellulidae			1				1	2
Orthoptera	**9**			**1**	**14**	**5**	**19**	**48**
Acridiidae	4			1	8	5	5	23
Gryllidae	4				4		14	22
Tettigonidae	1							1
Tridactylidae					2			2
Scorpiones	**10**		**7**	**2**	**18**	**5**	**14**	**56**
(blank)	10		7	2	18	5	14	56
Solfugida	**4**						**12**	**16**
Solfugae	1						6	7
(blank)	3						6	9
Thysanura		**2**		**5**				**7**
Lepismatidae		2		5				7
Grand Total	**1987**	**45**	**257**	**154**	**1348**	**63**	**1635**	**5489**

GOLDER MEMBER OF WSP

Biodiversity

C5

4 Biodiveristy baseline data -Amphibian species data

Region	Sampling Location	Common Name	*Genus*	*Species*	IUCN Status	Observation type	Vegetation Type
Ngamia	n/a	Hook-snouted worm snake	*Afrotyphlops*	*brevis*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Nakukulas	TKLA_08	Rupell's agama	*Agama*	*ruepelli*	Not yet assessed	Found in rocky area	Acacia/Commiphora deciduous bushland and thicket
Amosing	TKLA_07	Turkana toad	*Amietophrynus*	*turkanae*	Data Deficient	Caught in pitfall trap	Acacia tortillis Riparian Forest
Ngamia	n/a	Puff adder	*Bitis*	*arietans*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Katamanak	TKLA_11	North-East African carpet viper	*Echis*	*pyramidum*	Least Concern	Found under fallen, rotting vegetation	Semi-desert shrubland
Amosing	n/a	North-East African carpet viper	*Echis*	*pyramidum*	Least Concern	Tullow Snake Callout Record	Not recorded
Ngamia	n/a	North-East African carpet viper	*Echis*	*pyramidum*	Least Concern	Tullow Snake Callout Record	Not recorded
Amosing	n/a	Kenya Sand Boa	*Eryx*	*colubrinus*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Ngamia	TKLA_06	Speke's sand lizard	*Heliobolus*	*spekii*	Not yet assessed	Mostly seen by day moving on the ground	Wooded Ephemeral Streams
Amosing	TKLA_07	Speke's sand lizard	*Heliobolus*	*spekii*	Not yet assessed	Mostly seen by day moving on the ground	Acacia tortillis Riparian Forest
Nakukulas	TKLA_08	Uniform-scaled gecko	*Hemidactylus*	*isolepis*	Not yet assessed	Found under rock	Acacia/Commiphora deciduous bushland and thicket
Ngamia	TKLA_06	Brook's gecko	*Hemidactylus*	*brookii*	Not yet assessed	Mostly seen on tree trunks at night	Wooded Ephemeral Streams
Amosing	TKLA_07	Brook's gecko	*Hemidactylus*	*brookii*	Not yet assessed	Mostly seen on tree trunks at night	Acacia tortillis Riparian Forest
Leporot	TKLA_01	Somali-Masai clawed gecko	*Holodactylus*	*africanus*	Not yet assessed	Found at night under thorn bush	Mixed Acacia/Hyphaene Riparian Forest
Ngamia	TKLA_06	Somali-Masai clawed gecko	*Holodactylus*	*africanus*	Not yet assessed	Nocturnal; caught in pitfall trap	Wooded Ephemeral Streams
Amosing	TKLA_07	Long-tailed sand lizard	*Latastia*	*longicaudata*	Not yet assessed	Mostly seen by day moving on the ground	Acacia tortillis Riparian Forest
Amosing	TKLA_07	Kenya dwarf gecko	*Lygodactylus*	*keniensis*	Least Concern		Acacia tortillis Riparian Forest
Leporot	TKLA_01	Kenya dwarf gecko	*Lygodactylus*	*keniensis*	Least Concern	Mostly seen on tree trunks by day	Mixed Acacia/Hyphaene Riparian Forest
Katamanak	TKLA_11	Kenya dwarf gecko	*Lygodactylus*	*keniensis*	Least Concern	Mostly seen on tree trunks by day	Semi-desert shrubland
Leporot	TKLA_01	Sundevall's writhing skink	*Mochlus*	*sundevalli*	Least Concern		Mixed Acacia/Hyphaene Riparian Forest
Ngamia	TKLA_06	Sundevall's writhing skink	*Mochlus*	*sundevalli*	Least Concern	Caught in pitfall trap	Wooded Ephemeral Streams
Amosing	TKLA_07	Sundevall's writhing skink	*Mochlus*	*sundevalli*	Least Concern	Caught in pitfall trap	Acacia tortillis Riparian Forest
Ngamia	n/a	Red spitting cobra	*Naja*	*pallida*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Ngamia	TKLA_06	Turkana shield-backed ground lizard	*Philochortus*	*rudolfensis*	Least Concern	Caught in pitfall trap	Wooded Ephemeral Streams
Leporot	TKLA_01	Link-marked sand snake	*Psammophis*	*biseriatus*	Not yet assessed		Mixed Acacia/Hyphaene Riparian Forest
Ngamia	TKLA_06	Link-marked sand snake	*Psammophis*	*biseriatus*	Not yet assessed	Found basking on low bush	Wooded Ephemeral Streams
Ngamia	n/a	Speckled sand snake	*Psammophis*	*punctatus*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Amosing	n/a	Rufous Beaked Snake	*Rhamphiophis*	*rostratus*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Ngamia	n/a	Rufous Beaked Snake	*Rhamphiophis*	*rostratus*	Not yet assessed	Tullow Snake Callout Record	Not recorded
Ngamia	n/a	Black tiger snake/Large-eyed snake	*Telescopus*	*dhara*	Not yet assessed	Tullow Snake Callout Record	Not recorded

Biodiversity

C5

5 Biodiveristy baseline data -Bird species

Bird species recorded during the FSD Baseline assessment in the following vegetation communities: Acacia / Commiphora Bushland and thicket (ACB), Ephemeral Stream Woodland (ESW), Acacia tortilis riparian woodland (ARW), Acacia reficiens low woodland (ALW), Faidherbia – Celtis Riparian Forest (FCR), Acacia – Sanseviera Bushland (ASB), Acacia Boswellia Shrubland (ABS), Open water (OW) and Towns and villages (TWV)

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Abdim's stork	X	X	X	X				
Abyssinian Roller	X	X	X	X	X			X
Abyssinian Scimitarbill	X	X	X					
Abyssinian Wheatear	X	X	X	X				
African Cuckoo	X			X				
African Darter							X	
African Dusky Flycatcher		X						
African Firefinch		X	X					
African Fish-eagle							X	
African Goshawk	X	X	X					
African Grey Flycatcher	X	X	X		X			
African Grey Hornbill	X	X		X	X			
African Harrier-hawk	X		X	X				
African Hawk-Eagle			X					
African Mourning Dove			X					
African Palm-Swift	X	X	X					
African Paradise-flycatcher	X			X				
African Pied Wagtail							X	
African Pygmy-kingfisher	X			X				
African Silverbill		X						
African Thrush				X				
Augur Buzzard		X						
Barn Swallow		X		X	X		X	X
Bateleur		X		X	X			
Bearded Woodpecker	X			X	X			
Beautiful Sunbird	X	X	X	X	X			
Black Crake							X	
Black Cuckoo				X				
Black Kite		X		X				
Black-backed Puffback				X				
Black-bellied Bustard	X	X						
Black-bellied Sunbird	X							
Black-cheeked Waxbill	X							
Black-chested Snake-eagle					X			
Black-crowned Night Heron				X				
Black-crowned Tchagra		X	X					
Black-faced Sandgrouse	X	X	X					
Black-headed Gonolek				X				
Black-headed Heron		X						
Black-headed Oriole		X	X	X				
Black-headed Plover	X							
Black-shouldered Kite				X				
Black-throated Barbet	X	X	X	X	X			

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Black-winged Kite					X			X
Bleating Camaroptera	X			X				
Blue-capped Cordon-bleu	X	X			X			
Blue-naped Mousebird	X	X	X		X			
Blue-spotted Wood-dove				X				
Bristle-crowned Starling		X						
Broad-billed Roller				X				
Brown Parrot	X	X	X	X	X			
Brown Snake eagle		X		X	X			
Brown-crowned Tchagra	X	X	X					
Brown-headed Kingfisher					X			
Brubru	X	X	X	X	X			
Buff-bellied Warbler				X				
Cardinal Woodpecker	X	X		X				
Cattle Egret		X						
Chestnut Sparrow		X						
Chestnut Weaver	X	X	X		X			
Chestnut-bellied Sandgrouse					X			
Chestnut-headed Sparrow-Lark					X			
Chin-spot Batis	X	X	X					
Cinnamon-chested Bee-eater		X	X					
Common Bulbul	X	X	X	X	X			
Common Drongo	X	X		X				
Common Fiscal	X	X						
Common Hoopoe					X			
Common Kestrel		X			X			
Common Quail		X	X					
Common Waxbill			X					
Crested Francolin		X		X	X			
Crested Lark		X			X			
Cut-throat Finch			X		X			
Dark Chanting-goshawk	X			X	X			
D'Arnaud's Barbet		X	X		X			
Dickinson's Kestrel			X					
Diederik Cuckoo		X	X					
Dwarf Raven	X							
Eastern Black-headed Oriole	X			X				
Eastern Chanting Goshawk		X	X					
Eastern Violet-backed Sunbird	X	X	X		X			
Eastern Yellow-billed Hornbill					X			
Emerald-spotted Wood-dove	X		X	X	X			
Ethiopian Swallow					X			
Eurasian Hobby			X					
European Bee-eater		X			X			
Fan-tailed Raven	X	X	X					
Fawn-coloured Lark		X						
Fischer's Sparrow Lark		X						
Fischer's Starling		X	X					
Fork-tailed Drongo	X	X	X	X	X			

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Four-banded Sandgrouse		X	X		X			
Fox Kestrel		X			X			
Foxy Lark					X			
Gabar Goshawk	X	X	X	X				
Giant Kingfisher							X	
Golden-backed Weaver				X				
Golden-breasted Bunting	X	X	X					
Grasshopper Buzzard					X			
Great Spotted Cuckoo	X	X	X					
Greater Blue-eared Starling				X				
Greater Honeyguide	X			X	X			
Green Woodhoopoe		X	X		X			
Green-backed Heron							X	
Green-winged Pytilia		X	X		X			
Grey Woodpecker	X			X				
Grey Wren-warbler	X		X		X			
Grey-backed Camaroptera				X				
Grey-backed Fiscal			X	X				
Grey-headed Bush-shrike	X			X				
Grey-headed Kingfisher				X	X			
Grey-headed Kingfisher	X			X				
Grey-headed Sparrow		X	X					
Hadeda Ibis	X			X				
Hamerkop							X	
Harlequin Quail	X							
Helmeted Guineafowl				X	X			
Hemprich's Hornbill		X						
Heuglin's Wheatear					X			X
Hoopoe	X	X	X					
House Sparrow								X
Hunter's Sunbird		X						
Isabelline Wheatear	X	X		X				
Jackson's Hornbill	X	X		X	X			
Jacobin Cuckoo		X	X	X				
Kenya (Eastern) Violet-backed Sunbird	X	X	X					
Kenya Rufous-Sparrow		X						
Klaas's Cuckoo	X	X	X	X				
Kori Bustard		X	X					
Lanner Falcon	X	X			X			
Lappet-faced Vulture		X						
Laughing Dove	X	X	X	X	X			X
Lesser Honeyguide	X			X				
Lesser Kestrel	X	X						
Lesser Striped Swallow	X						X	
Levaillant's Cuckoo		X						
Lilac-breasted Roller				X	X			
Little Bee-eater	X	X	X	X	X			
Little Sparrowhawk	X	X						

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Little Swift		X					X	X
Little Weaver	X	X	X					
Long-crested Eagle				X				
Long-tailed Cormorant							X	
Long-tailed Paradise-whydah					X			
Magpie Starling	X	X		X	X			
Marico Sunbird	X			X				
Meyer's Parrot			X	X				
Mottled Swift				X				
Mourning Collared-dove	X			X	X			
Mouse-coloured Penduline-Tit		X			X			
Namaqua Dove	X	X	X	X	X			X
Northern Brownbul	X			X				
Northern Crombec		X	X		X			
Northern Grey-headed Sparrow	X							
Northern Puffback					X			
Northern Red-billed Hornbill	X			X	X			
Northern Wheatear		X	X		X			X
Northern White-crowned Shrike	X			X				
Nothern White-crowned Shrike	X	X	X	X	X			X
Nubian Woodpecker	X	X	X	X	X			
Olive Bee-eater	X							
Orange-breasted Bush-shrike	X			X	X			
Orange-winged Pytilia		X						
Pale Flycatcher	X	X		X	X			
Pale Prinia	X	X	X		X			
Pallid Harrier	X							
Pallid Honeyguide	X	X						
Palm-nut Vulture				X				
Parrot-billed Sparrow	X			X	X			X
Pearl-spotted Owlet					X			
Pied Crow	X		X					X
Pied Kingfisher							X	
Pink-breasted Lark					X			
Pin-tailed Whydah			X					
Plain Nightjar		X						
Plain-backed Pipit		X						
Pringle's Puffback			X					
Purple Grenadier	X	X	X	X	X			
Purple Roller		X						
Pygmy Batis		X			X			
Pygmy Falcon	X	X	X					
Pygmy falcon		X	X		X			
Quail Plover		X						
Rattling Cisticola	X							
Red-and-yellow Barbet	X	X	X	X	X			
Red-billed Firefinch				X				
Red-billed Hornbill	X	X	X	X				

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Red-billed Oxpecker					X			
Red-billed Quelea				X	X			
Red-cheeked cordon-bleu				X				
Red-chested Cuckoo	X			X				
Red-chested Sunbird		X						
Red-eyed Dove				X				
Red-fronted Barbet				X				
Red-fronted Prinia					X			
Red-fronted Tinkerbird	X	X		X	X			
Red-fronted Warbler			X					
Red-rumped Swallow	X							
Red-throated Rock Martin		X						
Red-winged Lark	X							
Red-winged Starling		X						
Ring-necked Dove	X	X	X	X	X			X
Rock Dove (Feral Pigeon)								X
Rosy-patched Bushshrike	X	X	X					
Rufous Chatterer	X	X	X	X	X			
Rufous-tailed Scrub Robin					X			
Rüppell's Starling	X	X		X	X			X
Scarlet-chested Sunbird	X	X	X	X				
Scissor-tailed Kite					X			
Shikra	X			X	X			
Singing Bush Lark		X						
Slate-coloured Boubou	X	X	X	X	X			
Somali Bunting		X			X			
Somali Courser	X	X						
Somali Crow					X			X
Somali Fiscal		X			X			X
Somali Golden-breasted Bunting			X					
Somali Sparrow		X	X					X
Somali Tit					X			
Speckled Mousebird	X			X	X			
Speckled Pigeon	X	X						X
Speckle-fronted Weaver	X	X	X		X			
Spotted Eagle-Owl		X						
Spotted Flycatcher	X	X	X					
Spotted Morning Thrush			X					
Spotted Palm-thrush	X	X	X	X				
Spotted Thick-knee	X	X						
Spur-winged Plover	X	X	X					
Steel-blue Whydah		X	X					
Steppe Buzzard		X	X					
Steppe Eagle	X	X		X				
Stone Partridge		X						
Striped Kingfisher	X			X	X			
Striped Pipit		X						
Sulphur-breasted Bushshrike			X					

Common name	ARW	ACB	ESW	FCR	ALW	ASB	OW	TWV
Superb Starling	X	X	X	X	X			X
Tambourine Dove				X				
Tawny Eagle		X	X	X				
Tawny-flanked Prinia	X	X	X					
Thick-billed Weaver							X	
Three-streaked Tchagra		X						
Variable Sunbird	X	X	X	X	X			
Village Indigobird	X							
Village Weaver	X			X				
Violet-backed Starling	X	X	X					
Vitelline Masked Weaver	X	X	X	X				
Wahlberg's Eagle		X						
Wattled Starling	X	X	X		X			
Western Banded Snake-eagle				X				
White-backed Vulture		X						
White-bellied Bustard		X						
White-bellied Canary					X			
White-bellied Go-away-bird	X	X	X	X	X			
White-billed Buffalo-weaver	X	X	X	X	X			X
White-breasted Cormorant							X	
White-browed Coucal	X			X				
White-browed Robin-chat	X			X				
White-browed Scrub Robin	X	X	X	X	X			
White-browed Sparrow-weaver	X	X	X	X	X			X
White-crested Helmetshrike	X	X	X	X				
White-crowned Shrike				X				
White-headed Buffalo-weaver	X	X	X	X	X			X
White-headed Mouse-bird		X	X					
White-rumped Swift	X							
White-throated Bee-eater	X	X	X					
Willow Warbler	X		X	X	X			
Wire-tailed Swallow							X	
Woodland Kingfisher				X				
Yellow-bellied Eremomela	X	X			X			
Yellow-billed Kite					X			X
Yellow-breasted Apalis	X			X				
Yellow-spotted Bush-sparrow					X			
Yellow-spotted Petronia	X	X	X					
Yellow-vented Eremomela		X			X			
Zebra Waxbill			X					

Biodiversity

C5

6 Biodiveristy baseline data -Mammal species

Appendix F_Mammal Baseline Data

Method / Species	Acacia/ Commiphora deciduous bushland/ thicket	Acacia/ Commiphora/ Euphorbia stunted bushland/ thicket	Acacia/ Commiphora/ Indigofera stunted bushland	Mixed Acacia/ Hyphaene Riparian Forest	Ephemeral Stream Woodland	Total
Camera trap						
Hyaena hyaena					1	1
Otocyon megalotis		2				2
Foraging evidence						
Hystrix sp.		1				1
Orycteropus afer					1	1
Harp trap						
Lavia frons					2	2
Incidental						
Canis mesomelas		1				1
Hyaena hyaena		1				1
Lavia frons					6	6
Lepus capensis			1			1
Madoqua guentheri					1	1
Orycteropus afer		1				1
Xerus rutilans		12	3	1	7	23
Xerus rutilus		3			3	6
Roost search						
Nycticeinops schlieffeni		1				1
Sherman trap						
Acomys percivali		1			1	2
Acomys wilsoni					1	1
Arvicanthis niloticus					2	2
Atelerix albiventris		1				1
Elephantalus rufescens					1	1
Gerbilliscus nigricaudus					1	1
Gerbillus sp.		2			1	3
Taterillus sp.		1	2			3
Xerus rutilus		1				1
Track						
Hyaena hyaena		2				2
Track pad						
Civet/Mongoose		1			1	2
Canis sp.		1				1
Crocuta crocuta					2	2
Crocuta/Hyena		2				2
Mellivora capensis					1	1
Transect						

Appendix F_Mammal Baseline Data

Method / Species	Acacia/ Commiphora deciduous bushland/ thicket	Acacia/ Commiphora/ Euphorbia stunted bushland/ thicket	Acacia/ Commiphora/ Indigofera stunted bushland	Mixed Acacia/ Hyphaene Riparian Forest	Ephemeral Stream Woodland	Total
Atelerix sclateri		2	2			4
Canis aureus		1				1
Civettictis civetta	1					1
Crocuta crocuta		1				1
Galago senegalensis		4	2		4	10
Genetta maculata					2	2
Genetta sp.		1				1
Gerbillius sp.		1				1
Ictonyx striatus		1	4			5
Leptailurus servalis					2	2
Lepus capensis		19	7		2	28
Madoqua guentheri			4			4
Orycteropus afer	1				1	2
Xerus rutilans		4	2		3	9
Total	**2**	**68**	**27**	**1**	**46**	**144**

Ecosystem Services

C6

1 Ecosystem Services Prioritisation exercise

PRIORITISATION OF ES ACCORDING TO PROJECT IMPACT

Priority ecosystem services are those services for which the answers to questions 1 and 2 are "Yes" or "Unknown", **and** "No" or "Unknown" to question 3. If the answer to either question 1 or 2 is no, then the ecosystem service is non-priority

Impact prioritisation spreadsheet

Ecosystem Service	Supplying Ecosystem	Potentially affected beneficiaries/locations	Potentially affected benefits	1. Could the project affect the ability of others to benefit from this ES? (Y/N/?)	2. Is this ES important to beneficiaries' livelihoods, health, safety or culture? (Y/N/?)	3. Do beneficiaries have viable alternative to this ES? (Y/N/?)	Priority ES 1 = Priority 0 = Non-priority
Provisioning							
Food – Cultivated foods	Riparian woodland Ephemeral stream woodland	Residents near Turkwel Gorge Reservoir	Beneficiaries' ability to generate income and livelihoods, and supplement dietary food intake – seasonal sorghum gardens and via beekeeping enterprises is not expected to be directly or indirectly affected by the Project land-take or activities.	N	Y	?	0
Food – Cultivated foods	Riparian woodland Ephemeral stream woodland	Residents near Turkwel Gorge Reservoir	Beneficiaries' ability to generate income and livelihoods, and supplement dietary food intake via sorghum gardening enterprises is not expected to be directly or indirectly affected by the Project land-take or activities.	N	Y	?	0
Food – Grazing/browsing resources for Livestock	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Reduced grazing area due to Project land-take and increased pressure from population influx will reduce grazing availability, which may limit the ability of people to raise livestock for subsistence, livelihood and cultural purposes.	Y	Y	N	1
Food – wild foods	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Reduced wild food plant and/or bush meat availability due to reductions in woodland/bush land cover that supports food plant/animal species Reduced vegetation cover may limit bee's ability to produce honey and honey production.	Y	Y	?	1

Ecosystem Service	Supplying Ecosystem	Potentially affected beneficiaries/locations	Potentially affected benefits	1. Could the project affect the ability of others to benefit from this ES? (Y/N/?)	2. Is this ES important to beneficiaries' livelihoods, health, safety or culture? (Y/N/?)	3. Do beneficiaries have viable alternative to this ES? (Y/N/?)	Priority ES 1 = Priority 0 = Non-priority
Medicinal plants	*Acacia/Commiphora* bushland/ thicket Riparian forest Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Reduced availability of traditional medicines due to reduction in woodland/bush vegetation cover that supports plant species used for traditional medicine.	Y	Y	?	1
Biomass fuel – firewood and charcoal	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Freely-accessible energy sources for cooking, heating – reduced availability due to reduction in vegetation cover supplying the ES.	Y	Y	N – most people in AoI do not have the ability to purchase alternatives	1
		Residents in Kochodin and Lokichar Locations	Reduced supply of wood/charcoal for purchase.	Y	Y	Y	0
Biological raw materials – construction of traditional houses	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Ability to construct homes and animal shelters, traditional utensils.	Y	Y	?	1
Biological raw materials – Animal skins	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Project land take could reduce ability of beneficiaries to raise livestock with subsequent effects on the availability of animal skin/hide for sale or use.	N	n/a	n/a	0
Fresh water	Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Availability and quality of fresh water for drinking may be compromised by abstraction from groundwater, reliance on the Operator for supply to water points.	Y	Y	N	1
	Turkwel Gorge Reservoir	Residents in Kochodin and Lokichar Locations	No Project impacts on supply of water from Turkwel Gorge Reservoir to beneficiaries are anticipated.	N	Y	Y	0

Ecosystem Service	Supplying Ecosystem	Potentially affected beneficiaries/locations	Potentially affected benefits	1. Could the project affect the ability of others to benefit from this ES? (Y/N/?)	2. Is this ES important to beneficiaries' livelihoods, health, safety or culture? (Y/N/?)	3. Do beneficiaries have viable alternative to this ES? (Y/N/?)	Priority ES 1 = Priority 0 = Non-priority
Regulating							
Air quality	*Acacia/Commiphora* bushland/ thicket Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Project effects on ecosystems that provide this ecosystem service (reduction in extent) are negligible in the context of available unaffected areas in AoI.	N	n/a	n/a	0
Water flows and timing	Riparian woodland Ephemeral stream woodland	Locations in West Pokot and Turkana County	Abstraction of water from the Turkwel Dam could result in disturbance/interruption of flows to downstream beneficiaries.	Y	Y	N	1
		Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Reduction in extent of riparian vegetation and lugga habitat in AoI due to Project land take could limit the ability of ecosystems to supply this service.	Y	Y	N	1
Regulation of Disease	*Acacia/Commiphora* bushland/ thicket	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	The arid, desert environment limits the availability of suitable conditions for malaria vectors. Vegetation clearance is unlikely to push the regulation of disease across a sustainability of regulatory threshold.	N	n/a	n/a	0
Soil stability & erosion control	Acacia/Commiphora bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Vegetation clearance for construction may reduce the ability of the surrounding soils to withstand erosive forces of wind and floods.	N	n/a	n/a	0
Pollination	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	All beneficiaries are reliant on the pollination of plant species that produce wild foods and /or provide for livestock grazing / browsing and the harvest of subsistence crops. The project is however unlikely to significantly impact any pollinator species.	N	n/a	n/a	0

Ecosystem Service	Supplying Ecosystem	Potentially affected beneficiaries/locations	Potentially affected benefits	1. Could the project affect the ability of others to benefit from this ES? (Y/N/?)	2. Is this ES important to beneficiaries' livelihoods, health, safety or culture? (Y/N/?)	3. Do beneficiaries have viable alternative to this ES? (Y/N/?)	Priority ES 1 = Priority 0 = Non-priority
Cultural							
Ethical and spiritual values	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	Sacred sites and intangible cultural heritage are intrinsically linked with natural ecosystems such as riparian forest, luggas, arid grasslands and rocky mountains and substantially contribute to beneficiaries' sense of identity. Construction activity, and presence of the Project in the landscape are likely to affect indigenous sense of place and belonging.	Y	Y	N	1
Educational and inspirational	*Acacia/Commiphora* bushland/ thicket Riparian woodland Ephemeral stream woodland	Mobile pastoralists; Residents in Kochodin and Lokichar Locations	The Turkana landscape inspires folklore and contributes to beneficiaries' sense of heritage and identity. Construction activity, and presence of the Project in the landscape are likely to affect beneficiaries' sense of heritage and identity.	Y	Y	N	1

PRIORITISATION OF ES ACCORDING TO PROJECT DEPENDENCE

Priority ES are those services for which the answers to question 1 is "Yes" or "Unknown", **and** "No" or "Unknown" to question 2. If the answer to question 1 is no, it is automatically a non-priority ecosystem service. Changes in an ecosystem service can be driven both by causes of ecosystem change external to the Project and by the Project's own impacts.

Priority ecosystem services according to the extent of Project Demand

Ecosystem Service	1. Could this ES change in ways that will affect operational performance (Y/N/?)	2. Does the Project have viable alternatives to this ES (Y/N/?)	Priority ES 1 = Priority 0 = Non-priority
Provisioning			
Fresh water	Y – The operational success of the Project is reliant on abstraction of construction water (from groundwater). Stakeholders perceive that the Project may impact the quantity of water. The drawdown of groundwater as a result of pumping from boreholes before the pipeline is commissioned could affect groundwater supply for nearby communities (e.g. Nakukulas, Lokicheda), therefore the Project is reliant on the quantity of freshwater remaining constant throughout its lifetime in order to maintain its social privilege to operate. Cumulative impact of abstraction from Turkwel River by other projects unknown	N	1
Regulating			
Air quality	Y - Stakeholders might perceive that the Project could affect air quality, the Project would therefore be reliant on this ecosystem service to continue in order to maintain its social privilege to operate.	N	1
Water flows and timing	Y – The Project will affect luggas and ephemeral streams which may cause flooding which could affect operational performance.	Y – engineering mitigation measures to manage surface and sub-surface flows in the construction and operation phases of the Project are considered sufficient to reduce potential impacts to negligible significance.	0
Soil stability & erosion control	Y – Vegetation clearance for construction may reduce the ability of the surrounding soils to withstand erosive forces of wind and floods.	Y – engineered measures for the control of erosion arising from vegetation removal are considered sufficient to minimise the impacts of vegetation clearance.	0
Cultural			
Ethical and spiritual values (sacred trees)	Y – the Project is reliant on the availability of this ES remaining constant throughout its lifetime in order to maintain its social privilege to operate	N – there are no alternatives to the presence of the Project in the landscape.	1
Educational and inspirational	Y – the Project could be reliant on the availability of this ES remaining constant throughout its lifetime in order to maintain its social privilege to operate	N – there are no alternatives to the presence of the Project in the landscape.	1

Ecosystem Services

C6

2 Ecosystem Services Prioritisation exercise - Appendix A - Turkana Plants

Turkana plant name	Species	Use	Description of Use	Reference
Amuroekile		Medicinal	Treating stomach diseases including diarrhoea and vomiting.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ebei	*Balanites rotundifolia*	Food	Poisonous ebei fruits are boiled like edung to provide food for people.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ebei	*Balanites rotundifolia*	Forage	Leaves are eaten by livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ebucharatet		Construction materials	Serves as a house construction material, in conjunction with edung.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Echokokile	*Commiphora cuneata*	Medicinal	Acts in the same way as echuchuka inducing vomit and treating stomach ailments.	Turkana plant name reference: Mwaura & Kaburu, 2008
Echuchuka	*Euphorbia cuneata*	Medicinal	Fluid is used as an effective remedy for stomach problems (acidity and ulcers). It induces vomit through which the sickness fluids are removed from the body.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Edapal	*Dobera glabra*			Juma (2009)
Edome	*Cordia sinensis*	Utensils	Used for making traditional carved sticks with curved heads, and *Ekicholong* (Turkana seat/head rest).	(Booth et al., 2015)
Edung	*Boscia coricea*	Forage	Fresh edung leaves are consumed by camels and when they are dry and fall down are important feed for goats and donkeys. Donkeys feed on the bark.	Turkana plant name reference: Mwaura & Kaburu, 2008

Turkana plant name	Species	Use	Description of Use	Reference
Edung	*Boscia coricea*	Food	Edung fruits are gathered by women and boiled for long hours to supply food for the family. Being poisonous the fruits are usually boiled from seven o'clock in the morning to three o'clock in the afternoon to be ready for human consumption. Around October, edung becomes plentiful. It is collected and cooked in large sufurias for sharing with everyone. All Turkana foods are shared, but some foods are restricted especially entrails are never eaten by pregnant women as it is believed to bring bad omen and deformities.	Turkana plant name reference: Mwaura & Kaburu, 2008
Edweite		Utensils	Used to make all the traditional Turkana stools, utensils (plates, cups and spoons).	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eengol	*Hyphaene*	Utensils	Leaves are used for weaving baskets and mats and making rope; and trunks are used as poles for construction (Booth et al., 2015).	Booth et al., 2015; Turkana plant name reference from Mwaura & Kaburu
Eengol	*Hyphaene*	Construction materials	Leaves are used for weaving baskets and mats and making rope; and trunks are used as poles for construction (Booth et al., 2015).	Booth et al., 2015; Turkana plant name reference from Mwaura & Kaburu
Egis		Medicinal	Used to treat livestock diseases, which include loukoi, emany, lojaa, lokot, lotomee, lomoo, ngiboruok (foot and mouth disease), amil, lonyang, lokot, loidiit.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eipa	*Maerua oblongifolia*	Medicinal	Toothbrushes, superior to those from esekon; believed to contain germ-killing chemicals.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008

Turkana plant name	Species	Use	Description of Use	Reference
Eipa	*Maerua oblongifolia*	Forage	Eipa which needs support from other trees to grow (always existing near acacia trees) is eaten by camels and goats (which consume the leaves).	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008
Ekabekebeke	*Lycium europaeum*	Medicinal	A very effective treatment for snakebites (fluid from the leaves are smeared in the bitten place to remove the poison and fangs stuck in the body).	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008
Ekabekebeke	*Lycium europaeum*	Forage	Camel feed.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008
Ekabekebeke	*Lycium europaeum*	Utensils	Used to produce transport trays used during migrations to carry luggage.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008
Ekabonyo		Medicinal	Acts in the same way as echuchuka inducing vomit and treating stomach ailments.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekadel	*Commiphora africana*			Juma (2009)
Ekalale	*Ziziphus mauritiana*	Forage	Leaves and flowers are feed for livestock, as are its fruits.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
Ekalale	*Ziziphus mauritiana*	Food	Fruits used by people. Ekalale is pound with stone and to it is added milk, blood, fat and flour to make a firm paste which is very delicious and keeps one satisfied for long.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekalale	*Ziziphus mauritiana*	Utensils	Branches are used for making bows, fencing, and the making of stools .	(Booth et al., 2015)
Ekaliko		Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekalio		Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekamongo	*Leptadenia hastata*	Medicinal	Treats wounds and is considered the most important antiseptic, but it is usually very painful.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Watkins, 2010
Ekunoit	*Acacia senegal*	Food	Fluid is tapped and chewed as sweets.	Turkana plant name reference: Mwaura & Kaburu, 2008
Ekurichanait	*Delonix elata*	Forage	Pods, leaves and flowers are feed for livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekurichanait	*Delonix elata*	Food	Roots and pods are eaten by people.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
Ekurichanait	*Delonix elata*	Utensils	Used to make all the traditional Turkana stools, utensils (plates, cups and spoons).	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekurichanait	*Delonix elata*	Medicinal	The roots and pods are used as medicine.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekurichanait	*Delonix elata*	Construction materials	Used in the construction of houses.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ekwangorong	*Commiphora schimperi*	Forage	Eaten by livestock only.	Turkana plant name reference: Mwaura & Kaburu, 2008
Elamach	*Balanites pedicellaris*	Food	Fruits are also boiled for hours to make them edible, and provide food for people.	Turkana plant name reference: Mwaura & Kaburu, 2008
Elamach	*Balanites pedicellaris*	Forage	Leaves are browsed by livestock.	Turkana plant name reference: Mwaura & Kaburu, 2008
Elamach	*Balanites pedicellaris*	Food	People consume this.	Turkana plant name reference: Mwaura & Kaburu, 2008
Elap		Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Elemach	*Balanites sp.*			Juma (2009)

Turkana plant name	Species	Use	Description of Use	Reference
Eligoi		Medicinal	Used to treat livestock diseases, which include loukoi, emany, lojaa, lokot, lotomee, lomoo, ngiboruok (foot and mouth disease), amil, lonyang, lokot and loidiit.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Elim	*Diospyros scabra*	Medicinal	Pounded and used to treat stomach complaints such as diarrhoea, vomiting and constipation.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Elim	*Diospyros scabra*	Construction materials	Supplies the materials for construction of various structures.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Elim	*Diospyros scabra*	Forage	Leaves are eaten by livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Emekwi	*Indigofera spinosa*	Food	A staple food of Turkana people.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Emekwi	*Indigofera spinosa*	Forage	Main food item for camels and donkeys.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Emus		Medicinal	Act in the same way as echuchuka inducing vomit and treating stomach ailments.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
Emus		Medicinal	(The thorny plants) are first roasted over the fire to remove the thorns. It is then pounded with stone and put in water to boil and mixed with milk and drunk - only one cup helps one to remain healthy for up to two years! It induces diarrhoea which then relives the individual of the trouble causing fluids.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Emus		Medicinal		South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Engiminae		Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Engomo	*Grewia tenax*	Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Mwaura & Kaburu, 2008
Epat	*Grewia mollis*	Food	People consume this.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; Turkana plant name ref from Watkins, 2010
Epetet	*Acacia nubica*	Medicinal	Eye ailments.	Turkana plant name reference: Mwaura & Kaburu, 2008
Epetet	*Acacia nubica*	Forage	Pods, leaves and flowers are important livestock feed.	Turkana plant name reference: Mwaura & Kaburu, 2008

Turkana plant name	Species	Use	Description of Use	Reference
Epetet	*Acacia nubica*	Food	Fluid serves as sweets to children.	Turkana plant name reference: Mwaura & Kaburu, 2008
Epetet	*Acacia nubica*	Medicinal	Used for treating eye diseases and stomach ailments.	Turkana plant name reference: Mwaura & Kaburu, 2008
Epong		Medicinal	Found only in the hills and is useful for curing worms (minyoo) and stomach problems. It also heals joint pains and eases delivery in camels but it is highly poisonous and must be taken with great caution; it must be boiled and the top cream removed and thrown away. The sieved clear solution is drunk.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eregai	*Acacia reficiens*	Food	A main food of Turkana people	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eregai / eregae	*Acacia reficiens*	Forage	Feed for livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eregai / eregae	*Acacia reficiens*	Construction materials	Fencing material for livestock structures.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Eregai / eregae	*Acacia reficiens*	Food	Ngiminai (used as sweets just like ekunoit whose fluid is tapped and chewed as sweets) for children.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ereng	*Cadaba farinosa / Maerua crassifolia*	Medicinal	Toothbrushes.	Turkana plant name reference: Mwaura & Kaburu, 2008

Turkana plant name	Species	Use	Description of Use	Reference
Ereng	*Cadaba farinosa / Maerua crassifolia*	Food	People consume pods.	Turkana plant name reference: Mwaura & Kaburu, 2008
Ereng	*Cadaba farinosa / Maerua crassifolia*	Forage	Livestock consume leaves.	Turkana plant name reference: Mwaura & Kaburu, 2008
Ereng	*Cadaba farinosa / Maerua crassifolia*	Construction materials	Houses and livestock structures.	Turkana plant name reference: Mwaura & Kaburu, 2008
Erodo		Medicinal	Act in the same way as echuchuka inducing vomit and treating stomach ailments.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Esanyanait	*Acacia elatior*	Construction materials	Provide shed for both people and livestock.	Turkana plant name reference: Mwaura & Kaburu, 2008
Esanyanait	*Acacia elatior*	Forage	Pods, leaves and flowers are consumed by livestock during dry season.	Turkana plant name reference: Mwaura & Kaburu, 2008
Esanyanait	*Acacia elatior*	Cultural	Whenever there is an issue facing the community such as sickness, drought, the elders come together under the tree (Ewoi and Esanyanait) and slaughter a camel, goat or sheep and share the meat with God and amongst themselves.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
Esekon	*Salvadora persica*	Medicinal	Toothbrushes; roots are used to treat stomach ailments (acids, ulcers); they are pounded and put in water and drunk only once to induce vomiting. But the esokon drink also serves as an appetizer (giving one an urge to eat). The tubers are dug from the soil, smashed and put in water, allowed to rest for some time before being administered on the sick. It is then drink as prescribed - half two hundred and fifty grammes container for children and the full tin cup for adults.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Esekon	*Salvadora persica*	Food	Fruits are eaten by livestock and people.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Esekon	*Salvadora persica*	Forage	Fruits are eaten by livestock, fresh esekon leaves are good feed for camels while the dry leaves are eaten by goats and donkeys.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Esekon	*Salvadora persica*	Food	A main food of Turkana people.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Mwaura & Kaburu, 2008
Etesiro	*Calotropis procera*	Medicinal	When someone is pricked by a thorn which breaks in the body. You break etesro and drop its milk in the	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
			placepricked by the thorn. The thorn would come out two days later.	
Etesiro	*Calotropis procera*	Medicinal	Also serves as a purgative to remove stuck placenta when a camel delivers.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Etesiro	*Calotropis procera*	Recreational	Leaves are used while chewing tobacco to retain the taste for longer.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Etesiro	*Calotropis procera*	Medicinal	Leaves also serve as a curative for wounds - milky sap from leaves serves this purpose.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ewoi	*Acacia tortilis*	Forage	Leaves, flowers and pods are used as livestock feed - its leaves and flowers are essential livestock feed.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ewoi	*Acacia tortilis*	Food	Pods are consumed by people. Ewoi is pounded and added with milk and eaten. It is believed to satisfy hunger and keeps one satisfied for long. Black discharge is used for drinks (put in water and boiled as sugar and milk are added to it).	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Ewoi	*Acacia tortilis*	Wood	When an ewoi tree dries up it is used to provide firewood and charcoal for domestic use for cooking and for sale.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016

Turkana plant name	Species	Use	Description of Use	Reference
Ewoi	*Acacia tortilis*	Cultural	Whenever there is an issue facing the community such as sickness, drought, the elders come together under the tree (Ewoi and Esanyanait) and slaughter a camel, goat or sheep and share the meat with God and amongst themselves.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Kayep		Medicinal	Leaves provide treatment for certain ailments in both people and livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Kayep		Forage	Used as feed for livestock.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Locham		Medicinal	Used for treating coughs.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016
Lorodo	*Cissus rotundifolia*	Medicinal	Used to treat lobute' or swellings, 'egong' or diarrhoea, and chest problems - the tubers and roots are pounded and its liquid drunk while the res put in water for bathing. The medicine is very sharp in taste.	South Turkana Cultural Heritage Baseline Survey Phase 2 July-Aug 2016; name ref from Watkins, 2010
	Commiphora sp.	Utensils	Used for making local cups and bowls for drinking, and Ekicholong.	Booth et al., 2015
	Euphorbia tirucalli	Medicinal	Used to induce abortion.	Tullow driver pers. comm. during biodiversity surveys (2016)

Cultural Heritage

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1 Cultrural Heritage baseline fieldwork summary

1.0 CULTURAL HERITAGE GAZETTEER

All Universal Transverse Mercator (UTM) coordinates are presented UTM 36N. Under 'Materials Recorded', a "1" indicates a material is present, whilst "0" indicates it is not present.

Table 1: Gazetteer - Archaeological Assets

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded									
			Pottery - Rim/Neck	Pottery - Decorated	Pottery - Undecorated	Lithic - Quartz	Lithic - Chert	Lithic - Obsidian	Lithic - Rhyolite	Lithic - Other	Palaeontological	Jewellery
AR-001	800384	282428	0	0	0	1	1	0	0	1	0	0
AR-002	800352	282426	0	0	0	1	1	0	0	0	0	0
AR-003	800202	282395	0	0	0	1	0	0	0	0	0	0
AR-004	800166	282387	0	0	0	1	0	0	0	1	0	0
AR-005	800461	282380	0	0	1	0	0	0	0	1	0	0
AR-006	799233	282368	0	0	0	1	0	0	0	1	0	0
AR-007	800187	282339	0	0	0	1	0	0	0	1	0	0
AR-008	800163	282327	0	0	0	1	0	0	1	1	0	0
AR-009	800033	282315	0	0	0	1	0	0	0	0	0	0
AR-010	799189	282314	0	0	0	0	0	1	0	0	0	0
AR-011	799014	282295	0	0	0	0	1	0	0	0	0	0
AR-012	799025	282269	0	0	0	1	0	0	0	0	0	0
AR-013	799457	282232	0	0	1	1	0	0	0	0	0	0
AR-014	798983	282213	0	0	0	0	0	0	1	0	0	0
AR-015	799332	282194	0	0	1	0	0	0	0	0	0	0
AR-016	798972	282146	0	0	0	0	1	0	0	0	0	0
AR-017	800174	282087	0	0	1	0	0	0	0	0	0	0
AR-018	800306	281462	0	0	1	0	1	0	0	0	0	0
AR-019	799968	281260	0	0	0	1	0	0	0	0	0	0
AR-020	797876	281004	0	0	1	0	0	0	0	0	0	0
AR-021	797840	280961	0	0	1	0	0	0	0	0	0	0
AR-022	797948	280929	0	0	1	0	0	0	0	0	0	0
AR-023	797975	280693	0	1	0	0	0	0	0	0	0	0
AR-024	797988	280682	0	0	1	0	0	0	0	0	0	0
AR-025	797620	280496	0	0	0	1	0	0	0	0	0	0
AR-026	801511	280349	0	0	1	0	0	0	0	0	0	0
AR-027	801934	280194	0	0	1	1	0	0	0	1	0	0
AR-028	801862	280152	0	0	0	1	0	0	0	0	0	0
AR-029	799798	279941	0	0	0	1	0	0	0	0	0	0
AR-030	799825	279924	0	0	0	1	1	0	1	1	0	0
AR-031	799636	279893	0	0	0	1	0	0	0	1	0	0
AR-032	799911	279854	0	0	0	1	0	0	1	1	0	0
AR-033	799693	279829	0	0	0	1	0	1	0	0	0	0
AR-034	799734	279822	0	0	0	1	0	0	0	1	0	0
AR-035	799996	279753	0	0	0	1	0	0	0	0	0	0
AR-036	799945	279723	0	0	1	1	1	0	0	0	0	0
AR-037	799819	279720	0	0	1	1	1	0	0	0	0	0
AR-038	799851	279718	0	0	0	1	1	1	0	0	0	0
AR-039	799889	279705	0	0	0	0	1	0	0	0	0	0
AR-040	799657	279624	0	0	0	1	0	0	0	0	0	0
AR-041	799594	279509	0	0	0	1	0	0	0	0	0	0
AR-042	800497	279289	0	0	0	1	0	0	0	0	0	0
AR-043	800491	279132	0	0	0	1	0	0	0	0	0	0
AR-044	798963	273347	0	0	0	0	0	1	0	0	0	0
AR-045	799434	273310	1	0	0	0	0	0	0	0	0	0
AR-046	799259	273276	0	0	1	0	0	0	0	0	0	0
AR-047	798494	273257	0	0	0	0	0	0	1	0	0	0
AR-048	798505	273205	0	0	0	0	1	0	0	1	0	0
AR-049	798524	273169	0	0	0	0	1	0	0	0	0	0
AR-050	798289	273152	0	0	0	0	0	0	1	1	0	0
AR-051	798326	273152	0	0	0	1	1	0	0	0	0	0
AR-052	798130	273099	0	0	0	1	0	0	0	0	0	0
AR-053	799480	273043	0	0	0	1	0	0	0	1	0	0
AR-054	799611	272435	1	0	1	0	0	0	0	0	0	0
AR-055	800536	272106	0	0	1	0	0	0	0	0	0	0
AR-056	800738	272000	0	0	1	0	0	0	0	0	0	0
AR-057	800738	271989	0	0	1	0	0	0	0	0	0	0
AR-058	800868	271796	0	0	1	0	0	0	0	0	0	0
AR-059	801000	271776	0	0	0	0	0	1	0	0	0	0
AR-060	800535	271587	0	0	0	0	0	0	0	1	0	0
AR-061	801501	271318	0	0	0	0	1	0	0	0	0	0
AR-062	801871	271163	0	0	1	0	0	0	0	0	0	0
AR-063	801862	271012	0	0	1	1	0	0	1	0	0	0
AR-064	801907	271005	0	0	0	0	0	1	0	0	0	0
AR-065	801686	270998	0	0	1	1	0	0	0	1	0	0
AR-066	801008	267361	0	0	1	0	0	0	0	0	0	0
AR-067	800512	267221	0	0	1	1	0	0	0	0	0	0
AR-068	803279	267135	0	0	1	0	0	0	0	0	0	0
AR-069	799872	266907	0	0	1	0	0	0	0	0	0	0
AR-070	799892	266832	1	0	1	0	0	0	0	0	0	0
AR-071	799969	266804	0	0	1	0	0	0	0	0	0	0
AR-072	799765	266766	0	1	1	0	0	0	0	0	0	0
AR-073	801983	266748	0	0	0	0	0	1	0	0	0	0
AR-074	799901	266745	0	0	1	0	0	0	0	0	0	0
AR-075	799898	266711	0	0	1	0	0	0	0	0	0	0
AR-076	799717	266689	0	0	1	0	0	0	0	0	0	0
AR-077	801438	266548	0	0	0	1	0	0	0	0	0	0
AR-078	801459	266393	0	0	0	1	1	1	0	0	0	0
AR-079	801458	266392	1	0	1	0	0	0	0	0	0	0
AR-080	803962	266377	0	0	1	0	0	0	0	0	0	0
AR-081	801396	266372	0	0	0	1	1	0	1	0	0	0
AR-082	801354	266346	0	0	0	1	1	0	1	0	0	0
AR-083	803505	266245	0	0	0	0	1	0	0	0	0	0
AR-084	801105	266212	0	0	0	1	0	0	0	0	0	0
AR-085	800894	266207	0	0	0	1	1	1	0	0	0	0

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded									
			Pottery - Rim/Neck	Pottery - Decorated	Pottery - Undecorated	Lithic - Quartz	Lithic - Chert	Lithic - Obsidian	Lithic - Rhyolite	Lithic - Other	Palaeontological	Jewellery
AR-086	800944	266138	0	0	1	0	0	0	0	0	0	0
AR-087	800941	266121	0	0	0	0	1	0	0	0	0	0
AR-088	800781	266075	0	0	0	0	0	1	0	0	0	0
AR-089	801130	266068	0	0	0	1	0	0	0	0	0	0
AR-090	801102	266052	0	0	0	1	0	0	0	0	0	0
AR-091	800751	265992	0	0	1	1	0	1	1	0	0	0
AR-092	800778	265976	0	0	0	1	1	1	0	0	0	0
AR-093	800773	265928	0	0	0	1	0	0	0	0	0	0
AR-094	799997	265865	0	0	0	1	0	0	0	0	0	0
AR-095	799551	265734	0	0	1	0	0	0	0	0	0	0
AR-096	799999	265632	0	0	0	1	0	0	0	0	0	0
AR-097	799848	265592	0	0	0	1	1	0	1	0	0	0
AR-098	799813	265555	0	0	0	0	0	1	1	0	0	0
AR-099	799792	265540	0	0	0	0	0	1	0	0	0	0
AR-100	799779	265514	0	0	1	0	1	1	1	1	0	0
AR-101	800902	265496	0	0	1	0	0	0	0	0	0	0
AR-102	799504	265495	0	0	0	0	0	1	0	0	0	0
AR-103	800845	265279	0	0	1	0	0	0	0	0	0	0
AR-104	796707	260877	0	0	0	1	0	1	0	0	0	0
AR-105	796570	260876	0	0	1	0	1	0	0	0	0	0
AR-106	796676	260874	0	0	0	0	1	0	1	0	0	0
AR-107	796651	260868	0	0	0	1	0	0	0	0	0	0
AR-108	796224	260820	0	0	0	1	0	0	1	0	0	0
AR-109	796130	260811	0	0	0	1	0	0	1	0	0	0
AR-110	795853	260764	0	0	0	0	0	0	1	0	0	0
AR-111	801898	257875	0	0	0	0	0	1	0	0	0	0
AR-112	801966	257643	0	0	1	0	1	1	1	0	0	0
AR-113	801699	257628	0	0	0	0	0	0	0	1	0	0
AR-114	801498	257606	0	0	0	0	1	0	0	0	0	0
AR-115	801870	257501	0	0	0	0	0	0	1	1	0	0
AR-116	801483	257495	0	0	0	1	0	0	0	0	0	0
AR-117	801969	257486	0	0	0	1	1	1	0	1	0	0
AR-118	799080	256999	0	0	0	0	0	1	0	0	0	0
AR-119	799001	256995	0	0	0	1	0	0	0	0	0	0
AR-120	799164	256968	0	0	1	0	0	0	0	0	0	0
AR-121	799201	256892	0	0	0	0	1	0	0	0	0	0
AR-122	801074	256873	0	0	1	0	0	0	0	0	0	0
AR-123	801351	256848	0	0	1	0	0	0	0	0	0	0
AR-124	799086	256712	0	0	0	0	0	0	0	1	0	0
AR-125	799163	256585	0	0	0	1	0	1	0	0	0	0
AR-126	799136	256545	0	0	1	0	0	0	0	0	0	0
AR-127	802444	255998	0	0	0	0	0	1	0	0	0	0
AR-128	803423	255998	0	0	0	1	0	0	0	0	0	0
AR-129	802442	255986	0	0	0	0	0	1	0	0	0	0
AR-130	803444	255861	0	0	1	0	0	0	0	0	0	0
AR-131	803020	255850	0	0	1	0	0	0	0	0	0	0
AR-132	803145	255824	0	0	1	0	0	0	0	0	0	0
AR-133	803056	255760	1	1	1	0	0	0	0	0	0	0
AR-134	803429	255734	1	0	1	0	0	0	0	0	0	0
AR-135	802054	255720	0	0	1	0	0	0	0	0	0	0
AR-136	802302	255687	0	0	1	0	0	0	0	0	0	0
AR-137	803065	255638	0	0	1	0	0	0	0	0	0	0
AR-138	802192	255499	0	0	1	0	0	0	0	0	0	0
AR-139	799835	254425	1	0	1	0	0	0	0	0	0	0
AR-140	799958	254376	0	0	1	0	0	0	0	0	0	0
AR-141	799929	254364	1	0	1	0	0	0	0	0	0	0
AR-142	799930	254362	0	0	0	0	0	0	0	0	0	1
AR-143	799641	254351	0	0	0	0	0	1	0	0	0	0
AR-144	799913	254350	0	0	1	0	0	0	0	0	0	0
AR-145	799211	254286	0	0	1	0	0	0	0	0	0	0
AR-146	800418	254263	0	0	0	1	0	0	0	0	0	0
AR-147	800561	254194	0	0	1	1	0	0	1	1	0	0
AR-148	799892	254091	0	0	0	1	0	0	0	0	0	0
AR-149	800037	254072	0	0	1	0	0	0	0	0	0	0
AR-150	800414	253831	0	0	1	0	0	0	0	0	0	0
AR-151	803694	250411	0	0	0	0	0	0	1	0	0	0
AR-152	803913	250085	0	0	0	0	0	0	1	0	0	0
AR-153	808773	248351	0	0	0	0	1	0	0	0	0	0
AR-154	808522	248094	0	0	0	0	0	0	0	1	0	0
AR-155	808507	247991	0	0	0	0	0	0	0	1	0	0
AR-156	808480	247986	0	0	0	0	0	0	0	1	0	0
AR-157	808921	247965	0	0	1	1	1	1	0	1	0	0
AR-158	808845	247931	0	0	0	1	0	0	0	1	0	0
AR-159	808919	247880	0	0	0	0	1	0	1	0	0	0
AR-160	808931	247856	0	0	0	0	0	0	0	1	0	0
AR-161	809222	247830	0	0	0	1	1	0	0	1	0	0
AR-162	809131	247821	0	0	1	0	0	0	0	0	0	0
AR-163	809091	247770	0	0	0	1	1	0	0	1	0	0
AR-164	809270	247764	0	0	0	1	1	0	1	0	0	0
AR-165	808851	247760	1	0	0	0	0	0	0	1	0	0
AR-166	806661	247759	0	0	0	1	0	0	0	0	0	0
AR-167	809197	247755	0	0	0	1	0	0	0	1	0	0
AR-168	808717	247751	0	0	1	0	0	0	1	1	0	0
AR-169	809111	247747	0	0	0	0	0	0	0	1	0	0
AR-170	809155	247739	0	0	1	1	1	0	0	1	0	0
AR-171	806738	247729	0	0	0	0	0	0	1	0	0	0
AR-172	806894	247717	0	0	0	0	0	0	1	0	0	0
AR-173	806784	247716	0	0	0	0	0	0	1	0	0	0
AR-174	806831	247711	0	0	0	0	0	0	1	0	0	0
AR-175	806854	247709	0	0	0	0	0	0	1	0	0	0
AR-176	806843	247709	0	0	0	0	0	0	1	0	0	0
AR-177	808826	247692	0	0	0	0	0	1	0	0	0	0
AR-178	807156	247661	0	0	0	0	0	0	1	0	0	0
AR-179	807149	247657	0	0	1	0	0	0	1	1	0	0
AR-180	807189	247656	0	0	0	0	1	0	1	0	0	0
AR-181	809034	247638	0	0	0	1	1	0	1	1	0	0
AR-182	808672	247625	0	0	0	1	1	0	0	0	0	0
AR-183	807292	247620	0	0	0	0	0	0	1	0	0	0
AR-184	808945	247613	0	0	0	1	1	0	1	1	0	0
AR-185	808263	247613	0	0	0	0	0	0	0	1	0	0

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded									
			Pottery - Rim/Neck	Pottery - Decorated	Pottery - Undecorated	Lithic - Quartz	Lithic - Chert	Lithic - Obsidian	Lithic - Rhyolite	Lithic - Other	Palaeontological	Jewellery
AR-186	808639	247596	0	0	0	0	0	0	0	1	0	0
AR-187	808293	247591	0	0	0	0	0	0	0	1	0	0
AR-188	807521	247584	0	0	1	1	1	0	0	0	0	0
AR-189	808737	247583	0	0	0	1	1	1	1	1	0	0
AR-190	808778	247527	0	0	0	0	0	0	1	0	0	0
AR-191	803582	247511	0	0	0	1	0	0	0	0	0	0
AR-192	808868	247506	0	0	1	0	0	0	0	0	0	0
AR-193	808848	247468	0	0	0	0	0	0	1	0	0	0
AR-194	808129	247462	0	0	0	0	0	0	0	1	0	0
AR-195	808351	247446	0	0	0	0	1	0	0	0	0	0
AR-196	807983	247444	0	0	1	1	1	1	0	1	0	0
AR-197	808453	247430	0	0	0	0	1	1	0	0	0	0
AR-198	808490	247378	0	0	0	0	0	0	0	1	0	0
AR-199	808546	247376	0	0	1	1	1	1	1	0	0	0
AR-200	808658	247371	0	0	1	0	0	0	0	0	0	0
AR-201	803015	247369	0	0	0	1	0	0	0	0	0	0
AR-202	808373	247314	0	0	0	1	0	0	0	1	0	0
AR-203	807881	247292	0	0	0	1	1	1	0	0	0	0
AR-204	808685	247288	0	0	1	0	0	0	0	0	0	0
AR-205	808515	247237	0	0	1	0	0	0	0	0	0	0
AR-206	807748	247207	0	0	1	0	0	0	0	0	0	0
AR-207	808546	247202	0	0	0	0	0	0	1	0	0	0
AR-208	808529	246965	0	0	1	0	0	0	0	0	0	0
AR-209	807285	246844	0	0	0	1	0	1	1	0	0	0
AR-210	807466	246816	0	0	0	1	0	0	0	0	0	0
AR-211	805542	246752	0	0	1	0	0	1	0	0	0	0
AR-212	805137	246625	0	0	0	0	1	0	1	1	0	0
AR-213	805109	246552	0	0	0	0	0	0	1	0	0	0
AR-214	808646	246276	0	0	1	0	0	0	0	0	0	0
AR-215	804272	246212	0	0	0	1	0	0	0	0	0	0
AR-216	804315	246194	0	0	0	0	0	0	1	0	0	0
AR-217	807493	246192	1	0	1	0	0	0	0	0	0	0
AR-218	804387	246189	0	0	0	1	0	0	0	0	0	0
AR-219	804341	246139	0	0	0	1	1	0	1	1	0	0
AR-220	804251	246094	0	0	0	1	1	1	1	0	0	0
AR-221	804247	246072	0	0	0	1	0	0	1	0	0	0
AR-222	804308	246066	0	0	0	1	0	0	1	0	0	0
AR-223	808996	246048	0	0	1	0	0	0	0	0	0	0
AR-224	805383	246045	0	0	1	0	0	0	0	0	0	0
AR-225	805229	246001	0	0	0	0	0	1	0	0	0	0
AR-226	807527	245982	0	0	1	1	0	0	0	0	0	0
AR-227	805111	245897	0	0	0	1	1	0	1	0	0	0
AR-228	805233	245892	0	1	1	0	0	0	0	0	0	0
AR-229	805114	245836	0	0	0	0	0	0	1	0	0	0
AR-230	805066	245822	0	0	0	1	0	0	1	0	0	0
AR-231	805049	245776	0	0	0	0	1	0	1	0	0	0
AR-232	805072	245764	0	0	0	1	0	1	0	0	0	0
AR-233	808501	245600	0	0	0	0	1	0	0	0	0	0
AR-234	807331	245526	0	0	1	0	0	0	0	0	0	0
AR-235	809546	245484	0	0	1	0	0	0	0	0	0	0
AR-236	804541	245421	0	0	0	0	1	0	1	0	0	0
AR-237	804536	245385	0	0	0	0	1	1	0	0	0	0
AR-238	810518	245374	0	0	1	0	0	0	0	0	0	0
AR-239	804584	245367	0	0	0	1	1	0	1	0	0	0
AR-240	804495	245355	0	0	0	0	10	0	1	0	0	0
AR-241	804552	245349	0	0	0	1	0	0	0	0	0	0
AR-242	810642	245202	0	0	0	0	0	0	1	0	0	0
AR-243	807916	245165	1	0	1	0	0	0	0	0	0	0
AR-244	807945	245032	0	0	0	0	1	0	0	0	0	0
AR-245	806005	244958	0	0	0	0	1	0	0	0	0	0
AR-246	807893	244785	0	0	0	1	0	1	1	0	0	0
AR-247	805537	244770	0	0	0	1	0	0	1	0	0	0
AR-248	807872	244755	0	0	0	1	0	1	0	0	0	0
AR-249	808037	244753	0	0	0	1	1	0	1	1	0	0
AR-250	807978	244718	0	0	0	1	1	1	1	1	0	0
AR-251	807964	244698	0	0	0	1	1	1	1	0	0	0
AR-252	807933	244683	0	0	0	1	1	1	1	1	0	0
AR-253	807877	244667	0	0	0	1	0	0	1	1	0	0
AR-254	807895	244657	0	0	0	1	0	1	1	0	0	0
AR-255	810222	244618	0	0	0	0	1	0	1	0	0	0
AR-256	810407	244615	0	0	0	0	0	0	1	0	0	0
AR-257	810323	244614	0	0	0	0	0	0	1	0	0	0
AR-258	806732	244611	0	0	0	1	0	0	0	0	0	0
AR-259	810251	244609	0	0	0	0	0	0	0	1	0	0
AR-260	810208	244605	0	0	0	0	0	0	1	0	0	0
AR-261	806797	244600	0	0	1	0	0	0	0	0	0	0
AR-262	810308	244594	0	0	0	1	0	0	0	0	0	0
AR-263	807738	244590	0	0	0	0	0	0	1	1	0	0
AR-264	810313	244574	0	0	0	0	0	0	1	0	0	0
AR-265	807806	244570	0	0	0	1	0	0	1	1	0	0
AR-266	810379	244565	0	0	0	0	1	1	0	0	0	0
AR-267	807765	244555	0	0	0	1	0	0	0	0	0	0
AR-268	810291	244555	0	0	0	0	0	0	1	0	0	0
AR-269	805508	244550	0	0	0	0	0	0	1	0	0	0
AR-270	810303	244543	0	0	0	1	0	0	0	0	0	0
AR-271	805661	244533	0	0	0	1	0	0	0	0	0	0
AR-272	810277	244517	0	0	0	0	1	0	0	0	0	0
AR-273	810368	244512	0	0	1	0	1	0	0	0	0	0
AR-274	805657	244499	0	0	0	1	0	0	0	0	0	0
AR-275	810295	244494	0	0	0	0	0	0	1	0	0	0
AR-276	808559	244492	1	0	1	0	0	0	0	0	0	0
AR-277	810203	244488	0	0	0	0	0	0	1	0	0	0
AR-278	810206	244462	0	0	0	0	0	0	1	0	0	0
AR-279	805561	244454	0	0	0	1	1	0	1	1	0	0
AR-280	807661	244448	0	0	0	0	0	1	0	0	0	0
AR-281	810208	244432	0	0	0	1	0	0	1	0	0	0
AR-282	810360	244416	0	0	1	0	0	0	0	0	0	0
AR-283	810178	244404	0	0	0	0	1	0	1	0	0	0
AR-284	807486	244384	0	0	0	0	1	0	0	0	0	0
AR-285	807673	244370	0	0	1	0	0	0	0	0	0	0

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded									
			Pottery - Rim/Neck	Pottery - Decorated	Pottery - Undecorated	Lithic - Quartz	Lithic - Chert	Lithic - Obsidian	Lithic - Rhyolite	Lithic - Other	Palaeontological	Jewellery
AR-286	807489	244349	0	0	0	0	0	0	0	1	0	0
AR-287	807519	244314	0	0	0	1	1	1	1	0	0	0
AR-288	807448	244229	0	0	0	0	1	0	1	0	0	0
AR-289	806353	244212	0	0	0	0	0	0	1	0	0	0
AR-290	806383	244190	0	0	0	1	0	1	0	0	0	0
AR-291	808977	244148	0	0	1	0	0	0	0	0	0	0
AR-292	807581	244120	0	0	0	0	1	0	0	0	0	0
AR-293	808848	244059	1	1	0	0	0	0	0	0	0	0
AR-294	807172	244001	0	0	1	0	0	0	0	0	0	0
AR-295	807055	243998	0	0	1	0	0	0	0	0	0	0
AR-296	805986	243962	0	0	0	0	0	0	1	0	0	0
AR-297	805987	243959	0	0	0	1	0	0	1	0	0	0
AR-298	805986	243946	0	0	0	0	0	1	0	0	0	0
AR-299	805984	243944	0	0	0	0	0	0	1	0	0	0
AR-300	805992	243944	0	0	0	1	0	0	0	0	0	0
AR-301	806080	243926	0	0	0	1	0	0	0	0	0	0
AR-302	808708	243885	0	0	0	0	0	0	1	0	0	0
AR-303	806107	243881	0	0	0	1	0	0	0	0	0	0
AR-304	808669	243874	0	0	0	0	0	0	1	0	0	0
AR-305	808866	243869	0	0	0	1	0	0	1	0	0	0
AR-306	808722	243843	0	0	1	0	0	0	0	0	0	0
AR-307	808725	243826	0	0	0	1	1	0	1	0	0	0
AR-308	808757	243813	0	0	0	1	0	0	1	0	0	0
AR-309	808738	243811	0	0	1	0	1	0	0	0	0	0
AR-310	808678	243805	0	0	0	1	1	0	0	0	0	0
AR-311	806033	243802	0	0	0	1	1	0	1	0	0	0
AR-312	805963	243756	0	0	0	1	0	0	0	0	0	0
AR-313	806029	243755	0	0	0	0	1	0	0	0	0	0
AR-314	808760	243753	0	0	0	0	1	0	0	0	0	0
AR-315	807892	243381	0	0	0	1	0	0	0	0	0	0
AR-316	807893	243376	0	0	0	1	0	1	1	0	0	0
AR-317	807634	243242	0	1	0	1	1	1	1	0	0	0
AR-318	805000	242244	0	0	0	0	0	0	1	0	0	0
AR-319	804981	242240	0	0	0	1	0	0	1	0	0	0
AR-320	804931	242199	0	0	0	1	0	0	0	0	0	0
AR-321	804887	242186	0	0	0	1	0	0	0	0	0	0
AR-322	804990	242179	0	0	0	1	0	0	1	0	0	0
AR-323	804904	242161	0	0	0	0	1	1	0	0	0	0
AR-324	805009	242090	0	0	0	1	0	0	0	0	0	0
AR-325	804887	242080	0	0	0	0	0	0	1	0	0	0
AR-326	804968	242052	0	0	1	1	0	0	0	0	0	0
AR-327	804920	242040	0	0	0	0	1	0	0	0	0	0
AR-328	804899	242026	0	0	0	1	0	0	0	0	0	0
AR-329	805005	242011	0	0	0	1	0	0	1	0	0	0
AR-330	804898	242002	0	0	0	1	0	0	0	0	0	0
AR-331	805062	241996	0	0	0	1	0	0	1	0	0	0
AR-332	806058	241558	0	0	0	1	0	0	0	0	0	0
AR-333	810703	241332	0	0	0	1	0	0	1	0	0	0
AR-334	810306	241324	1	1	1	0	1	0	0	0	0	0
AR-335	810708	241288	0	0	0	1	0	0	1	0	0	0
AR-336	809972	241260	0	0	0	0	0	0	1	0	0	0
AR-337	809971	241254	0	0	0	0	0	1	0	0	0	0
AR-338	809968	241210	0	0	0	0	0	0	1	0	0	0
AR-339	810663	241183	0	0	0	0	0	0	1	1	0	0
AR-340	810702	241159	0	0	0	0	0	0	1	0	0	0
AR-341	810508	241157	0	0	0	1	1	0	1	1	0	0
AR-342	810753	241060	0	0	0	0	0	0	1	0	0	0
AR-343	810756	241031	0	0	0	1	0	1	1	0	0	0
AR-344	810648	240998	0	0	0	1	0	0	1	0	0	0
AR-345	810765	240985	0	0	0	0	0	0	1	0	0	0
AR-346	810620	240981	0	0	0	1	0	0	1	0	0	0
AR-347	810871	240980	0	0	1	0	0	0	0	0	0	0
AR-348	810698	240898	0	0	0	0	0	0	1	0	0	0
AR-349	810524	240871	0	0	0	1	0	0	1	0	0	0
AR-350	810735	240853	0	0	1	0	0	0	1	0	0	0
AR-351	810721	240807	0	0	0	0	0	0	1	1	0	0
AR-352	810536	240771	0	0	0	1	0	0	0	0	0	0
AR-353	811703	240748	0	0	0	0	1	0	0	0	0	0
AR-354	810735	240671	0	0	0	0	0	0	1	0	0	0
AR-355	810457	240564	0	0	0	0	0	0	0	1	0	0
AR-356	811447	240390	0	0	0	1	0	1	1	0	0	0
AR-357	811536	240368	0	0	0	1	0	0	1	0	0	0
AR-358	811540	240352	0	0	0	0	1	1	0	0	0	0
AR-359	811424	240280	0	0	0	0	0	0	1	0	0	0
AR-360	811636	240205	0	0	1	0	0	0	0	0	0	0
AR-361	810655	239989	0	0	0	1	0	0	0	0	0	0
AR-362	809756	239988	0	0	0	1	0	0	0	0	0	0
AR-363	810575	239983	0	0	0	1	0	0	0	0	0	0
AR-364	809656	239952	0	0	0	0	0	0	1	0	0	0
AR-365	809747	239944	0	0	0	1	0	0	1	0	0	0
AR-366	811842	239928	0	0	0	1	0	1	1	1	0	0
AR-367	810051	239923	0	0	0	1	0	0	0	0	0	0
AR-368	809514	239922	0	0	1	1	0	1	1	0	0	0
AR-369	811752	239872	0	0	0	1	1	1	1	0	0	0
AR-370	811701	239868	0	0	0	0	0	0	0	1	0	0
AR-371	809521	239850	0	0	0	0	0	0	1	0	0	0
AR-372	809565	239845	0	0	0	1	0	0	0	0	0	0
AR-373	809530	239825	0	0	0	1	0	0	0	0	0	0
AR-374	809504	239802	0	0	0	1	1	1	1	0	0	0
AR-375	811222	239802	0	0	1	0	0	0	1	1	0	0
AR-376	810754	239707	0	0	1	0	0	0	0	1	0	0
AR-377	811403	239682	0	0	0	1	0	0	1	0	0	0
AR-378	811304	239676	0	0	1	0	0	0	1	0	0	0
AR-379	811234	239668	0	1	0	1	1	1	1	0	0	0
AR-380	811244	239643	0	0	0	1	0	1	0	0	0	0
AR-381	810872	239643	0	0	0	0	0	0	1	0	0	0
AR-382	810861	239618	0	0	0	1	0	0	1	0	0	0
AR-383	810702	239591	0	0	0	0	0	1	1	0	0	0
AR-384	811348	239591	0	0	0	1	0	1	1	1	0	0
AR-385	811237	239591	0	0	0	1	0	0	0	0	0	0

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded									
			Pottery - Rim/Neck	Pottery - Decorated	Pottery - Undecorated	Lithic - Quartz	Lithic - Chert	Lithic - Obsidian	Lithic - Rhyolite	Lithic - Other	Palaeontological	Jewellery
AR-386	810737	239590	0	0	0	1	0	0	0	0	0	0
AR-387	810885	239589	0	0	0	0	1	0	1	0	0	0
AR-388	810857	239543	0	0	0	0	0	0	1	0	0	0
AR-389	810978	239541	0	0	0	1	0	0	1	0	0	0
AR-390	811961	239538	0	0	0	1	0	0	0	0	0	0
AR-391	812256	239535	0	0	0	1	1	1	1	0	0	0
AR-392	812228	239534	0	0	0	0	1	0	1	0	0	0
AR-393	812160	239532	0	0	0	0	0	0	1	0	0	0
AR-394	812222	239531	0	0	0	1	1	1	0	0	0	0
AR-395	812089	239522	0	0	0	1	0	0	1	0	0	0
AR-396	809682	239511	0	0	0	1	0	0	0	0	0	0
AR-397	811885	239510	0	0	0	1	0	0	0	0	0	0
AR-398	811774	239496	0	0	1	0	0	0	0	0	0	0
AR-399	811890	239493	0	0	0	1	0	0	1	0	0	0
AR-400	811804	239483	0	0	1	0	0	0	0	1	0	0
AR-401	811998	239430	0	0	0	0	1	0	0	0	0	0
AR-402	811985	239413	0	0	0	0	0	0	1	0	0	0
AR-403	811742	239169	0	0	0	0	0	0	1	0	0	0
AR-404	811678	239130	0	0	0	0	0	0	1	0	0	0
AR-405	811668	239110	0	0	0	0	0	0	1	1	0	0
AR-406	811656	239101	0	0	0	1	0	0	1	0	0	0
AR-407	811658	239076	0	0	0	0	0	0	1	1	0	0
AR-408	811727	239066	0	0	0	0	0	0	1	1	0	0
AR-409	811631	239011	0	0	0	0	0	0	1	0	0	0
AR-410	811529	238998	0	0	0	1	0	0	0	0	0	0
AR-411	809428	238958	0	0	1	0	0	0	0	0	0	0
AR-412	811540	238958	0	0	0	1	1	0	0	0	0	0
AR-413	811591	238944	0	0	0	1	0	1	1	0	0	0
AR-414	811098	238939	0	0	0	0	0	0	1	0	0	0
AR-415	811615	238935	0	0	0	0	0	0	1	0	0	0
AR-416	811579	238921	0	0	0	0	1	0	1	0	0	0
AR-417	811788	238865	0	0	0	1	1	0	0	0	0	0
AR-418	811731	238832	0	0	0	1	0	0	0	0	0	0
AR-419	809433	238800	0	0	0	1	0	0	0	1	0	0
AR-420	809452	238794	0	0	0	0	0	0	1	0	0	0
AR-421	809449	238767	0	0	0	0	0	0	1	0	0	0
AR-422	809436	238745	0	0	0	1	0	0	1	1	0	0
AR-423	809078	238593	0	0	0	0	0	0	1	0	0	0
AR-424	808945	238533	0	0	0	1	1	1	1	1	0	0
AR-425	810064	238480	0	0	0	0	0	0	0	0	1	0
AR-426	809976	238243	0	0	0	0	0	0	1	0	0	0
AR-427	810499	238130	0	0	1	0	0	0	0	0	0	0
AR-428	812324	237424	0	0	0	0	0	1	0	0	0	0
AR-429	812284	237388	0	0	0	1	1	0	0	0	0	0
AR-430	811350	237372	0	0	0	1	0	0	1	0	0	0
AR-431	812346	237293	1	0	1	0	0	0	0	0	0	0
AR-432	812399	237267	0	0	0	1	0	0	1	0	0	0
AR-433	811212	237257	0	0	0	1	0	0	0	0	0	0
AR-451	799544	282653	0	0	1	1	0	0	0	1	0	0
AR-452	800709	280770	0	0	1	0	0	0	0	0	0	0
AR-453	799962	280452	0	0	1	1	0	0	0	0	0	0
AR-454	799919	280436	0	0	0	1	0	0	0	0	0	0
AR-455	801243	280432	0	0	0	1	0	0	0	0	0	0
AR-456	799918	280352	0	0	1	0	0	0	0	0	0	0
AR-457	799125	280334	0	0	0	0	1	0	0	0	0	0
AR-458	799198	279529	0	0	0	1	0	0	0	0	0	0
AR-459	799437	278890	0	0	0	1	0	0	0	0	0	0
AR-460	799498	278880	0	0	0	1	0	0	0	0	0	0
AR-461	800736	278793	0	0	1	1	1	1	0	0	0	1
AR-462	800817	278756	0	0	0	1	0	0	0	0	0	0
AR-463	800851	278725	0	0	0	1	0	0	0	0	0	0
AR-464	799525	278424	0	0	1	1	0	0	0	0	0	0
AR-465	800735	277574	0	0	0	1	0	0	0	0	0	0
AR-466	800694	277517	0	0	0	1	0	0	0	0	0	0
AR-467	800662	277421	0	0	0	1	0	0	0	0	0	0
AR-468	793341	262175	0	0	0	1	0	0	0	0	0	0
AR-469	801496	256083	0	0	0	1	0	0	1	0	0	0

**AR-468 – coordinates captured by GPS are erroneous. Asset is located in Etom.*

Table 2: Gazetteer - Living Cultural Heritage Assets

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded				
			Grave/Burial	Religious Building	Protected Tree	Fire Pit	Living CH - Other
CH-001	801022	283306	0	0	1	0	0
CH-002	800711	283156	0	0	1	0	0
CH-003	801217	283052	0	0	1	0	0
CH-004	800634	282848	1	0	0	0	0
CH-005	796068	282615	1	0	0	0	0
CH-006	795947	282517	1	0	0	0	0
CH-007	796247	282476	0	0	1	0	0
CH-008	795711	282063	0	0	1	0	0
CH-009	798615	281878	0	0	1	0	0
CH-010	800877	281637	0	0	0	0	1
CH-011	797835	281503	1	0	0	0	0
CH-012	797936	280928	1	0	0	0	0
CH-013	801612	280546	0	0	0	0	1
CH-014	800333	275775	0	0	0	1	0
CH-015	800335	275774	0	0	0	1	0
CH-016	800335	275773	0	0	0	1	0
CH-017	800323	275772	1	0	0	0	0
CH-018	800105	275548	0	0	1	0	0
CH-019	800118	275546	0	0	1	0	0
CH-020	800114	275543	0	0	1	0	0
CH-021	800105	275538	0	0	1	0	0
CH-022	800102	275532	0	0	1	0	0
CH-023	795841	274890	0	0	1	0	0
CH-024	796170	273945	0	0	1	0	0
CH-025	795893	273925	0	0	1	0	0
CH-026	798539	273285	1	0	0	0	0
CH-027	798313	273202	1	0	0	0	0
CH-028	799088	273186	1	0	0	0	0
CH-029	797497	272223	0	0	1	0	0
CH-030	796604	271831	1	0	0	0	0
CH-031	800381	269353	0	0	1	0	0
CH-032	800098	269245	0	0	1	0	0
CH-033	802391	268001	0	0	1	0	0
CH-034	802388	267991	0	0	1	0	0
CH-035	802366	267975	0	0	1	0	0
CH-036	802363	267973	0	0	1	0	0
CH-037	802369	267969	0	0	1	0	0
CH-038	802357	267966	0	0	1	0	0
CH-039	800863	267334	0	0	0	1	0
CH-040	800871	267320	0	0	1	0	0
CH-041	800866	267319	0	0	0	0	1
CH-042	800866	267317	0	0	1	0	0
CH-043	800744	267087	0	0	1	0	0
CH-044	801424	267021	1	0	0	0	0
CH-045	801419	267018	1	0	0	0	0
CH-046	801227	266888	0	0	1	0	0
CH-047	795968	264069	1	0	0	0	0
CH-048	795139	263996	0	0	1	0	0
CH-049	795278	263506	0	1	0	0	0
CH-050	795404	263312	0	1	0	0	0
CH-051	794916	263256	0	1	0	0	0
CH-052	797884	263232	1	0	0	0	0
CH-053	796134	262743	1	0	0	0	0
CH-054	803067	262540	0	0	0	0	1
CH-055	803056	262518	0	0	0	0	1
CH-056	803044	262517	0	0	0	0	1
CH-057	796272	262460	1	0	0	0	0
CH-058	796243	262455	1	0	0	0	0
CH-059	796827	262228	1	0	0	0	0
CH-060	799338	261684	1	0	0	0	0
CH-061	805747	259701	1	0	0	0	0
CH-062	806541	259029	0	0	0	1	0
CH-063	806529	259023	0	0	0	0	1
CH-064	806523	259019	0	0	1	0	0
CH-065	806526	259019	0	0	0	0	1

Golder ID	Easting (UTM)	Northing (UTM)	Materials Recorded				
			Grave/Burial	Religious Building	Protected Tree	Fire Pit	Living CH - Other
CH-066	806088	258976	1	0	0	0	0
CH-067	805831	258783	1	0	0	0	0
CH-068	798943	258412	1	0	0	0	0
CH-069	797001	256433	0	0	0	1	0
CH-070	796997	256423	0	0	0	0	1
CH-071	796995	256422	0	0	1	0	0
CH-072	796812	256365	1	0	0	0	0
CH-073	796821	256364	0	0	0	1	0
CH-074	797684	256071	1	0	0	0	0
CH-075	798969	256067	0	0	0	1	0
CH-076	798961	256062	1	0	0	0	0
CH-077	804709	251236	1	0	0	0	0
CH-078	804878	251215	0	0	1	0	0
CH-079	804874	251208	0	0	1	0	0
CH-080	804870	251194	0	0	1	0	0
CH-081	804876	251191	0	0	1	0	0
CH-082	804872	251189	0	0	1	0	0
CH-083	813686	246117	0	0	0	0	1
CH-084	813224	246018	0	0	1	0	0
CH-085	813389	245779	1	0	0	0	0
CH-086	813391	245773	0	0	0	1	0
CH-087	813384	245727	1	0	0	0	0
CH-088	813362	245712	1	0	0	0	0
CH-089	804520	245394	1	0	0	0	0
CH-090	808495	245382	1	0	0	0	0
CH-091	813290	243866	0	0	1	0	0
CH-092	813290	243795	0	0	1	0	0
CH-093	813294	243790	0	0	0	0	1
CH-094	813376	243334	0	0	0	0	1
CH-095	813377	243332	0	0	0	1	0
CH-096	813372	243315	0	0	1	0	0
CH-097	811009	239468	1	0	0	0	0
CH-098	810212	238527	1	0	0	0	0
CH-099	809269	238468	1	0	0	0	0
CH-100	809275	238452	1	0	0	0	0
CH-101	809269	238430	1	0	0	0	0
CH-102	811254	238187	1	0	0	0	0
CH-105	807920	245636	1	0	0	0	0
CH-106	807605	244917	1	0	0	0	0
CH-108	798338	273661	0	0	0	0	1

2.0 CATALOGUE OF KEY INFORMANT INTERVIEWS

Details of the KIIs completed in 2016, which focused solely on cultural heritage, are presented in Table 3. Details of KIIs completed in 2019, which had a broader focus but included questions on cultural heritage, are provided in Section 12.0; these included a series of KIIs undertaken between 21 January and 5 February 2019 and between 11 and 15 June 2019, including one meeting a Pokot cultural specialist (William Lepotokou) on 15 June 2019.

Table 3: Catalogue of Key Informant Interviews

Audio Recording ID	Date	Settlement	Participants	Position of Participants
R1	07 Apr 2016	Lochwaa	[redacted] [redacted] (+1 Elder in attendance)	Chief Chief Elder
R2	07 Apr 2016	Karoge	[redacted] (+30 Elders & 16 women in attendance)	Seer
R3	08 Apr 2016	Kapese	[redacted] [redacted]	Elder Elder
R4	09 Apr 2016	Kapese	[redacted] [redacted] [redacted]	VSO Elder Elder
R5	09 Apr 2016	Lokook	[redacted] (+ 18 Elders in attendance)	Elder
R6	11 Apr 2016	Nakukulas	Not applicable – witness to ceremony only	
R7	12 Apr 2016	Lotimaan	[redacted] [redacted] [redacted]	Legio Maria follower Legio Maria follower Elder
R8	12 Apr 2016	Nakukulas	[redacted] (+24 Elders in attendance)	Seer
R9	13 Apr 2016	Lokicheda	[redacted] [redacted] (+12 Elders in attendance)	Elder Elder
R10	13 Apr 2016	Lotimaan	[redacted] (2 women who were at the watering point) (+4 other women in attendance)	Women from village
R11	14 Apr 2016	Lotimaan	[redacted] (2 women who were at the watering point) (+3 other women in attendance)	Women from village

Audio Recording ID	Date	Settlement	Participants	Position of Participants
R12	14 Apr 2016	Lotimaan	[redacted] [redacted] (+4 other men, +4 other women)	Elder Elder
R13	15 Apr 2016	Asikiim (part of Kapese)	[redacted] [redacted] (+2 others – 1 Elder and 1 elderly woman)	Elder Elder
R14	16 Apr 2016	Nakukulas	[redacted]	Seer
R15	18 Apr 2016	Kapese	[redacted]	Seer
R16	19 Apr 2016	Kapese	[redacted] [redacted] [redacted]	Elder Elder VSO
R17	19 Apr 2016	Kapese	[redacted]	Elder (of Asikiim)
R18	21 Jul 2016	Kasuroi	[redacted].	Elders, women and youths from village
R19	22 Jul 2016	Karoge	[redacted] [introduction]	Seer
R20	22 Jul 2016	Nawoyalim	[redacted] [redacted]	Women from village
R21	22 Jul 2016	Akibuket	[redacted] [redacted] [redacted] [redacted] [redacted]	Seer Women from village

Audio Recording ID	Date	Settlement	Participants	Position of Participants
			[redacted]	
R22	23 Jul 2016	Tirikol	[elder absent, so villagers did not wish to talk]	
R23	23 Jul 2016	Kaikol	[redacted]	Elders, women and youths from village
R24	25 Jul 2016	Amoruakwan	[redacted]; and [redacted]	VSO Chief Elder Elder Youth Representative Women and youths from village
R25	25 Jul 2016	Nayanae-engol	[redacted]	VSO VSO VSO Elders, women and youths from village
R26	26 Jul 2016	Kapetatuk	[redacted]	Elders, women and youths from village

Audio Recording ID	Date	Settlement	Participants	Position of Participants
			[redacted]	
R27	26 Jul 2016	Lomokamar	[redacted]	Elders, women and youths from village
R28	27 Jul 2016	Dapar	[names not recorded as SP assistant was absent]	Elders, women and youths from village
R29	27 Jul 2016	Lowoidapal	[redacted]	Elders, women and youths from village
R30	28 Jul 2016	Kaloucholem	[redacted];	VSO Elders, women and youths from village

Audio Recording ID	Date	Settlement	Participants	Position of Participants
			[redacted]	
R31	01 Aug 2016	Karoge	[redacted]	Seer

3.0 PHOTOGRAPHS

Figure 1: Undecorated pottery (AR-217)

Figure 2: Decorated pottery (AR-317)

Figure 3: Undecorated pottery with hole (AR-080)

Figure 4: Undecorated pottery (AR-079)

Figure 5: Cowrie shell (AR-142)

Figure 6: Cowrie shell (AR-142)

Figure 7: Rhyolite flakes (AR-213)

Figure 8: Rhyolite flakes (AR-213)

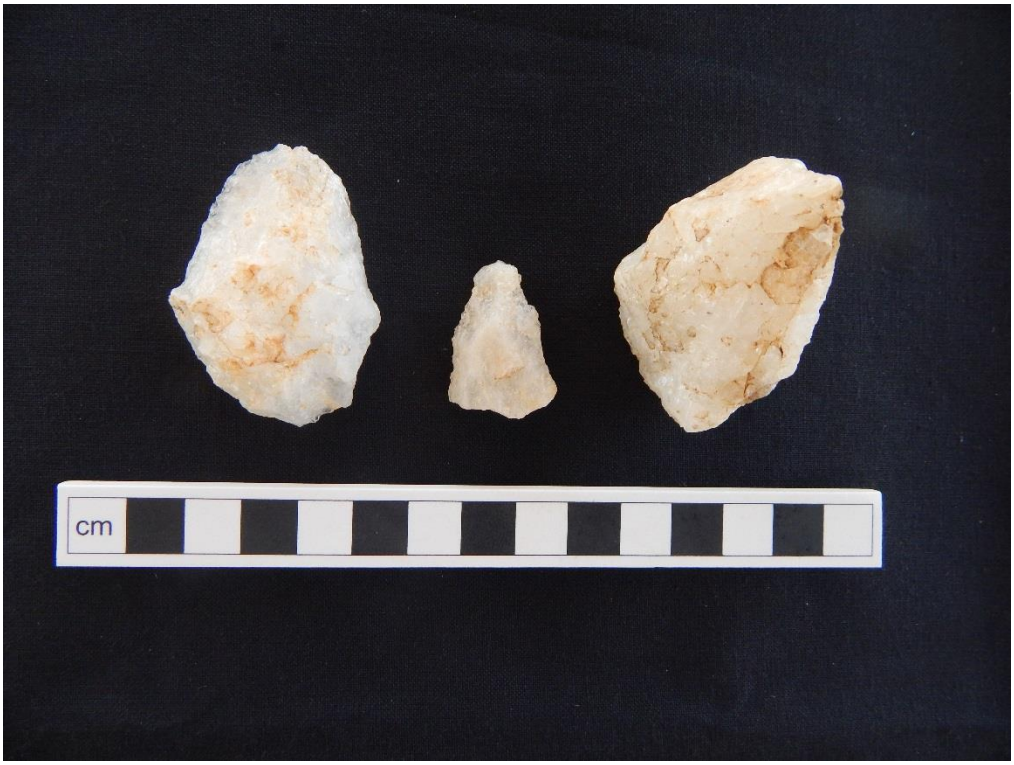

Figure 9: Quartz flakes (AR-303)

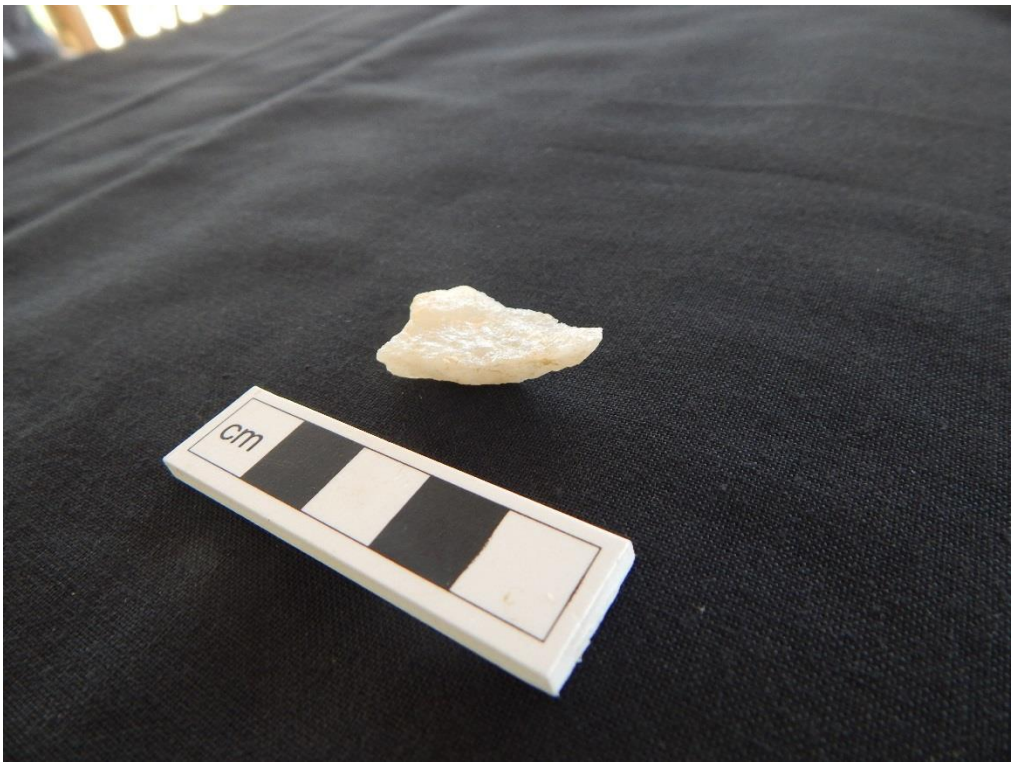

Figure 10: Quartz flake (AR-303)

Figure 11: Chert flake (AR-284)

Figure 12: Chert flake (AR-284)

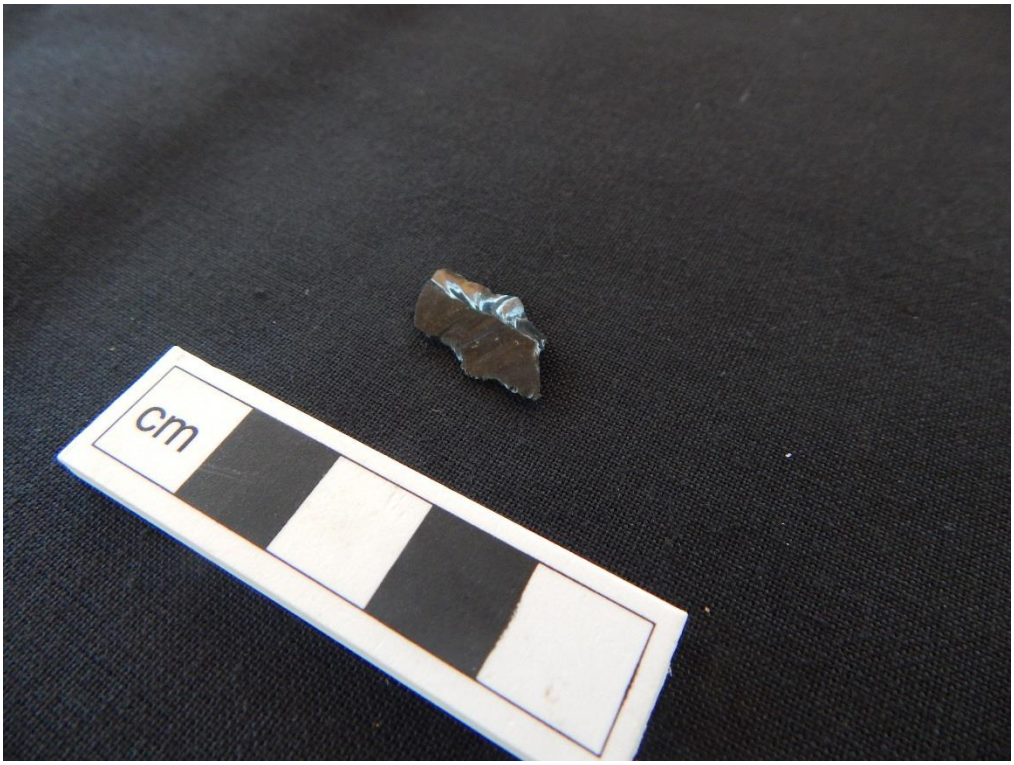

Figure 13: Obsidian flake (AR-088)

Figure 14: Obsidian flake (AR-088)

Figure 15: Lithic assemblage (AR-252). Stone tools ranging from large rhyolite flakes to smaller obsidian and chert flakes (including some microliths).

Figure 16: Lithic assemblage (AR-251). Stone tools ranging from large rhyolite flakes to worked quartz to smaller obsidian and chert flakes (including some microliths).

4.0 ARCHAEOLOGICAL CHRONOLOGY FOR KENYA

Table 4: Archaeological Chronology for Kenya ***(Schematic representation for illustrative purposes only. Not to scale)***

<table>
<tr><th>Geological Period</th><th>Kenyan Archaeological Period</th><th>Other periods referenced</th></tr>
<tr><td rowspan="2">Pliocene
(5.3 Million BP - 2.6 Million BP)</td><td></td><td rowspan="3"></td></tr>
<tr><td rowspan="4">Early Stone Age (ESA)
(3.3 Million BP – 300,000 BP)</td></tr>
<tr><td rowspan="4">Pleistocene
(2.6 Million BP – 11,700 BP)</td><td rowspan="2">Acheulean
(1.8 Million BP –300,000 BP)</td></tr>
<tr><td rowspan="2">Middle Stone Age (MSA)
(300,000 BP – 50,000 BP)</td></tr>
<tr><td rowspan="3">Later Stone Age (LSA)
(50,000 BP – 2,000 BP)</td><td rowspan="2"></td></tr>
<tr><td rowspan="2">Holocene
(11,700 BP - present)</td><td>Neolithic
(8,000 BP – 2,000 BP)</td></tr>
<tr><td>Iron Age
(2,000 BP – 500 BP)</td><td></td></tr>
</table>

TURKANA FIELDWORK SUMMARY

The following fieldwork summary reports were prepared by Philemon Ochieng' Nyamanga (National Museums of Kenya) in 2016. They document the Key Informant Interviews (KIIs) that were undertaken across two phases of fieldwork in 2016 and summarise the findings of those KIIs. KIIs were undertaken with community members in 20 settlements across the South Lokichar Basin in 2016, in order to achieve the following objectives:

- To identify sites of cultural significance (e.g. religious, sacred or ritual sites, cemeteries or burial areas), record their locations and extents and understand how they are used/accessed;
- To record the oral history of the settlement and land use in the area; and
- To document an understanding of local traditions and practices (e.g. belief systems) that are important to the communities (intangible cultural heritage).

The 20 settlements in which KIIs were conducted in 2016 were:

- Akibuket;
- Amoruakwan;
- Asikiim;
- Dapar;
- Kaikol;
- Kaloucholem;
- Kapese;
- Kapetatuk;
- Kaaroge;
- Kasuroi;
- Lochwaa;
- Lokicheda;
- Lokook;
- Lomokamar;
- Lopuroto;
- Lotimaan;
- Lowoidapal;
- Nakukulas;
- Nawoyalim; and
- Nayanae-engol.

Cultural Heritage

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2 Cultural Heritage fieldwork report April 2016

Turkana Fieldwork Summary

Philemon Ochieng' Nyamanga

April 2016

1. Introduction

We have had a fruitful two week interviews with Turkana elders in South Turkana sub-county, conducted between the 7th and 17th April 2016. The purpose of this fieldwork was to document the tangible and intangible cultural heritage of the Turkana people. The following is a brief summary of the key findings of the fieldwork highlighting the possible gaps. The summary captures the history, lifecycle, religion, and economy. We were lucky to attend a cultural ritual and managed to interview two seers. All the interviews were audio-tapped except the discussion with the Kapese Chief and the Kapese seer. We took photographs of the sites visited and recorded the locations. We talked with the chiefs where they were available and sought permission to interview the identified elders, village social officers (VSOs) and seers.

2. History

The Turkana are a Nilotic speaking people. They have had a long connection with the Turkana plains and are thus referred to as Plains Nilites. As a pastoral people, the Turkana pursue a seminomadic lifestyle. Most of the centres we visited consisted of temporary structures with few material possessions other than their rich and diverse livestock. New permanent or semi-permanent structures are being established largely in urban centres like Lokichar. It is not yet clear how the settlements originated and developed historically. Many Turkana settlements are closely parked together or isolated homesteads within particular localities. The main challenges of the community have rested with insecurity, drought and water problems. Most informants held that they were born in those settlements and that even their fathers and grandparents also lived here. It implies that several generations have lived in these settlements. Since most of the settlements are constructed with perishable materials little evidence about past settlements is available other than a few graves and archeological finds. For example, the abandoned homes with standing structures in Lokicheda, water blocking structures formerly serving irrigated farmlands in Askiim, abandoned settlements like Lopuroto and elsewhere now turned into grazing lands, among others. It is therefore important to regard the Turkana as the natives of the area with a long history of occupation to their settlements and grazing lands spread across the expansive plains to the neighbouring highlands.

3. Childhood and education

The Turkana value children and therefore each man usually married several wives to beget children. They socialize their children to take up the pastoral skills of herding livestock and protecting the people and their livestock. At birth, the child is given a name, usually a name of a family member or elder. There is also naming by where children are born, for example, Ekion is a name given to a child born in the kitchen. Birth celebrations are mainly attended by women and children to welcome the newborn. Men

never attended such celebrations but gave the animals and other provisions to be used in the ceremony. The food of the new-born was mainly goat milk, breastmilk and porridge. Meat was provided for the mother of the newborn and the guests who came to welcome the baby. The mother of the newborn was expected to consume sufficient meat to enable her regain strength and energy and resume other key roles of family care. The mothers nursed the children and taught them basics of survival in the arid and insecure environment that is Turkana land. As they grow older the boys are closely supervised by their fathers and elders while the girls are supervised by their mothers and taught skills on milking, cooking, and constructing houses and structures for the livestock. With the introduction of modern education it is realized that few children go to school. In urban centres children drop out due to early marriages. Modern educational institutions and urban life style and other changes in the area are likely to bring in changes in Turkana cultural traditions relating to child development and socialization.

4. Adulthood and Marriage

Turkana young men are usually initiated into adulthood through a ceremony conducted by the elders in the various ritual tree sites. The initiate brings with him an animal to be slaughtered, roasted and shared by the community elders who then bless the initiate and give him a guide to talk on his behalf and to teach him community secrets. After about a week another animal is slaughtered to release the initiate and separate him from the guide. It is after this that the young adult can now seek a marriage partner, for whom he pays bridewealth. The marriage process begins with the young man informing his father that he wished to get married. The father would then confirm if there were enough sheep, goats, cows and camels for the bridewealth and then directs him (his son) to go and find a suitable woman. He would go to the girl's family and report back to his father, who then takes the initiative of arranging for the negotiations regarding the bridewealth to be given to the bride's family. Such negotiations would take even a month and upon agreement the bridewealth would be given and a wedding conducted. Married women were expected to guard against immorality as this affected the entire family and the livestock. It is only when bride-price was paid and a traditional wedding conducted that the man had rights over the children born by his wives. Like most African communities, the Turkana practice polygyny and the payment of bridewealth in terms of camels, cattle, sheep, goats and donkeys.

5. Religion

The Turkana have retained their traditional beliefs and practices although some new forms of change might be expected as a result of the twenty other religious institutions (churches and mosques) that are spreading in the area. The traditional beliefs of the Turkana were influenced by the belief in God (Akuj) and the seers who were responsible for solving the problems facing the community such as drought, insecurity, diseases and death. The Turkana believe that Akuj is in control of their lives, the lives of their livestock, their security and their environment. The seer is a very important spiritual leader in the Turkana community. There are three kinds of seers depending on what they rely on for spiritual guidance for understanding phenomena around them: dreamers, shoe-readers and livestock intestine-readers. Each settlement might have all the three kinds of seers together; otherwise each settlement usually has a seer. Most of the remedies for the various problems diagnosed by the seers involved some ritual in which an animal (domestic and wild), bird or plant could be used/slaughtered.

Most of the modern religions are largely based in town/urban centres across Turkana land. The pastors and preachers usually go out to the villages to preach to their followers. They do not wait for the followers to come to them in the churches. Most church activities are held once weekly, especially on Sundays except for the Seventh-day Adventists who congregate on Saturday. Apparently the modern/Christian new churches' traditions are being integrated in the Turkana cultural/traditional practices as even seers are active members of the ? churches with some of them even serving as pastors.

6. Economy and industry

Turkana people rely largely on their livestock as a source of their livelihood. Some of the community members are traders and others are contractors working in the construction industries. In some areas there are people who live by cultivation especially along the River Turkwell and others on fishing along Lake Turkana. Most of the people in the research area practice a pastoral economy. They keep and manage their livestock which includes cows, camels, goats, sheep, donkeys and some poultry. Women also make charcoal for sale largely in the nearby urban centres. The discovery of oil and gas and water will undoubtedly contribute the economy and industry and the lives of the people of Turkana County.

7. Tangible Heritage

There two forms of tangible heritage: movable and immovable. Among the movable cultural heritage of the Turkana include clothes and body covers, bowls, pots, sufuria, knives, spears, water containers, headrests, snuff containers and metal rings among others. The women wear a rich collection of necklaces made of beads and metal. Both men and women wear earrings and bangles. Special metallic bangles identify individuals with their respective age grades. There are two such grades, Ngirsae and Ngimor. The Ngirsae wear silvery metals on the left hands while the Ngimor wear golden metals on their right hands.

The immovable heritage of the Turkana includes their houses, burials and livestock structures as well as meeting and ceremonial sites under various trees. Turkana houses are built by women from materials collected from the available plants (tree branches and grass). Due to scarcity of grass most of the structures are covered with large polythene sheets. Some of the houses are smeared with soil while others have iron sheet roofing.

8. Intangible Heritage

The intangible heritage of the Turkana includes their language, myths, stories, chants, ceremonies, and skills and knowledge expressed in body incisions, haircuts styles, the culinary traditions and practices and games.

The Turkana people around this area speak mainly their native language. Some of the members of the community speak Swahili, English and neighbouring languages of the Borana and Pokot. There exist no folklore on the origin and development for most of the settlements, what exists in some cases are

names of settlements associated with certain personalities, for example Kapese, named after Apese, a young girl who loved music dearly and used to sing praises to people.

In the ceremonies, the Turkana slaughter rams, goats and camels and share the ritual meat among the elders and male children in attendance. The meat of the slaughtered animal is roasted and portioned out to elders beginning with the eldest to the youngest. Most of the ritual sittings and dances are conducted in arc-like or circular formations around the *akiriket* – the food serving platform. The elders sit on their stools and in front of them lies a table of foliage onto which the meat is served.

9. Death and Burial

The Turkana have a rather inconspicuous funerary tradition. In the past the Turkana used to mourn and bury only elderly men and women. The elders were buried in their respective cattle sheds usually the camel or goat-shed in a sitting posture and the grave covered with a heap of sticks. Women on the other hand were buried in their houses. The children and young people were just thrown in the fields or put on trees where they would be covered with their clothing and left there. People avoid burial places, especially the pregnant women as this might bring bad luck to the woman and unborn child. When a person dies people mourn only for a while and burial is done immediately. Thus if someone died in the evening s/he would be buried the following day. An animal would be slaughtered and shared with the family and relatives who come to mourn. After burial the home would be abandoned as people moved to another site. Widows are usually not remarried except those that are still young and in their reproductive age. Today there are permanent graves made of stone and plaster. We documented some of these where? in the sites that they existed. It is not clear who leads the burials. All that is known is that a grave is dug using a hoe and then the covered body is laid in it and covered with soil.

10. Conclusion

Modern changes may affect any traditional society both positively and negatively. The Turkana have a pastoral cultural tradition whose continuity hinges on the committed embrace by the people. This brief report has summarised the findings of the recent baseline survey conducted in Lokichar at the following settlements: Lochwaa, Kaaroge, Kapese (lokook and Askiim), Nakukulas, Lokicheda and Lotiman. It has touched on the history, the tangible and intangible cultural heritage and the economy of the Turkana from the purview of the elders of these settlements. The comprehensive report will provide appropriate details and fill in evident gaps. The accuracy of the information provided might be affected by the translations which were made in three languages (Turkana, Swahili and English) used simultaneously in the interviews. Another challenge the research faced relates to the willingness of the informants to give information. Some of the informants were unwilling to discuss some issues, to be taped or photographed. All possible effort was made to secure permission to record the interviews and take pictures. Finally, there was the challenge of requests for gifts of food; gift giving being an essential aspect of Turkana culture.

Cultural Heritage

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3 Cultural Heritage fieldwork report July-August 2016

South Turkana Cultural Heritage Baseline Survey

Phase 2, July to August 2016

Report

By

Ochieng' P. Nyamanga

August 2016

CONTENTS

1. INTRODUCTION

During this phase of the consultations, we dealt with thirteen interviews that were attended by several persons (in excess of two hundred, annex 1) from whom we obtained crucial data on the Turkana cultural traditions based on the natural and cultural heritage. We relied on the interview guide that was prepared by Golder Associates as in the previous phase. The interviews were conducted from between the 21st July and 1st August 2016. The following report provides the results of the interviews following the order in which the information was obtained by date and village. Lucas Ariong assisted with the translations and we are immensely thankful to his good job without which this report would not have been possible.

2. KASUROI

We were scheduled to have an interview with the community on the 21st July 2016. We first had a courtesy call with chief Josephine of Kapese. We then proceeded to Kasuroi from Lokichar and had a fruitful interview with thirty six members of the settlement. Lucas Ariong made the introductions and then in the next two hours we gathered immense knowledge about the community. The thirty six people in attendance at the interview included the following:

Ekiru Kapua	Emuria Sapirnyang	Peter Ekeno
Loree Lotonya	Ayanae Enipona	Samuel Awesit
Robert Elipan	William Ewoi	Anna Lorot
Peter Erongat	Ekoriachumi Ekai	Ejikon Lokemer
John Enipona	Abuu Mauyo	Christine Ekai
Selina Iligwel	Simeon Kitoe	Lourien Akai
Amoboi Kangole	Lomenye Ejore	Lokiru Lochuch
Mary Epeyon	Lowoi Lotur	Ekal Lomokirion
Annah Namiir	Alfred Ebenyo	Esinyen Naut
Jeremiah Ekapan	Ekai Naut	Maruo Webei
Eurien Naut	Achuka Losekon	
Joseph Ekai	Lorot Etabo	
Annah Amathe	Margaret Etabo	

Kasuroi has a background of flight from the Pokot. Originally a grazing land, Kasuroi became a Turkana settlement the herdsmen who settled here run away to the east fearing the Pokot the worst of which occurred in the nineteen thirties. The inhabitants of Kasuroi started living here in the nineteen thirties as a Crown settlement established by the British as a Pastoralist Kraal the original inhabitants of this settlement may have come either from the south or west but nobody seems to know for certain where they came from. What is known about the inhabitants is that they have lived here for several generations much of whose history is forgotten due to the oral nature of the Turkana knowledge system.

The inhabitants of Kasuroi are largely of two sections of the Turkana community Esonyoka and Ngimatak. There are fourteen ere in this settlement, namely: Kasuroi, Kalkol, Natudawo, Kadongolo, Amaruakwan, Wachorokalei, Nanangakina Kaekoe Ekwan, Akou Ekori, Lomeseksil, Hoyo kwee, Kaapoa, Kalitakere, and Tirikwel.

The economy of this community has largely depended on pastoral livelihood system gathering wild fruits and hunting game. Although considered among the richest settlement of the Turkana, Kasuroi people today engage in shop-keeping, charcoal trade among other business people whose mainstay is herding large livestock. They are mainly sheep herders and the name of Esonyoka derives from the sheep tail.

Charcoal burning and selling of maize, flour (unga) and shop-keeping are merely fallback occupations resulting from drought and insecurity.

Kamatak (Ngikamatak) are a people whose speech is unclear, they speak in a way that they mean the opposite of what they shay for instance if a member of the community tells you take this and share with so and so he means do not share what I give you. The people do not speak plainly and it is rather difficult to understand them.

How do the people of Kasuroi bring up their children? Although today the people take their children to school pursuing formal education that begins with Pre-School and Primary to Secondary School, traditionally the people taught the children how to tend animals. They began

by taking care of small stock and later assist older people with the work before they could be left alone to look after the livestock all by themselves. Once a boy was able to care for the livestock by himself he would be mandated to raise his own stock having the prerogative to sell or give them out to anyone at will even so the father remained in control guiding the son until old age.

When does a child become an adult? When a Turkana child gets initiated or marries he becomes an adult given a portion of livestock and may decide where to live independently.

How is initiation done? Initiation is a long process beginning with the decisions of the father. The father may decide that all his sons are initiated all at the same time or separately for which provides the requisite ritual animal for every initiate must slaughter an animal during his initiation. Initiation is usually done following age-set system Ngimor and Ngirsae. Each initiate must bring with him beads two sheets headgear tobacco sugar animal fat and an animal to slaughter (if there are ten initiates they must have in total ten goats or sheep to kill each one killing his own). After the slaughter of the animal and sharing with the members present the initiate stays away from his family for five or seven or ten days after which he is given animal gifts to start life with. Headgear and ochre special earth smeared on the initiate body and ostrich feathers were central to the ceremony the initiate had to wear these during the five to ten day period after which the hair was shaved and normal life resumed. One has to be initiated before one could marry.

Who decides when one is fit for marriage? It was the father of every boy to make such a decision or the eldest son if the father was not there. It also depends on the wealth an individual has. Once one was initiated one could marry one's preferred wife. The family looked for special qualities in the girl to be married especially such traits as being social friendly and hardworking. After that identification negotiations were. Somebody was assigned to the initiate as his guide. After that identification negotiations were made especially between the man and the girl at personal level but if the girl was tough the man needs reinforcement of friends (mothers and sisters) after which the father was engaged together with other relatives to visit and have discussions with the girl's father and is usually characterised by eating of a ram and presentation of gifts like sugar and the bride-wealth is finally given to seal the marriage. Many people are brought to witness the

agreement sealed by slaughter of a bullock. Friends then gave the girl gifts> the following animals would be given as bride-wealth: two hundred shoats (sheep and goats), thirty to fifty camels, eighty cows and five to ten donkeys.

the groom and the bride wore traditional attire (goatskin for the lady< beads and ostrich feathers and headgear for the man) ostrich feathers are usually bought from the local shops smuggled from the game parks/reserves through the black market. These items greatly provide colour and pomp to the wedding and the feather colours especially defined one's age (black for the Ngimor and brown or white for the Ngirsae.

Which cultural places are used by the people of Kasuroi? The community has a traditional cultural tree in the east where elderly people meet to rest, make important community decisions and pray and offer gifts to Akuj (God). the pray to God in through animal offerings and food sharing> a camel cow or goat would be killed and roasted through the roasting process the people believe they are presenting an acceptable gift to Akuj and as the smoke rises to the sky they believe they are in communion with God. Traditional prayers (agata) are performed by an elderly person (usually a seer/dreamer) who is able to foresee rain< floods and other calamities as drought and invasion and would call upon God to protect the community and give them rain during drought as well as forgive their wrongs or stop floods and raids from neighbouring communities the people believe that when they meet with God they must appease him with a sacrificial gift and show reverence to him as giver of life and riches on which the community's existence lies. There is no designated place for initiation and marriage; for these activities the people would go to the elderly kraal and this gives them some difference from other Turkana communities which have designated initiation and marriage sites. The community also treasures the Alusili grave in Kaikol village.

Kasuroi has fourteen ere and the community apart from being committed to their traditions also has representatives in modern religions, especially Christian Churches such as Roman Catholic, Reformed Church, Maranatha Church, Seventh-Day Adventist Church (SDA), and Legio Maria.

The fourteen ere of Kasuroi include:

Kasuroi	Wachorokalei	Hoyo Kwee
Kalkol	Nanangakina	Kalitakere
Natudawo	Kaekore Ekwan	Tirikwel.
Kadongolo	Akon Ekori	
Amaru Akwan	Lomeseksil	

The Kasuroi people reportedly have no myths or legends but usually sung and dance in the evenings when all activities are finished when the young men and women would go to an open-land and sung general songs praising community heroes. They jump high and land in a systematic pattern in dances that took about four hours. Men and women sung and dance during happy moments of plenty during the rainy season when the people had plentiful food, a lot of milk plenty pasture and water and dancing reflected the bounties and joy of the people the elders' tree site was noted as a group of trees forming a triangle in the Kasuroi River. The trees are ekurichanait (36N 0795893 0273925), ekurichanait and esekon (36N 0796170 0273945) and three acacia where the participants gather and share meat (36N 0795841 0274890).

3. NAWOIYALIM

Interview with the People of Nawoyalim was conducted on the 22nd July 2016. We first drove to the home of the elder and seer, Achuka Mzee. We found him and his wife preparing snuff in the grinding stone in the company of their little girl. There were three other men with him. The main grinding stone is called akries (aknes?) and the small one ikalele. We then drove to a few homes to ask the people to assembly for the interview under the tree of meeting. The homes (kraals) are very wide apart and few. We spoke with two women, Erebona Akriakol and Nakereru Lopwal, and a boy who was tending shoats and three children.

Nawoyalim derives a tall elim tree among acacia. The trees are available to the east. Children grow up to assume various roles. Children cared for up-to seven or ten years and if male he looks after the young animals but if a girl she prepared to watering of animals and building structures for both people and livestock. It is the responsibility of the female Turkana to do homemaking

while the boys took care of the goats and camels.

While in the past the people fed the children on milk, fat and meat, today however they are fed on porridge (uji), ugali, soup and milk. The routine daily life activities of the people of Nawoyalim includes bread earning through charcoal burning and selling, fetching water and taking care of children as well as watering livestock as other people go out to look for water, firewood one woman usually remained at home to take care of the children

That is the importance of beadwork to the Turkana? Beads stand for the Turkana culture being part of the traditional attire; wearing beads helps preserve the people's traditions. On top of the beads hung a metal ring which represents that one is married. The colours of the beads mean nothing other than providing variation and enhanced aesthetics.

The people of Nawoyalim have schools in Karoge and older children go there for formal education. Churches are also found in Kaaroge and only outreach programmes reach the village especially those of the Catholic Church.

Traditionally the people of Kaaroge approached God through meetings especially when there are issues such as drought or disease outbreak when elders converged during day or at night to kill an animal (a goat, sheep or camel) and pray to Akuj. Such prayer is called agata. It is when all elders come together and pray, hoping that appropriate and immediate answers would be given to the community and relieve any pain and suffering of the people. During such occasions the people sing and dance as they sought God's guidance and protection.

There are two **significant cultural sites** in **Nawoyalim**: tree of meeting for elders and the grave of Aman Lochuch after which one of the ere is named. The elders' tree where the people conduct marriage negotiations (today others go to the church), initiations and prayers under two acacia trees (36N 0801022 0283306; 36N 0801217 0283052). The grave to the west in the upper side of the river (36N 08000634 0282848).

When does a girl or boy become ready for marriage? As the girl grows up she is engaged in daily watering of livestock and periodic construction and repair of living structures (houses for people) and for animals, she is bound to meet young men one of whom could approach her with a marriage proposal which she communicates to the family in due course and negotiations begin. it must be remembered that the girl must be fully prepared by training her in animal care, watering and construction skills by the elderly women she is also given proper training in appropriate dressing with beads and hair makeup as well as slaughtering skills. Cooking is part of the training she is given including the distribution of food and the sources of construction materials. The construction materials are basically derived from plants such as ekurichanait (for houses), eregai for livestock structures.

Comment on any taboos (food taboos during pregnancy). Some clans with special marks (Ngimacharim) forbid pregnant women from eating animal entrails as this would lead to abnormal births and difficulties including miscarriage, deformities (cripple dumb or deaf) any contemporary changes in women roles? Not really, most of the people are still rural and traditional in focus and therefore remain attached to the pastoral economy.

4. AKIBUKET

After the interviews at Nawoyalim we moved on to Akibuket and spoke to a much larger group, about twenty people in the company of the Kaaroge elder (Achuka Mzee) who is also a seer. Like Nawoyalim, the village has few inhabitants mainly women and children as the men go out very early to attend to the cattle. We drove across the village inviting the available people to converge at the elim tree where we conducted the interview for about two hours. The elim tree is a very important meeting place. The meeting started with seven women and eight children but rose to around twenty as more women and children joined in. Apart from the women, one harder, Ekiru Edopal, came with some sheep and joined in the interview. The women included: Ewolan Lopuyo, Lowari Lorot, Kiyoga Lorot, Eturoe Loperito, Loumwa Nachoo, Lyorio Nachoo, Aperit Lopungurei, Koole Nachoo and several children. We took pictures of those present at the interview. Akibuket derives from bountiful milk and churning to produce fat. The name derives

from the wet season when the community has a lot of pasture and water during which animals produce a lot of milk which is fermented and churned to produce fat (animal oil), the churning (shaking) process is called akibuk.

What are the most important plants used by the community? To the community living here land and trees mean much to their welfare and that of the livestock. Most important plants include elim, ekalale, ewoi, eipa, acaciaand eegai. Eregai is very important to the livestock when the livestock have enough eregai to eat, the people also have enough food and living conditions improve. In terms of priority: ewoi (acacia) and ekalale are the most important trees for the Turkana, the trees produce fruits. Ekalale produces leaves and flowers for livestock and fruits for people. Ewoi produces leaves, flowers for livestock and pods for both man and livestock. They produce these during the dry season and are the trees that the people rely on for pastoral production due to their resilience (resistance to drought).

There are also some six **medicinal plants** used by the community: emus, echuchulka, amuroekile, elim, locham and ekamongo. Amuroekile is used for treating stomach diseases including diarrhea, vomiting. Etesro helps when someone is pricked by a thorn which breaks in the body. You break etesro and drop its milk in the place pricked by the thorn. The thorn would come out two days later. Epetet is used for treating eye ailments. Elim is pound and used to treat stomach complaints such as diarrhea, vomiting and constipation. Ekamongo treats wounds and is considered the most important antiseptic, but it is usually very painful. Locham is used for treating coughs.

The community also uses a number of plants for construction work- construction of houses and resting sheds : the eregai and small acacia trees as well as epetet. Edung is especially used for constructing houses but ebucharatet also serves as a house construction material. Edung is used in other cultural activities in the community including initiation. The seeds of edung are boiled for several hours and used to seal the process of initiation. The seeds are eaten by the elders presiding over such initiation as a sign of final blessing to the initiates. The same is true for marriage ceremonies and when a mother has given birth. In both cases edung is consumed as the

final meal served to the elders and the mother when she is ready to come out of seclusion from the house. Edung is, therefore, key in Turkana community cultural life. When the young child is shaved edung is cooked and fed to the woman who has shaved him or her.

Few animals and birds are used food by the community. Small children eat birds like ekolsalalat, ekuri as well as rabbits (sungura) and squirrels. Middle-aged people and the elderly do not eat such foods.

How is the daily life like here? Girls and women in general engage in several domestic activities. They burn and sell charcoal, herd and water livestock, process skins to make traditional attire such as dress, dance costumes and ceremonial pieces as elou, abwo, egolos which are important women attire.

How frequent were the ceremonies? Most Turkana traditional cultural activities took place during the wet season and more so during the transitional phases of the seasons, between the wet and dry season, around July and August, just before the onset of dry season in September. The community conducts several ceremonies including initiation (asapan), traditional weddings usually are conducted with pomp and celebration as there is plenty supply of food and water and the people make merry with songs and dances>

Who makes the beads that the Turkana women wear? Everyone usually has the choice of what beads to wear by colour design and layers. One of the women present (Ekionga Lorut) is known for making such beads to the family members and for other people in the community at a small fee just like it is done in the salons. She is usually paid five hundred shillings for making the beads but insisted that she made the beads free of charge for family members. She buys the beads from the shops at one thousand one hundred for each layer of beads (each layer is marked by different colours: black, red, blue, green, and yellow. The beads are usually supplied from Nairobi, Nakuru and Eldoret.

The community members held that there were no myths, legends or historical stories commemorating special events in the area. What the people remember is a universal Turkana myth about the Pokot man and the Turkana woman. Once upon a time in Turkana South, there were conflicts between the Turkana and the Pokot. Men had gone grazing as usual but left a woman in the kraal to take care of it and the children. A Pokot man came and found the woman alone in the kraal. The Pokot man asked the Turkana and the community has treasured the story to show that even women can defend the community and should not belittled. The story reminds the living of the need to think and act fast especially when in danger. The story indicated that females have abilities: strength, speed and clear quick thought that could be used in defence of the society. Elsewhere in Loima the woman has been identified as Lokitaung.

The interview ended with the beliefs and heritage sites. Among the churches that were said to exist in the area included New Apostolic and Catholic. Most of the people are members of the New Apostolic Church which serves the community through an outreach programme. They meet near the women's houses and under the trees. They generally meet on Sundays and Tuesdays. Among the important heritage sites in the community are the elder's tree (36N ?) under which we held the interview and whose coordinates had been taken the previous time (in April). The other site is the grave of Nachoo Kopwa Kaikol (36N 0798613 0281876).

6. KAIKOL

We conducted the interviews at Koikol on 23rd July 2016. We started by asking which people lived here and where they come from as well as the meaning of Kaikol. Kaikol is named after an old woman who was married to the founder of the village. The first wife of this man was called Kaikal. When she died the people renamed the community after her for remembrance.

Kaikol belong to the Esonyoka subsection of the Turkana. They came here from the east from a place named Kaikor Sogol. The founder was called Nasenyang. The people of Kaikol rely on their environment for many things. Among the important plants are ewoi, ekalale, ekurichanait,

epetet, eyadung and eregai.

Ewoi (acacia) provides pods for both people and livestock as well as construction materials for building homestead structures (houses for people and sheds for the animals). It is also a source of charcoal and stools (headrests). Ekalale provides fruits for livestock and people, sheds and meeting places for the community, its leaves are feed for the livestock and the tree provides construction materials. Male stools are usually made from ewoi and ekalale. Ekurichanait flowers are important fattening feeds for the livestock (animals eat ekurichanait to grow fat) but the plant also provides the best materials making traditional stools (ekicholong) and for construction of homestead structures (houses and sheds for livestock and people). Most traditional tools are made from ekirichanait (plates and other containers used by the community). Epetet provides leaves and barks for animals as well as flowers for honey making and seeds for livestock. Edung (eyadung or eadung) have bitter fruits that must be boiled thoroughly (for several hours) to be edible to people. Edung leaves are livestock feed, much as eregai flowers. Eregai also supplies much of the construction materials to the community. The community also exploits the wildlife resources for food especially rabbits, squirrels and birds (ekuri). The fox however is among the great enemies of the Turkana as it preys on the goats.

How is the daily life pattern of men and women in this village? Female members of the Kaikol community usually engage in several economic activities including charcoal burning and sale, gathering firewood, watering livestock and fetching water for family use for drinking and cooking, constructing shelter for use by the people and livestock (anok), houses (akou) and resting sheds (ekol).

Men on the other hand looked after cattle and other livestock by providing day and night guards (security) as well as ensuring the family needs such as food, clothing among others were met by providing animals for slaughter or sale to acquire essential domestic needs, planning for periodic migrations especially through the guidance of seers.

While the people settled here a long time ago, there are no songs, myths or legends commemorating their migration or subsequent settlement.

How does a man prepare himself for marriage? After all necessary preliminary preparations and negotiations are done, the man gives out bride wealth (dowry) to the bride's family (five hundred shoats, fifty cows, thirty camels and ten donkeys) is given out (usually contributed by his brothers, and friends).

How is the camel important to the community? Camels provide milk and being resistant to drought can survive anywhere during difficult situations of prolonged drought as well as plentiful conditions. Camels are basically attached to the male members of the society. They usually live longer than other livestock, being less vulnerable to theft from rustlers and attack from wildlife and when sold a camel fetches a lot of money (up to fifty thousand shillings) which can be used to meet crucial home needs.

What are the basic items used in your homes? The Turkana home has several utensils and tools. Akurum serves as gourds for storing milk while waiting to be used by the family. Elepit is the smaller milk container used for milking and pouring the milk into the bigger milk container, akutwam, for longer fat storage lasting up to one year. Atubwa serves as the traditional plate, akaloboch is the service spoon, and ebur is a gourd for storing fried meat lasting at least two weeks. Etio gourd for storing fresh milk to be churned to produce fat and the rest of the milk drunk by the family, ejomu (traditional sleeping mat), asajait carrying tray used for transporting things during migration.

When does a child become an adult? A child attained adulthood when teenage ends (akreum), when he is able to bring a woman home, marry and impregnate a woman. But it is initiation which clears a child to enter adulthood. Initiation (asapan) is usually conducted after the initiate has had enough requirements to undergo the ceremony. The initiate buys beads, sheets, arm bands (rings) tire shoes, ostrich feathers (white or black), cooking fat, sugar, fresh milk from cattle and tobacco. Tobacco is particularly important to the Turkana. Bought from the shops

tobacco is involved in all traditional ceremonies in the community (blessing the new born and symbolizes sharing and communion with Akuj (God). In asapan the elders share the tobacco and put some into the fire as God's share.

How does the community approach God? Turkana elders usually converge in certain site, slaughter and eat an animal (cow, goat, sheep or camel). after all has been done one of the elders stand up with a spear that was used to slaughter the animal (its sharp end facing upwards) and prays (prays that God supplies plenty of livestock, many camels, health for both people and livestock, blessings to the community in the form of rain), for all the good things the community needs and curses all bad things. Prayers are said at all times (especially whenever there is need, when there was threat of livestock diseases or impending raid or drought). Such prayers are made either very early in the morning or at night depending on the types of need. Although there are many churches in the area the people still cling to such traditional ways of approaching god. The available churches include: Catholic, Maranatha and Reformed Church.

We need to recall in closing that Kaikol has two ere: ere Alusil and Amasenyang. The community has two significant cultural sites: the grave of Losil Nasenyang (enter coordinates) where to date is visited by family members whenever they wish presenting various gift items (sugar, tobacco and slaughter a goat and share. They go there under the leadership of the eldest son of senior mother living. We saw three sets of fire stones on the site (enter coordinates) and the tree of meeting (36N 0800102 0275532) consisting of five trees (two ekalale and three acacia). The following sixteen people were present during the interviews:

Kitoe Nakuwa	Akalepatan Elibit	Edut Angomot
Atiir Nakuwa	Lokeredio Losil	Amaler Akatapan
Akiru Nakuwa	Ekutan Elibit	Sarah Ngisekon
Kooli Nakuwa	Esinyan Akatapan	Five Children

6. AMARUAKWAN

We arrived early on Monday 25th July 2016 and luckily found a number of people assembled for interview. In fact we started off with three men, fifteen women and five children. A little while later three other women and one child also came and joined the group. There were therefore twenty-one adults and six children in attendance at the interview, but only the following eighteen of them had their names written down (two adults and six children were not taken):

Esther Amuron (VSO)	Margaret Asinyen	Nawar Epong
Napatet Ngikinae (Elder)	Christine Akadeli	Lokol Etot
Peter Ewalan (Youth Rep)	Nalet Napatet	Awesit Epong
Sarah Amatoi	Lotujan Loimaluk	Ayangan Ebow
Esther Achuka	Akeno Epong	Ekadeti Lokitoe
Awesit Aletia	Akure Eporon	Teresa Ewal

Amaruakwan means the grave of a woman on which a white stone was placed- this elderly woman was called Lobotol Ekalale. Her husband died long before she came here with her two sons. Later when she died she was buried at her grave (enter coordinates) the community then adopted the name of the stone on her grave in honour of her since she was a very kind person.

How long have the people lived here? The community has lived here for many years, having migrated from Loima during drought they arrived her in search of pasture and water. They came here as Ngimatak clan but today their off-springs are now Esonyoka. The community has four ere (lobor, lukwei, lobalyo and ekaran) today. When the people arrived they first settled at Lochwaa and then to Kaaroge, Kasuroi and finally here at Emuruakwan.

What is basis of the people's livelihood here? The community relies on pastoralism raising livestock (camels, donkeys (esikiria), and exploiting natural resources in the surrounding, mainly plants.

How do you manage the livestock? During wet season when there is plenty supply of pasture for the livestock the people are never so worried. But as dry season sets in there is trouble yet the livestock must be sustained with regular supply of feed. Thus during dry periods the livestock feed on acacia pods as well as leaves of several trees including ekalale, epetet, erurichanait and ewoi.

It's the duty of young mature boys to take care of the cattle (cows), but it must be noted that the community must ensure the good health of their livestock at all times. They depend on modern and traditional medicine to treat livestock diseases. Traditional treatment involves use of various herbal remedies derived from a number of trees including echuchuka, egis, emus and eligoi. Among the livestock diseases affecting the community's pastoral economy are loukoi, emany, lojaa, lokot, lotomee, lomoo, ngiboruok (foot and mouth disease), amil, lonyang, lokot, loidiit.

Emany is a liver disease. Traditionally the people would put a stone on fire and press against the stomach of the sick animal but nowadays they buy modern livestock medicine from Agro-vet stores and shops in Lokichar.

Men bring down leaves from tall trees to feed livestock, provide food for the family (decide on which animals to slaughter or sell and when). More importantly the men are involved in traditional prayers and providing security for the family and community.

You indicated that among the roles of men is the judging cases (pursuing and punishing wrong doers) how do you decide on the cases? When a crime has been committed, for example, a goat has been stolen by someone, the footprints of the suspect is traced (followed) and if found the person is arrested and given preliminary discipline by caning (beating) and asked where he comes from, who his father is and how many they were when stealing the goat(s). He the guides the goat owner to his father (family) once he has revealed his father the goat owner explains the incidence to him and asks him to pay for the stolen goat (normally the charge for such theft is three goats for every stolen one) thus of three people were involved in the theft each of them would be fine three goats! Such punishment helps to deter livestock thefts.

Turning to the females, we must take note of the daily life pattern of activities they are engaged in. The interviewees noted that women especially contributed to the making of homes, spreading sleeping mats, organising the utensils (putting calabashes and plates well), fetching water, preparing and serving food for family use. They also burn and take charcoal to Kasuroi or Lokichar to sell to acquire other essential items for the family. It must be noted that charcoal buyers are not easily available sometimes one has to wait for a number of days before her charcoal is sold. Usually a debe which holds four goro goros (two kilogramme containers) is sold for one hundred shillings while a fifty kilogramme sack which contains five debes goes for five hundred shillings and the money is used to buy maize meal, beans, fat, sugar and tobacco for family use. The women also gather wild fruits for food. For instance, a woman could gather three debes of edung fruits in one instance. Other wild fruits are obtained from ngakalale, ngitit (acacia), esokon, egilae and loarakimak (kill woman). Most of the wild fruits are poisonous and could kill if not properly cooked (edung and elamach fruits are poisonous and must be cooked for several hours to be edible).

Which are the most important cultural sites in the community? There are two important sites: this place where we are conducting the interview is the elder's (note coordinates) and the founder woman's grave (give coordinates). The tree of meeting serves the community as a traditional prayer place, conducting initiations and marriages (negotiations and engagement). All community activities and celebrations are held here officiated by elders and the main elder is called Aleta (present in the interview) and seers (the community has two seers: Nakuyen Ewoton who is a rain seer and Loree Lotone seer of diseases and misfortunes).

How do you approach God? While noting that there existed a number of churches (Maranatha and Catholic) the community still relied on traditional rituals to commune with Akuj (God). For instance, when a member of the community falls sick the family members got together in the family and slaughter an animal and share with god and ask for healing for their son or daughter. The slaughter of an animal is believed to bring the community closer to God. Once slaughtered and roasted the animal is cut into pieces (some of the pieces are thrown about for use by God) and the rest of the meat is shared among those present. Thus, before any meat is eaten the cut

pieces are placed in a container and thrown to god by the officiating elder to appease him and ask for his blessing through prayer. After scattering the pieces of meat around the place and sharing with those present, the lead elder or seer chants prayers to God and then people disperse.

7. NAYANAE ENGOL

After the interview at Amaruakwan, we proceeded to Nayanae Egol for another interview for the day. We had twenty six people in attendance for the interview which like the others was tape recorded (using a digital recorder) and photographs taken of the people and the key heritage sites. There were eight men, fifteen women and five children (names of children were never noted unless they were old enough). The interview started a few minutes after eleven o'clock in the morning with the following persons in attendance:

Erupe Marus (VSO)	Alinga Logiron	Aladiko Naburo
Loregai Etidong (VSO)	Lokota Logiron	Atabo Ngimuyok
Longoria Lokaale (VSO)	Nakuwa Lokai	Alice Nakuwa
Lobolia Marus	Amujal Lokwong	Christine Loregai
Elyan Marus	Ekalale Lokuruka	Mary Tenge
Mtomi Mulen	Selina Nasekeny	Ilikwel Akwee
Rose Ekalale	Mary Lagotol	Ekeno Lomojong
Marum Loporucho	Aron Itidong	Elabo Ngitirai
Apese Loponcho	Losen Aiim	

Where did the originators of this community come from? There used to be a palm tree in the area. Tall palm tree had stayed for so long and when these people came here they got the tree and stayed nearby. The place was thus named after the palm tree. The inhabitants of this place belong to the Esonyoka clan. As there are no myths of traditions about the community's origin rather than the palm tree the present generation, being far removed do not remember where the people came from.

Which are the main cultural sites in the community? There are two significant tree sites in the community which act independently from each other: Erilbe Marua's family which uses the ekurichanait and Lorogae Etidong family which also uses it own tree for traditional decisions. The community has two ere: Engenai Engol and Loporucho Alinga. The people go to various churches including SDA, Maranatha and Roman Catholic.

Which trees supply food and medicine to the community? All small and big trees are important to the Turkana people of this area as well as to their livestock (cows, shoats and donkeys). Ewoi leaves, flowers and pods are used as livestock feed (pods are also consumed by the people). Ekalale leaves are feed for livestock while its fruits are used by livestock and people. Ekurichanait leaves and flowers are feed for livestock and pods as food for livestock and people. Etesro (photographed) flowers, leaves and pods are used by livestock. The tree is also medicinal and serves as purgative to removing the stuck placenta when a camel delivers but the placenta fails to come out normally. It is given to the camel to drink after which the placenta is released from the body. People also use etesro while consuming tobacco to retain its taste for long. Tobacco is wrapped in etesro gauzelike pods and put in the mouth and chewed. Leaves of etesro also serve as curative for wounds (the milky fluid from the leaves serve this purpose). Fresh edung leaves are consumed by camels and they are dry and fall down are important feed for goats and donkeys. Edung fruits are gathered by women and boiled for long hours to supply food for the family. Being poisonous the fruits are usually boiled from seven o'clock in the morning to three o'clock in the afternoon to be ready for human consumption. Donkeys feed on barks of edung tree. Eipa which needs support from other trees to grow (always existing near acacia trees) is eaten by camels and goats (which consume the leaves). The tree also serves as toothbrush to the people since it produces superior quality brushes than esekon and is also believed to contain certain germ killing chemicals.

Esokon has three major uses: first, esekon fruits are eaten by livestock and people. Secondly fresh esekon leaves are good feed for camels while the dry leaves are eaten by goats and donkeys. Finally, esekon roots are used to treat stomach ailments (acids, ulcers); they are pounded and put in water and drunk only once to induce vomiting. But the esokon drink also serves as an apetizer (giving one an urge to eat).

Kayep leaves are not only used as feed for livestock they also provides treatment for certain ailment in both people and livestock. Akabekebeke is also very special to the community. It serves purely as camel feed but is also used to produce transport trays used during migrations to carry luggage. Moreover it is also a very effective treatment for snakebites (fluid from the leaves are smeared in the bitten place to remove the poison and fangs stuck in the body).

Eregai is feed for livestock. Esanyanait leaves and branches provide shed for both people and livestock. Apart from serving as animal feed, eragai branches are fencing material for livestock structures but they also serve as ngiminai (used as sweets just like ekunoit whose fluid is tapped and chewed as sweets) for children. Epetet pods, leaves and flowers are important livestock feed. its fluid serves as sweets to children too, but it is also used for treating eye diseases and stomach ailments. Poisonous ebei fruits are boiled like edung to provide food for people, while the leaves are eaten by livestock. Elamach fruits are also boiled for hours to provide food for people while the leaves are eaten by livestock.

What is the importance of wildlife (animals and birds)? Rabbits, squirrels and rock burgers are among the wildlife available here as well as dikdik and numerous birds such as the dove which are edible.

The various roles and functions assigned to men and women in Turkana community reflect the core of their cultural life. For women, core tasks gravitated around burning charcoal, collecting firewood, looking after small stocks (goats and sheep), watering livestock and drawing water for the family use, taking care of children and other domestic responsibilities including cooking, serving children with food and milking livestock (camels, goats, cows). The Turkana woman also goes to shop in Lokichar (buying essential items needed by the family).

Men on the hand oversee various family management matters as well as caring for family livestock, taking care of the family members by providing food during difficult seasons of the year, organising marriage ceremonies, supervising the watering of family livestock, trekking and

recovering missing livestock, conducting initiation for young Turkana men and deciding on the marriage of the girls. Custom requires that girls should be given out in marriage in the order of the birth- beginning with the eldest and ending with the last. Men in this community usually have a huge responsibility of proving security for the family, the people and their property largely livestock, making critical decisions affecting the community and solving societal problems such as theft, fighting and quarrels and planning for future activities. It is therefore quite crucial that men must exercise good judgement and provide appropriate solutions to ensure societal prosperity.

What happens when a person dies? When an elderly person dies, his body is put inside the animal kraal and burial ceremonies ensue. First, people mourn and dig the grave, and then the body is buried in the livestock-pen after which the family members are shaved (wives, children and relatives) and cleared to depart and resume normal activities. We should note that during the mourning period nobody is allowed to kill an animal, marry or engage in initiation. It is after cleaning ceremony has been conducted at the funeral that the people are now free to carry out their normal duties. Burial usual takes place early in the morning or in the evening (five to six) and three to four days later the family members and relatives are shaved to mark the end of mourning and allow people to resume normal life.

8. KAPETATUK

We started the meeting with twenty five men some of whom were elderly others looking much younger. There were also four women and two children in the interview. Many more people joined till the number in attendance swelled to thirty nine, some of whom are listed below (see, p. 26). Kapetatuk is considered an important wet season grazing reserve. Those who migrate to graze as far as along the Kenya and Uganda border usually come back here with their large number of cattle. The place is therefore called a place of many livestock. Lomokomar was the founder of this settlement. As a cattle raiser Lomokomar migrated and settled around this place long ago (none of those in the interview would remember how long ago). The people who live

here belong to the Nasenyoka (Esonyoka) clan and they have the following five ere: Lomokomar, Aalim, Loporuto, Lomojong, Ekaran and Kooli.

What are the traditional duties of men and women living here and especially in relation to the environment and heritage conservation? Men have always had such central roles as listening and judging cases like theft of shoats (sheep and goats together), conducting initiation ceremonies for young boys, presiding over marriage ceremonies and participating in all important events in the community, helping to resolve disputes in the community, supervising various herding units, land protection including the conservation of the environment. The elders plan land use and demarcate it for ownership among the sub-clans and eres. One elder said, 'when you look around you will certainly notice that there are many trees here and there is no sign of cutting down of trees here. The elders ensure that those owning portions along the lugga do not destroy the trees because the trees provide the essential needs of their food needs and feed and medicine for our livestock.' This place receives very little rain and the shrubs and the trees must be seriously protected. When someone cuts down a family tree he is severely canned but when anyone cuts down a tree of another family he is finned ten goats or one camel particularly if the tree is ewoi, edung, esanyanait, ekalale or esokon.

What are the main uses of the primary trees? Ekalale fruits are eaten by livestock and people, but its leaves and flowers are eaten by livestock. Esanyanait pods, leaves and flowers are consumed by livestock during dry season. Ewoi flowers, pods and leaves are used by livestock. Its pods are consumed by people and livestock and its leaves and flowers are essential livestock feed. When an ewoi tree dries up it is used to provide firewood and charcoal for domestic use for cooking and for sale. Esokon is used to supply the people with tooth brushes. Elim tree supplies the materials for construction of various structures and its leaves are eaten by livestock.

Ekurichanait is used to make all the traditional Turkana stools, utensils (plates, cups and spoons). Edweite supplies the same traditional stools and utensils. Edung provides the main food needs of the community, but its fruits must be boiled long enough to make them edible, and so are elamach fruits. Some trees provide medicine to the community. First, echuchuka fluid is used as

an effective remedy for stomach problems (acidity and ulcers). It induces vomit through which the sickness fluids are removed from the body. Emus serves the same medicinal function like echuchuka, erodo, echokokile, ekabonyo- all act in the same way as echuchuka inducing vomit and treating stomach ailments.

Where do you get the feathers and what is their importance? Most Turkana men wear huts with ostrich feathers in ordinary life they have little meaning but in traditional ceremonies they serve important marks for the occasion. The feathers are important during marriage ceremonies.

In the initiation of boys which was dramatized, the initiates usually come from helplessness state requiring support to full responsibility of adulthood, they youth must stand up, be strong as they undertake the challenging life encounters.

When does marriage occur and what does it involve? After initiation comes marriage. Marriage begins with engagement (elotol) during which the mother and father of the girl are given a fat rum and tobacco privately by the boy admiring their daughter. When this has been done the engagement is made public and bride-wealth offered to the girl's family. Usually a huge responsibility several relatives and fruits contribute to the bride-price. The normal customary price given includes: a hundred camels, a hundred cows, five hundred goats and one to four donkeys. The marriage ceremony is sealed by killing a bull and putting on the pete around the neck of the wife. The bride is then introduced to the family during which time she is given gifts to start life (gifts of livestock).

When is the girl brought home? Before the bride-wealth is given to the girl's family she should have already left to be with her husband's family (her family of procreation). Once a ram, fat and sugar have been given to the bride's family she is usually grabbed and taken to her new home>

What are the roles of women? Turkana girls and women have similar duties. It is the basic duty of women to construct houses, look after small stock, cut branches of acacia for building family structures and animal sheds, fetching water, preparing hand-dug water-points in the lugga, burn

charcoal and sell to acquire other things the family needs that can be contained from shops in Lokichar, cooking for the family, gathering wild fruits and cooking them for the family to eat in the evening.

Which items do women use in the homes? Items used by women in domestic work include Utensils (sufurias for cooking and carrying water, and plates) and water gallons. Young girls made and prepared skins (important traditional clothing), smeared red soil on the hair, bead-making and decorating the beads, watering livestock, supporting the mothers in gathering wild fruits and fetching water for the family, women gave food and water to their husbands.

Gathering Points: Elders Trees

Whenever there is an issue facing the community such as sickness, drought, the elders come together under the tree (ewoi and esanyanait) and slaughter a camel, goat or sheep and share the meat with God and amongst themselves. After sharing the meat the most elderly person stands up with a spear in his right hand and leads the prayer (agata); a special prayer made under adverse condition and conditions of great need. The ceremonies are usually conducted very early in the morning. The animal is killed at midnight and nobody interferes with it till morning when it is cut and roasted, then smaller pieces are cut out and offered to God first after which prayers are made and people disperse. We visited and noted two tree sites: a meeting tree (enter coordinates) and initiation tree (enter coordinates).

There are church adherents who usually go to various churches in Lokichar to pray especially Roman Catholic Church and Reformed Church. Music and dance are usually characteristic of marriage ceremonies. The persons at the interview all indicated that there are no myths or traditions commemorating events in the area.

Attire: Turkana men usually adorn in unique ways and carry several articles with them. The personal items of every Turkana man include; a walking stick, traditional stool, spear for killing animals and notching livestock and is a sign of protection, and a knife (abaidat) with a leather layer used for defence and for cutting meat. Women braid their hair mow-howk style smearing it

with oil and ochre. Both men and women wear shukas, beads and bangles of various colours as customary markers. The following individuals were at the interview:

Egiron Ekitoe	Awesit Nangolerupo	Agitait Ekaran
Lokwaoilongormug	Awoi Ikari	Nakuwa Akasukwout
Bogoita Alim	Nangoduk Loyomo	Aperit Nawet
Aliwot Longorimug	Ngikamatak Nakuwa	Lotakuny Longor
Lobolia Ikari	Loyomo Lomojong	Ekaran Ingole
Lopei Alem	Julius Amoja	Lokwama Ikapol
Echaa Lomojong	Taakaem E John	Nakengi Ngakah
Aregae Alim	Longorimug Lotwal	Kisike Alim
Loporicho Lomojong	Lochodo Lomokomar	Ekitoe Ekomwa
Abengo Lojore	Ekaleruk Lomokomar	Lokipi Alim
Ekolan Loyomo	Kooli Esekon	Emuria Loposimong
Namedi Nakuwa	Lokeno Alimikai	Losingen Loposimong
Akiru Lomojong	Lomojong	Ekiru Epuu

9. LOMOKOMAR

We had another interview on the twenty six at Lomokomar. We started off with four elders, five women and five children and the others joined later.

Lomokomar is the name of the elder who started living here long ago. Many people and generations existed before we were ever born they said. Lomokomar derives from abnormal horns: one normal and the other overturned. The people are Esonyoka clan and there are four ere in Lomokomar: Loputiro, Ekaran, Engole and Emaniman.

History: when did the first settler in Lomokomar come and where did he come from? The interviewed group did not know when Lomokomar settled here and where he came from. They

do not remember any myth or story narrating such event.

What are the major roles of family members? A Turkana family is made up of a father, his wives, children and livestock. The people treasure large families and are therefore polygynous. One of the elders indicated that a typical Turkana family could have ten women and twenty or more children.

Birth and Childhood: when a child is born a ceremony is performed to welcome the child into the family. A ram is killed and eaten together with edung, but this is basically a women ceremony where only women participate. After welcoming the birth there is a period of seclusion for the mother and the newborn. Thus another ceremony of reintegration (inviting them out of isolation from the rest of the community) is performed. It involves the slaughter of a goat and cooking of animal fat which the women share and the kid is shaved by the first woman of the family. It is after shaving that the child could be given to other people to carry the child is also taken to the father. Naming is usually done immediately after birth. Names are called out and any name that will be mentioned and the child begins to suckle will be the name of the child. Children are also named after other people, events, trees under which a birth takes place (e.g. ekalale, esanyanait, etis, eregai etc). The main food for children is breast milk, milk and fat from livestock. As they grow up children are taught appropriate roles related to homemaking and the pastoral economy while girls fetch water and water livestock, boys herd the livestock and defend the community.

When does one become an **Adult**? The maturity of children is noticed by the physical changes happening to their bodies as they mature the boys concentrate in livestock herding and later after asapan (initiation) they become adults allowed to marry and take men's chores. As with boys, girls' physical changes are noted: development of breasts and they are charged with fetching water and buying items from the market for family use. The girls are never initiated.

What is involved in **Initiation**? The climax of this central traditional process, young people sit down together under a tree and lean on it. Animals are slaughtered and initiates and elders share

the meat. After that the initiates are smeared with dung from the slaughtered animal and then sprayed with water. The water is held in a wooden container and splashed out by the elder on the initiates using a calabash. The most elderly person living officiates the ceremony (the elder was said to be over a hundred years old officiated such events). The event usually starts from around ten am and ends by midday basically for security reasons and if it goes beyond that time it would not be blessed by God. Every initiate must be taken by a guardian. Note that when they sat under the tree they had to be supported to get up. The guardian takes the initiate for several days and introduces him to the world and shows him all things that he needs to know: livestock (goats, sheep, camels, cows, and donkeys), various plants and food items like milk. The initiate used to take seven days with the guardian but today due to various commitments of the elders the periods lasts for only four days. Consumption of millet, sorghum, local brew (ngimeturana) is usually greater.

Roles of married men: Men are the pillar of Turkana nation providing security, medical needs during sickness, supervising and liaising with other elders from nearby eres on issues related to grazing and security.

How are disputes resolved? One of the possible problems faced by the community relates to adultery. When this is noticed the culprits are arrested and brought to the tree of elders and interrogated to confirm the allegations. If found guilty they are severely punished: both are canned and forced to sit in the hot sun for several hours, but the man must also pay a fine almost equivalent to the customary bride-price paid (five hundred shoats, twenty cows, twenty camels)- the bride-wealth typically includes two hundred to four hundred goats, thirty cows and forty camels.

What are the **Roles of Women** in your community? Women are active members of the community involved in constructing houses, homestead structures, fetching water for livestock, collecting fuel-wood for cooking, watering livestock, burning and selling of charcoal, looking after goats, shaking the trees for pods and leaves for feeding the livestock, going shopping, taking care of children and sick persons and cooking and serving them with food. When a woman takes charcoal to Lokichar it is sold to acquire maize flour, beans, sugar and tobacco for

the family. In many occasions the women gather wild fruits like edung and cook them to provide food for the family. Cooking and serving meals for the family is a key duty of every married woman.

Which churches are found here? Catholic, Reformed Church, PAG and SDA are the main churches in Lomokomar.

While the community insists there are no myths, they have songs and dances which are usually characteristic of the wet season when the community has enough pasture and water and during happy moments like marriage ceremonies.

Important **Cultural Sites** noted include: Tree where elders (36N 0802388 0267991) meet to discuss community matters and conduct marriage ceremonies and Lomokomar grave (36N 0801424 0267021).

The Lomokomar interview was attended by the following thirteen persons from the community:

Lowar Loputiro	Akuwom Ekaran	Ekuwom Lonyami
Lpatiro Esil	Esekon Kamais	Atiir Ekales
Ekaran Longech	Atebo Ngamuyok	Awoi Amaler
Erupe Ngasike	Ekudud Ngasitae	
Epeyon Lochodo	Akure Lowoi	

10. DAPAR

We started off with eleven men. We did not go with Lucas Ariong for the interview because he was attending some training.

Dapar is an area with a big river and the place had dense forest. It was a very risky place where thugs would stalk and waylay people. The name echoes the risky area of mugging and death.

Dapar has the following eight ere: Esokuoy, Losantei, Lomariamgei, Naduito, Nabulucha, Dapar, Remremee, and Karepum.

Lomokori, Nakwa, Komol, Kalimnyam, Echwaa, Namacharin, Lopole, Esekon, Ngataikwan, Murkwel, Lamuuk, Etubokori, Etwen and Kangole are the main (sub-clans elders?). The people interviewed indicated that in Dapar today there are three main churches: KAG, Full Gospel and Agape.

How did the people of Dapar worship God in the past? Before the Christian churches came the people sought help from Akuj to help their life, their livestock and their children. The community members came together and called upon God to heal them and to return anything or animal that was stolen from them. An elderly man would come before God with members of his community under the elders' tree of meeting and ceremonies and slaughtered a goat and shared the meat. To seek God's face during sickness, pieces of meat cut off from every part of the slaughtered animal would be offered to God and the prayers said whenever there was need. But the community also relied on herbal medicine to address health problems. They used lorodo to treat *lobute* (swellings), *egong* (diarrhoea) and chest problems. Lorodo tubers and roots are pounded and its liquid drunk while the rest put in water for bathing. The medicine is very sharp in taste.

Men's work: very old men were not assigned heavy duties apart from participating in community rituals and ceremonies. Men in general oversaw the care of livestock and ensuring security to the families.

Women built structures for both livestock and people, fetching water and collecting firewood for cooking and selling in town (at fifty shillings a bundle). They also burn charcoal and sell (about two hundred a debe) to obtain food items for the family; women also prepare and serve meals to family members.

What are the **Main Foods** used by the community and their livestock? Livestock is the main source for food for the Turkana people supplying their meat, blood, milk and fat. Shoats are the

most commonly slaughtered being numerous. Various plants also provide food for both the people and livestock. Edung is collected and put in water and cooked for several hours to remove their bitterness. Edung leaves are consumed by livestock. Edung, ewoi and ekurchanait are the most important plants providing food for people and livestock. Ekurchanait and eminae roots and pods are used as medicine and food while ekwangorong is eaten by livestock only. Ekurchanait also provides timber for producing containers, spoons and milking containers.

What are the main duties of men? Turkana men in Dapar as others engage in the care and management livestock and family and community. Accidental fights are resolved by compensation and fine of thirty goats is usually given to the person who has been wrongfully injured by another. Men listen to various families and community disputes (resolving conflicts between one ere and another) by bringing them together and discussing their issues. Those who provoke disputes are usually rebuked and serious troublemakers forced out of the community. For theft of livestock the elders ensure that compensation is made to the offended. The tree of elders serves as primary centre for meetings and customary activities like initiation and marriage which are officiated by elders.

Marriage: being polygynous the community members usually marry from two to ten women> when they still have little children they usually stay together but when the children grow older the homes are distributed around the lugga and remain close to one another for support during times of trouble and difficulties. When women have quarrels amongst themselves they are usually canned by their husbands. A man would always inform his wife of the need to have additional hands to help with the care of livestock, this way a man keeps his family larger and larger. It is not proper for a man to marry his wife's sister. When a boy grows up he weighs himself and if fit physically and materially, goes ahead to marry and pay requisite bride-wealth: one hundred camels, two hundred goats, fifty cows and ten donkeys. He buys rings of beads of different colours and neck rings and goes to the girl's family with sheep, sugar and tobacco. Interethnic marriage is not encouraged. The people emphasized that a Pokot girl would not be married by a Turkana man.

Death: when a person has died he is carried to his home. A grave is dug in the livestock pen

where the body is buried and some livestock are slaughtered and consumed. The widows and their children are usually cared for by the brother of the deceased. Children remain with their mothers. Graves are markers of dead members of the community. Graves are only dug for the elderly people only. There are several graves in Dapar: Nakwa and Lukwel graves were marked.

Cultural Sites of **Dapar** include: an acacia Tree of Meeting and Rituals (36N 079695 0256422), and three graves- Illikwel grave (36N 0798966 0256062) and Echwa grave (36N 0797684 0256071) and another (36N 0796812 0256365).

11. LOWOIDAPAL

After the interview with the elders of Dapar we proceeded to interview the people of Lowoidapal. The following were present for the interview: Nakwa Lomojong, Esokon Erka Ewoi Lonyalang, Etit Erika, John Ekitala, Lodeng Lomojong, Logok Lomojong, Lorot Emate, Ebei Ekuru, Lokomol Ekwong, Echakan Ngataikale, Lokiru Kibakte, Esinyen Ome, Jackson Lukiria, Elim Elifan and Lokee Ongoleyo.

History: The origins of Lowoidapal is unknown. The people maintain that they have always lived here over several generations. The founder of the Lowoidapal was a man called Lomojong Lomekere who had ten wives: Atai Ekare, Nakwa, Loyomo, Ekeno, Akeru, Achwe, Maruch, Namoni, Lokorita and Iteleng.

Lowoidapal has sixteen ere namely: Kiongomo, Naskarakiru, Esalotir, Nanyania, Nasomokoboko, Natwel, Ekunoit, Naitiokol, Kalemnyang, Napalagatao, Nayienere, Naiyene, Ekale, Lomokori, Ngakakimok, Lobei Angmanki and Namuniio.

Community Duties: Children take care of the small goats and sheep. Women collect water for family use and for cooking, they build home structures (houses for people and pens for livestock, burn and take charcoal to town and prepare meals for the family. Men organise initiations and marriages, solve community problems such as theft of livestock and discipline erring family

members. When someone's child steals another family's goat he spoken to and property returned to that family. In marriage men help with negotiations and pay dowry.

Environment and Food: Various trees provide food for the people and their livestock as well as medicine for their continued health. Emus (the thorny plants) are first roasted over the fire to remove the thorns. It is then pounded with stone and put in water to boil and mixed with milk and drunk- only one cup helps one to remain healthy for up to two years! It induces diarrhoea which then relives the individual of the trouble causing fluids. Epong (only found in the hills) is useful for curing worms (*minyoo*) and stomach problems. It also heals joint pains and eases delivery in camels but it is highly poisonous and must be taken with great caution; it must be boiled and the top cream removed and thrown away. The sieved clear solution is drunk. The people consume engomo, ewoi, edung, engiminae, ekaliko, epat, ekalio, elap, elamach. Ewoi, ekalale and dung are the most important. Ewoi is pounded and added with milk and eaten> it is believed to satisfy hunger and keeps one satisfied for long. Ekalale is pound with stone and to is added milk, blood, fat and flour to make a firm paste which is very delicious and keeps one satisfied for long. Around October, edung becomes plentiful. It is collected and cooked in large sufurias for sharing with everyone. All Turkana foods are shared> but some foods are restricted especially entrails are never eaten by pregnant women as it is believed to bring bad omen and deformities.

Enemy Attack: Each member of the family remains alert to any security threat. Strangers are monitored to know their intentions. In this community Ejakan (an elder) looks into such matters.

How do you approach God which churches are found here? People today approach God through church services. There are Roman Catholic, AIC and Apostolic. Before the churches came the elders would raise their hands and ask god to help them especially if a child was sick or livestock missing. They would slaughter an animal (usually sheep of goat) at the elders' tree after which the elder would call upon god to intervene and restore the child's health or return the livestock safely.

The **Cultural Sites of Lowoidapal** that were documented include**:** Ritual Tree (36N 0806523

0259019) and four graves- Akwaita Grave (36N 0805747 0259701), Eromul Mokrion Grave (36N 0806088 0267991), Jalinga Grave (36N 0802388 0267991) and Emuk Ekwakore Ekale Grave (36N 0802388 0258976). Amaler's Grave was not visited due to shortage of time.

12. KALOUCHOLIM

The interview was carried out on the 28th July2016 and the following thirty four people were in attendance (thirty-one men and three children):

Ailet Lotukoi (VSO)	Ekeno Kamar	Naikon Nakwan
Ekai Etidong	Eyanae Kula	Ekadeli Echwa
Alerinyang Lowoton	Eligoi Lotwae	Ekwom Eserum
Emaniman Agurum	Ngimuz Adoro	Amaler Naato
Ngiduruko Lopong	Kapelo Alemuu	Ewolete Lowote
Chom Ebach	Ngipeyok Kapela	Alewot Alema
Erupe Lowoton	Esinyen Lodio	Agerio Lodio
Nanjak Epur	Lokinyi Edome	Kimat Illikwel
Lokaru Eiton	Lodes Lopong	and three children.
Lokwee Nakoo	Ereng Lodio	
Moru Lotukoi	Erupe Kula	

The founders of Koloucholem included Lopuda Kare, Lelea Etidong, Eremon, Edome, Adero, Kapokor, Kula and Naaton Echwaba. They belong to the Esonyoka clan and have the following ere: Ekai, Lokonyi, Nakwan, Kwam, Najak, Aliwot, Erupe, Esinyen, Lolimi, Lokwee, Kimat, Esokon, Ekal, Amagae, Lokaru, Kapelo, Akuma and Iwalete.

Origins: None of the people resent remembers where their ancestors came from. There is no myth or legend about Kolouchalim but they have songs and dances performed during events like marriage but there is no singing in initiation.

What happens during **Initiation and Marriage**? Sharing of meat from slaughtered animals, fat from cows, milk, sugar, tobacco, millet, maize flour and the ceremony ends with prayers from an elder. Initiations are usually done in groups among the people present in the interview five had recently undergone initiation.

Marriage: marriage begins with young men having secret relations with the girls. Sometimes such relations were discovered they would be punished severely. Turkana customs require that an elder brother must marry before the younger. Thus if it is found that the boy has an unmarried brother he would not be allowed to marry the girl until his brother is officially married. Official marriage is commissioned by the father. The father would invite his wives, sons and tell the family that one of them was ready to get married and he is ready to pay the requisite bride-wealth. The mothers would then disclose the identity of the girl and the family would go ahead to debate to accept or reject her.

After this and especially when they are in agreement that the girl was suitable to join their family. The father then sends an envoy for engagement and allows the two families to sit together. Meanwhile the boy would be in the fields herding cattle. For this engagement meeting there must be rams depending on how large the girl's family is but normally four to five rams and the same for tobacco. The rams would be slaughtered and served to the girl's parents and then the girl's family would also slaughter an animal for the boy's parents. At this stage the family of the girl asks whether the suitors were ready for marriage and if they had the stipulated number of bride-wealth: sixty camels for rich people or twenty to thirty for not so wealthy, forty cows for rich families or twenty for not so rich, four hundred shoats for wealth families or one hundred to two hundred for the poorer families and ten donkeys for rich families or five for the not so rich families. The bride-wealth would be shared among the family members systematically. The beneficiaries of such a wealth would be the following: elderly brother of the girl's father, the father of the girl, mother of the girl, uncles, girl's brothers and aunts. The elderly brother of the girl's father would for instance get ten camels, twenty goats, ten cows and a donkey.

Roles of a wife: as other women a marriage girl would engage in milking animals, watering

livestock, bring water for family use, collecting firewood, cooking food and cleaning utensils.

Which are the consumed foods? Livestock (provides meat, fat, milk and blood) and plants (edung, esokon, ekalale, ewoi, emekwi and ergai) and are the main foods of the Turkana people. Edung fruits for food to people and livestock, herbs to treat ailments and leaves for livestock. Esokon fruits for people, leaves for livestock and roots for medical care for the sick people and livestock. Ekalale fruits for people, roots for medical care and leaves for livestock.
Ewoi pods and fruits for people and flowers and leaves for livestock; black discharge is used for drinks (put in water and boiled as sugar and milk are added to it). Emekwi is main food for camels and donkeys. Ereng for people's toothbrushes, pods for people, leaves for livestock and construction materials for people's houses and livestock structures.

Because of the great value the Turkana people attach to trees they do not cut trees down or burn charcoal in Kaloucholim. The community takes care of their animals and children in the same way they do their trees from which their livelihood derives. When a person cuts down a tree he is severely punished by canning and a fine of a camel or two cows. In like manner, the community hopes that their heritage will continue to be protected. Thus the men have huge responsibilities in the society: ensure the continued preservation of the environment, care for the sick both livestock and people, by offering traditional remedies derived from plants especially esokon roots (but if the ailment persists, the sick are referred to Lokichar).

How are ersokon roots/tubers obtained and prepared? The tubers are dug from the soil, smashed and put in water, allowed to rest for sometime before being administered on the sick. It is then drink as prescribed - half two hundred and fifty grammes container for children and the full tin cup for adults.

Death: Should an individual die he or she would be given a suitable burial. Small children are buried immediately while elderly persons are buried after one day; the grave is usually dug by young men. they dig the grave in the morning or in the evening between four and six pm. mourning period takes one month and is usually at individual level, there are usually no large gatherings as happens during traditional ceremonies are held (initiation and marriage) not being

well managed or the people not living to the stipulated customs. For instance, one someone dreams that the deceased relative needs food an animal is slaughtered immediately and taken to the dead person's grave and the rest of the meat is shared by those present. Usually meat, tobacco, sugar and fat are poured on the grave as gifts to the dead.

Churches and Family Problems: Kolouchachalim people adhere to such churches as Roman Catholic and Maranatha which are in Nakukulas as well as Apostolic and Legio (Legio Maria which is basically found in Lokichar). Family problems range from theft (akoko), scrambling for water -points and pasturelands, rape. In rape cases perpetrators are arrested, interrogated and punished- the man is usually fined several livestock equivalent to what was given as bride-wealth for married women. For girls the offender is charged two bulls which are then eaten by the elders. For conflicts related to water-points and pasturelands the issues are usually brought before the elders who listen to the intricacies of the conflict and prescribe appropriate penalty.

Two Cultural Sites were noted in kolouchalim: Elders Tree (36N 0802388 0267991) and Lopudakare Grave (36N 0804707 0257236).

13. KAAROGE SEER (ACHUKA MZEE, ALIAS ACHERIASE)

Paul Wheeler-house, Lucas Ariong and I were driven to Kaaroge the morning 1st August 2016 in a rather cooler weather than usual as it had rained in the night and early morning. Achuka Mzee welcomed us to his home. We presented him with the requisite gift (a white ram, two sheets wrappers (Maasai Shukas), sugar, tea leaves and maize meal). We then embarked on the interview as Paul took photos of the seer and his home, his livestock and filmed the interview in some phases. I also administered the interview, took pictures and recorded the interview, taking some notes with an audio recorder as Lucas made the translations. The family of Achuka was present. We took pictures of the compound, the livestock, the wives, children (four sons, Ekal Mzee, Ekalonon Lukwawi, Esekon Ahuka and Daniel Achuka were photographed with their father after the interview at about eleven o'clock.

Achuka was nicknamed Acheriase after the brown sports in his favourite white bull. Achuka has several livestock in his home but his cattle are held on the hilly grasslands to the west. Achuka had a big white bull with such sports. The Turkana call brown sports in livestock *ariase*.

Achuka's father was called Mzee Lomeyananaa. Mzee (Achuk's father) had a large family: four wives and several children. Achuka was born to Mzee's first wife. Achuka's mother had four sons all of whom are now dead except Achuka. The second wife of Mzee had three sons, the third had one son and the fourth had a son and two daughters. In brief Achuka's father had four wives who gave birth to eleven children altogether. All the second mother children are also dead but they have left behind grandchildren. The third mother s son is alive but not interested with traditional matters. Of the three children of Achuka's fourth mother only one daughter is still alive (brother and sister passed away). In summary, Achuka has two siblings who are still alive- the sister who is married to Nawakring family and the brother from the third mother. Achuka s father was a seer of the Kamat clan. Achuka is now the one continuing the legacy of his father.

Why were you chosen to succeed your father as a seer? *To become a seer one has to receive a blessing following a sequence which has now seen him as a seer after his third brother passed away, he received the blessing to become the seer of Kaaroge. His living brother who lives in Turkwel River at Kalimnyam was non-cooperative and defiant to traditional Turkana customs though of nearly equal age with him could therefore not become a seer.*

Where did your family come from before you settled here? *They originated from Loima as Ngimatak clan. They first settled at Lochwaa before coming to Kaaroge*.

What made your people move from Loima? *Our people migrated from there because they were searching for water and pasture for their livestock. Lochwaa has a perennial spring of water which never dried and the place was therefore called Echwaa Ngimatak.*

What means of transport did you use during that migration from Loima? ‘Our people used donkeys to transport our personal belongings and to date donkeys continue to be used for such service. Do you have donkeys? *I have a few donkeys and they have gone grazing that is why you haven’t been able to see them.*

Which other livestock do you have? *I have all types of lives (camels, cattle, goats and sheep. My cattle are kept at the northwest as cattle cannot survive here in plains because there is insufficient pasture.*

What is the value of chicken I have seen some chicken and dogs in your home? *Chicken for me are valueless. In fact, a want they taken away from here, they are merely used by children who love them dearly and who sometimes eat them. My family loves dogs. The dogs help catch squirrels and rabbits which children also eat. Dogs also assist us with grazing livestock.*

How large is your family? *I have a large family: two wives and several children> my two wives live in this compound with me.*

What kind of work do you do? *I have many responsibilities. I listen to and make judgements over family cases and advising my family members on how best to get out of problems and live good lives. I also assist with negotiations during the marriage of my daughters< talking to the family of my daughters’ admirers and giving them over to their families. I also have an honourable responsibility of providing food for my family that is why I have the livestock (camels, goats, and sheep) that you just saw leaving for grazing. These animals are also used to pay bride-price to the families of the girls who get married to my sons. I also serve an important function as a seer of Kaaroge, reading intestines of slaughtered livestock, interpreting phenomena from shoe patterns and dreams.*

Judgements: In serving the mandate of listening to and judging cases, which are some of the cases you have dealt with? *I have handled many cases touching on marriages, theft, adultery committed in the family and fights with neighbours.*

How do you handle fights? *Cases involving fighting are brought before me. I listen to them well carefully and give appropriate advice especially that such fights should not be repeated and prescribing solutions usually a fine of a goat. That goat is taken to the elders who slaughter it and roast it and eat to show reconciliation.*

How is theft handled? *For theft cases I listen to both the complainant and the accused and make appropriate judgement. Usually a fine of two goats for every goat stolen is levied on the offender. When facts prevail but the accused persistently refuses to accept, he is canned until he admits stealing. It is the boy's brothers who will cane him in the present of the elders and after he admits to the theft he is asked to pay the fine which is then given to the offended individual or family.*

How do you deal with cases of adultery? *Once such a case has been brought to my attention, I call two other elders to help me listen and judge the case well. If the accused is proved guilty of such offence he is finned a certain number of livestock and then warned to keep away from the woman. The fine for adultery is forty-two animals: thirty shoats, five camels, five cows and two donkeys. This fine is given to the members of the family of the woman who was defiled, and is subsequently shared out freely by that family. The woman or girl is usually canned by her parents and relatives (not the husband s family). It should be noted that the adulterous man having been warned but persists in the act will eventually die.*

How long does it take to resolve *a case such as adultery?* The adultery case usually lasts for ten days.

Please, now tell us about your work as a seer: how do you read the intestines, work with the shoes and handle dreams?

Reading intestines: *Whenever a goat has been slaughtered the intestines are placed on a flat surface read. The things that are usually seen are rain, drought, diseases, war, conflicts or raids. Whenever I see any of the above problems I summon the affected family or section of the community and disclose the matter to them and advise them appropriately on what to do to avert*

the impending problem as soon as possible, for example, to migrate in case of a raid or drought or kill another goat and conduct a fitting ritual to prevent the occurrence of disease or invasion. In case of a disease problem in a certain family, the family is advised on what to do whether to slaughter an animal in the night and sprinkle water on the affected or to gather at the elder's tree and conduct the ritual slaughter there. The slaughtered animal must be of a specified colour and gender as prescribed in the reading (e>g a black female goat or a white male goat.

Shoes: The pair of sandals is place on the ground and some tobacco is put on them before casting the pair of shoes. The resultant pattern formed as they land on the ground will be read and prescriptions made. The brown leather sandals were passed on to me from my father Mzee. They are made of giraffe hide. If the shoes spread out without lying on the other, it is understood that there is no trouble. But if they are touching at a certain inclination or upturned there is a problem- it could be a flood, drought, sickness or raid.

What is the role of tobacco in this activity? Tobacco is used to solicit permission from my father to give me an understanding of trends in the family health and advise on prescriptions for identified problems.

What might you see in case of drought? When drought is detected there may be advise to emigrate, or ask an elderly person to come and pray in a traditional way (slaughter an animal, give pieces out Akuj (God) and share the rest of the meat with people present and pray. For invasions, the people may be advised to migrate to safer places or to ready themselves to fight the enemy. In that case the warriors (*ngingiroko*) are prepared by giving them weapons and advised on effective strategies to fight and win over the enemy.

Dreams: *Whenever I have a dream relating to any matter (be it floods, drought, disease outbreak), I am also given ways to address and solve the problem(s). The same dream may, for instance, advise that it is best for the community to migrate. In these dreams I believe it is my father (Mzee) who comes to me occasionally to help the community with impending problems. I have had a number of dreams in the recent past. I dreamt about a Whiteman coming for oil exploration and for the seismic cables which came to me as auno (string) and in the case of the*

perennial Pokot-Turkana conflicts. I dreamt that two brothers who have been fighting for so long sharing one plate in the form of blood of a white cow. The dream meant that peace and harmony had been restored among warring groups.

What items do you use for your work? *I use a number of items while performing my work as a seer. I must dress up in traditional regalia as you see, have a bull's horn (*amwara*) in which tobacco is contained, shows (a pair of giraffe sandals), a long horn with a cows tail which is a symbol of authority as a seer and it also holds some tobacco, a spear which symbolizes power and a walking stick which is a normal item for all Turkana men.*

In relation to officiating core community cultural functions as initiation and marriage, what is your role in these? I do not officiate any of the above functions but other elders do so. I only go to these ceremonies as a participant if and when I am invited.

How is initiation done? *Normally the group of people to be initiated comes together bringing with them presents* to the place where the ceremony would take place. Each initiation candidate comes with a goats, tobacco, new sheets, beads, animal fat. When they are ready, each slaughters his animal and all slaughtered animals are roasted and shared out among the them and officiating elders. The initiates sit down next to a tree with their arms at the back and legs stretched out in front of them. While at such a position the most elderly person officiating the ceremony says a traditional prayer and water is sprinkled the initiates, two elders the help the initiates to stand (get up).

How is the initiation food shared? *There are two classes of food and items brought into the initiation forum: first are the animals each candidate brings a goat for the ceremony, which is killed, roasted and shared as a common meal for the people present at the ceremony. The other items include tobacco, sugar, beads, sheets and shoes which are given to the guardians (sponsors of the initiates).*

When does initiation take place? Turkana initiations take place from nine o'clock *in the morning till midday and must not go beyond the stipulated time otherwise the ceremony must be repeated*

if the time is passed. Tradition specifies that initiation ceremonies must last until midday and any ceremony that goes beyond such stipulated is considered a failed even which then must be redone.

When does marriage take place? What happens during such event? When a son of my family wants to marry he identifies a suitable girl from a family in another clan. I then organise the engagement team to visit the in-laws (the family of the girl). During engagement if the family is large two rams are slaughtered but is it is small only one ram would be slaughtered and eaten. In each case a bunda (a kilo) of tobacco is given to that family and serves as a binding factor, just as is performed at birth to bring together the new born with the world and family.
After engagement they return home to collect livestock for the bride-wealth. The bride-price is varied between the rich and the poor: whereas the poor give out thirty to forty shoats, the rich give two hundred to four hundred, thirty to fifty camels for the rich or tent to twenty for the poor, fifty to a hundred cattle for the rich or as few as ten for the poorer, and ten donkeys for the rich or two to five for the poor.

What are camels used for in the Turkana community? *Camels are significant in Turkana as a sign of permanent relationship as it survives anywhere and provides plenty of milk. Camels are given as bride-wealth during marriage, but also camels are given to friends and brothers as a symbol of genuine friendship and trust.*

What is the importance of community trees? The Turkana people love trees very much. They rest under them to escape the scourging heat of the sun. But more importantly there are trees where community ceremonies and significant functions are held. Every section of the community has an elder s tree where initiations and community cases are discussed and settled. The most important trees to the Turkana people are ewoi, ekalale, elim and edome (in order of their value in the community, beginning with the most important to the least).

How does the community deal with diseases and death? *The community relies on traditional and modern ways of dealing with these critical matters of existence. When a problem of grave magnitude such as disease or threat of death is experienced or revealed to the community by the*

seer by either reading of intestines, shoes or dreams, other elders are invited to the victim's home and a goat or sheep of a preferred colour and gender as directed by the seer is slaughtered, roasted and small pieces of meat cut out from various parts of the carcass is thrown about randomly by the officiating elder (seer). Finally, a prayer is conducted by him or someone delegated to do so. The prayer is called agata. After the prayers, water is given in a calabash to the seer who proceeds to sprinkle it on the sick person to cleanse him or her from sickness or impending death. For a sick animal roots from specified trees are extracted smashed and soaked in water and given to the animal to drink. The plants mostly used for treatment are egis, etestro, echuchuka and eligoi. Today, however, some people rely on veterinary services and medicines as well.

How do the Turkana perceive death? *For the Turkana death is perceived as a bad thing. When a child dies it is mourned and buried immediately after digging the grave. The grave is dug by the brothers or family members. For an elderly person the burial could be done the same day in the evening or early in the morning of the next day. When an elder has been buried, animals are killed and eaten. The family members are shaved a day after the burial. The grave is also usually dug by family members or young men. There are usually no prayers. The mourning period lasts for five to seven days. When the man dies the widows are isolated in a closed room for a while and will only come out when they have been shaved. Shaving the family after a member of the family has died symbolizes that a close family member has died and the family must be cleansed by shaving so that the misfortune could be kept at bay. Whereas only the forehead of initiates are shave at initiation, for deaths the entire hair must be shaved leaving only a narrow strip at the centre.*

14. SUMMARY AND CONCLUSIONS

The interviews with the remainder of the South Turkana community were done from the twenty first of July to the first of August 2016. All the planned communities were visited and interviews conducted except at Tirikol where the people refused to talk with us as their elder was not

around. We returned a week later but the elder had not returned. The interviews followed the prepared guide noting the villages, dates and times of interviews as reflected in the pictures of interviewees and digital audio records, and coordinates of significant cultural sites (elder s trees and graves) were taken using a GPS and noted (Annex 2 & 3).

The persons attending the interview were counted and names recorded (see lists under each village and Annex 1 column three). The interview centred on settlement and land use, religion and beliefs and the intangible cultural heritage. It took a life cycle, environmental and roles approaches- touching especially on birth, initiation, marriage, death, livestock management, livestock and people s foods, medical care, roles of children (boys and girls), women and men and finally the place and work of seers, for which the seer of Kaaroge, Achuka Mzee, was selected and interviewed as the climax of all the work for the second phase of community consultative forum as a basis for environmental and social impact assessment (ESIA) as required by law to evaluate the impact of oil production (explorations, discovery, drilling, transportation and processing and eventually sale), background information about the Tullow Oil activities in Kenya was distributed during the interviews.

The results depict a similar pattern with the first phase and the data from this phase will enrich and clarify some of the information obtained in April. For instance, the various pictures capturing recent cultural activities confirm the vivid ceremony we witnessed in Nakukulas. This indicates a similitude of the ritual process over the region. The most common clan is Esonyoka and the eres vary from four to sixteen (Annex 5). There are several churches (Annex 6) which are likely to infuse new traditions and thoughts in the community alongside the schools and may soon contribute to slow culture change. Already there are new housing forms using modern materials (iron sheets, blocks, and tiles). As indicated in the previous phase, the information contained in these pages may suffer from typographical errors or translation. Much effort was made to capture the facts as closely as possible but some gaps may remain, nevertheless. We would like to thank all elders, men, women and children who volunteered useful information to us. We also thank Tullow for hosting us in Kapese and financing the survey.

APPENDICES

Annex 1: Summary of Interviews by Date, Villages and Number Interviewees

Date	Village	Number of Interviewees	Photo Number DSCN	Digital Record	Notes
21/7/2016	Kasuroi	36	7264, 7265, 7267	18	Very productive. It had the second largest number of people at the interview.
22/7/2016	Nawoiyalim	6	7326,7327,7335-7340, 7343	19	Despite being least attended, it was also very productive and the voices of women echoed their heritage.
	Akibuket	20	7382-7403	20	Very productive
23/72016	Tirikol	12	-	-	Three men, five women and four children gathered but could not speak to us because their elder was not around.
	Kaikol	16	7406-7419,7442-7448	21	Very productive
25/7/2016	Amoruakwan	27	7449-7489	22	Very productive
	Nayanae Engol	26	7518-7536, 7540-7552, 7554	23	Very productive
26/7/2016	Kapetatuk	39	7570-7607	24	Very productive and had the highest number of people in attendance.
	Lomokomar	13	7616-7625, 7628	25	Very productive
27/7/2016	Dapar	9	7642-7654, 7658-7672	26	Very productive. We took down only two names. The pictures can give the exact number in

					attendance.
	Lowoidapal	16	7674-7677, 7737, 7769-7780, 7817-7823, 7829, 7831	27	Very productive
28/7/2016	Kolouchalem	34	7852,7864,7866-7917,7921-7926, 7931-7935	28a, 28b	Very productive
29/7/2016	Tirikol & Kimirik	-	-	-	The Tirikol elder was still away. The other village was just the same as Kasuroi. There was no one in Kimirik
1/8/2016	Kaaroge	6		30	Very productive. We got the seer and saw his livestock and family. He demonstrated how he works with sandals to foretell events.
Total	13	260		13	Successful interviews with useful data highlighting the Turkana cultural heritage

Annex 2: Elders' Trees by Village and Coordinates

Village	Tree	Location	Notes
Kasuroi	Ekurchanite	36N 0795893 0273925	
	Ekurichanait and Esekon	36N 0796170 0273945	Central meeting spot.
	Acacia	36N 0795841 0274890	Participants in a ceremony gather under the three acacia where they share meat.
Nawoiyalim	Acacia	36N 0801022 0283306	Central meeting spot.
Akibuket		36N 0798613 0281876	Central meeting spot.
Tirikol	-	-	-
Kaikol	Ekalale	36N 0800102 0275532	Central meeting spot.
	Acacia	36N 0800105 0275538	There are three acacia and another ekakale. The elders sit between two acacia and ekalale.
Amoruakwan	Acacia	36N 0797497 0272123	Central meeting spot for first family group on the west
Nayanae Engol		36N 0800098 0269245	Central meeting spot.
	Acacia	36N 0800381 0269353	Used by Maranatha Church for its services.
			Central meeting spot for family group on the east was not visited
Kapetatuk	Acacia	36N 0800744 0267087	Central meeting spot.
	Acacia	36N 0800871 0267320	Recent ritual activity noted- an initiation ceremony.
Lomokomar	Acacia	36N 0802388 0267991	Central meeting spot. There are five other satellite trees nearby.
Dapar	Acacia	36N 0796995 0256422	Recent ritual activity noted an initiation ceremony.
Lowoidapal	Acacia	36N 0806523 0259019	Recent ritual activity noted
Kolouchalem	Acacia	36N 0804870 0251194	Recent ritual activity noted an initiation ceremony.
	Ewoi	36N 0804872 0251189	

Annex 3: Graves by Village and Coordinates

Village	Grave Name	Location	Notes
Kasuroi	?		
Nawoiyalim	Aman Lochuch	36N 0800634 0282848	
Akibuket	Nachokopwa	36N 0798613 0281876	
Tirikol	-	-	
Kaikol	Losil Nasenya	36N 0800323 0275772	Nasenya was a seer and founder of Kaikol settlement. The grave is visited by the community whenever there is need especially on Sundays. They come with sugar, tobacco, and slaughter a goat and ritual activities are presided over by the eldest son living.
Amoruakwan		36N 0796604 0271831	
Nayanae Engol			
Kapetatuk			
Lomokomar	Lomokomar Elder	36N 0801224 0267021	
Dapar	Illikwel	36N 0798961 0256062	
	Echwan	36N 0797684 0256071	
		36N 0796812 0256365	
Lowoidapal	Akwaita	36N 0805747 0279701	Wife of Mokrion
	Eromula Mokrion	36N 0806088 0258976	Husband of Akwaita
	Jalinga	36N 0805831 0258783	
	Emuk	36N 0799338 0261684	
Kolouchalem	Lopudakare	36N 0804707 0257236	

Annex 4: Photos

Item	Photo Number	Notes
Camels	7512-7517, 7689-7700, 7969-7983	Very hardy and most precious
Goats	7342, 7378-7380, 7437, 7506, 7510, 7511, 7656, 7754, 7555, 7557, 7759, 7563-7569, 7833-7847	Mostly used for food and rituals, they are the animals given out in large numbers during marriage
Sheep	7785, 7860-7862, 7927-7930	Are not mentioned I most discourses but usually considered alongside goats.
Donkeys	7757,7758, 7760, 7761	Donkeys serve in transport and are also given as bride-price
Chicken	7267	Owned by Children for food
Dogs	7268,7269, 7283, 8027, 8028	Help with grazing and hunting
Graves	7365-7373, 7425, 7426-7430, 7490-7499, 7631,7632, 7678, 7680-7682, 7684, 7701-7709, 7734, 7738, 7741, 7765-7768, 7808-7816	Dead men and women elders of various community's have grave across the region which were marked out using a GPS
Sites with Marks of Recent Rituals	7611-7615, 7710-7730, 7789, 7793-7803	Various tree sites indicate signs of recent ritual activity
Charcoal Burning	7330, 7359-7360, 7362-7364, 7752, 7753, 7832	Is becoming an important economic activity but may soon be a threat to the trees.
Charcoal Selling	7307, 8260, 7285	Sacks of charcoal by the roadside awaiting buyers
Important Trees	7294-7298, 7339-7342, 7374-7377, 7388, 7404, 7405, 7420-7422, 7500-7505, 7537-7540,7553, 7558, 7560, 7561, 7608-7613, 7650-7667, 7936, 7937, 7918, 7919	Trees provide food for livestock and people, shed and meeting places for community cultural functions, some provided cure to health problems and drinks, dry and dead ones supplied wood-fuel and charcoal. While there are several trees, ewoi (acacia) and ekalale are the most important trees for the Turkana.
Pod Rods	7792,7961-7963	Such rods are used to harvest pods for people's and animals use.
Structures	7260-7262,7286-7289, 7290, 7304-7306,7308,709, 7319-7325,	Show continuity and change taking place in various parts of Turkana South

	7331,7350, 7351, 7354, 7355, 7358,7435, 7436, 7438, 7505-7637, 7638, 7639, 7830, 7964,7965	
Watering Livestock	7562, 7563, 7565-7569	Tullow drilled tanks where water is available for livestock and people.
Hand Dug Wells	7781-7788	Such well as found in the main luggas to supply the people's water needs. They are usually dry.
Dramatizing Initiation Process	7588-7590, 7593-7596	This provided a graphic display of the rite of initiation depicting a rise from helplessness to firmness.
Hills		Cattle graze around the hills to the west
Maize	8011	Crops like maize could be well here if rains are abundant or through irrigation.
Achuka Mzee	7317, 7318,7320, 7321	The seer of Kaaroge
Achuka's Family	8041,8034-8037	The seer has two wives and several children.
Achuka and Four Sons	8095-8097	Four of the seer's sons were around when we interviewed him.
Seer's Assistants	7311-7316	Mzee has two assistants.
Seer & Sandals	8077-8083	Demonstrating how the seer uses shoes to foretell societal matters especially conflicts, drought, illness, floods etc.
Snuff making	7318, 9320, 7321	Tobacco is a very important cultural material used as snuff or chewed during meetings. Tobacco also serves in the gifts given to elders and is important in prediction using shoes.
Gifts to the Seer	8002-8005, 8014, 8018,-8026, 8028-8033	A ram of specific colour, two sheets of wrappers, sugar and maize-meal.
SDA Church Lokichar	7990-8001	The pastor preaching and the congregation gathering outside the church.
Lucas Ariong	7636,8008, 8068,8069	Most of the translations were made by Lucas.
Paul	7634, 8007	Participated in archaeological surveys with Christine and James. He also accompanied me and Lucas for the

		interview with the seer of Kaaroge.
Nyamanga	8009,8010	Conducted the cultural interviews
James	7633,7635	Participated in archaeological surveys with Paul and Christine.

Annex 5: South Turkana Clans and Eres by Village

Village	**Clans**	**Ere**	**Notes**
Kasuroi	2	14	Esonyoka and Ngimatak clans. The fourteen ere are Kasuroi, Kalkol, Natudawo, Kadongolo, Amaruakwan, Wachorokalei, Nanangakina Kaekoe Ekwan, Akou Ekori, Lomeseksil, Hoyo kwee, Kaapoa, Kalitakere, and Tirikwel.
Nawoiyalim	1	?	?
Akibuket	1	?	?
Tirikol	-	-	-
Kaikol	1	?	Kaikol belong to the Esonyoka
Amoruakwan	1		Originally Ngimatak, today their off-springs are Esonyoka clan. It is interesting to find out how such change occurs. They have two seers: Nakuyen Ewoton who is a rain seer and Loree Lotone seer of diseases and misfortunes.
Nayanae Engol	1	?	The inhabitants belong to the Esonyoka clan.
Kapetatuk	1	5	The people are Nasenyoka (Esonyoka) clan and have the following five ere: Lomokomar, Aalim, Loporuto, Lomojong, Ekaran and Kooli.
Lomokomar	1	4	Esonyoka clan and there with four ere: Loputiro, Ekaran, Engole and Emaniman.
Dapar	1	8	The eight ere are: Esokuoy, Losantei, Lomariamgei, Naduito, Nabulucha, Dapar, Remremee, and Karepum.
Lowoidapal	1	16	The sixteen ere: Kiongomo, Naskarakiru, Esalotir, Nanyania, Nasomokoboko, Natwel, Ekunoit, Naitiokol, Kalemnyang, Napalagatao, Nayienere, Naiyene, Ekale, Lomokori, Ngakakimok,

			Lobei Angmanki and Namuniio.
Kolouchalem	1	18	They belong to the Esonyoka clan and have the following ere: Ekai, Lokonyi, Nakwan, Kwam, Najak, Aliwot, Erupe, Esinyen, Lolimi, Lokwee, Kimat, Esokon, Ekal, Amagae, Lokaru, Kapelo, Akuma and Iwalete.

(Lucas was to send information for confirmation of this part and fill gaps)

Annex 6: List of Churches

Church	**Notes**
Roman Catholic	Mentioned in nearly all sites
Reformed Church	Mentioned in nearly all sites
Maranatha Church	Mentioned in nearly all sites
Seventh Day Adventist (SDA)	Mentioned in nearly all sites
Legio Maria	Mentioned in nearly all sites
New Apostolic	Mention in some places
Pentecostal Assemblies of God (PAG)	Mention in some places

Although these churches exist among the people the community remains traditional maintaining its customs of initiation and marriage. These churches might slowly impact on the community in the long run.

Cultural Heritage

C7

4 Turkana Burial Practices

TURKANA BURIAL PRACTICES - SUMMARY

The following summary document was prepared by Lucas Ariong (TKBV, Social Performance) in 2016 and provides a summary of Turkana burial practices. This summary was used to help inform and contextualise the findings of the Key Informant Interviews and field walkover surveys that were conducted in 2016.

TURKANA PEOPLE'S BURIAL PRACTICES

The Turkana eminent people's burial sites are the places where died ones are laid to rest and be visited by the members of family. Turkana way of burying individuals differs from a class to class. These classes include prominent persons, poor people, women, young persons, middle aged, widowers, widows and children. All these individuals are buried by their families members and willing neighbours.

1. Eminent male persons;

Only, the eminent persons are buried by members of the family, relatives and age-set group. The youth mostly the sons of the eminent deceased person are allowed to dig the grave right at the centre of the goats structure or enclosure traditionally known as ***" A NOK"*** with the rest of mourners sited silently waiting for its completion. The body is lowered into the grave by the family members and the eminent deceased person age-set. Once the body is drawn into the grave, it is then **fully sealed** with soil initially extracted or burrowed out of the grave. On top of the soil, the heap of stones is piled on for easier identification of this grave in future. The collection of stones placed together on the grave forms lasting conspicuous elevation***.***

The final works on the grave is the heaping of branches of tree and thorns previously used in erecting goats' structure where kept for a safe night. The burial for a very important elder, seer and a rich man is a loud speaking sign of respect and recognition of his contribution to the well being of the family and a clan at large.

Later in time, the family relocates to a new site away from the grave usually 200 -500 metres to allow the deceased eminent person rest in peace. Customarily, it is believed that the deceased person had tirelessly worked while a life and therefore he requires maximum rest. Movements from people and animals as well as noises are treated as a total disturbance to the deceased person.

However, the **eminent** deceased person (mostly seer and a rich man) is regularly visited by family members, relatives and members of his age –set. During the visit, food in form of milk, meat from fatty slaughtered goat especially the ram and tobacco is supplied/given under the supervision of a senior most member of the family. The milk is poured on the grave. The meat is cut into smaller pieces and randomly dropped around and on the grave environment. Tobacco substance is also sprinkled on the grave accompanied by the word of prayer from the senior most persons administering the event. The celebration is concluded by cutting down fresh branches of trees and heaping them on the grave. By so doing, the deceased person is sheltered or protected from the natural catastrophes namely rain, hot sun, wind and destruction of grave by predators.

Upon your inquiry, it is worth noting that heaped soil, collection and piling of stones in larger quantity and regular visitation by the family members hence the renewal of grave's

"shade" makes such graves identical even after several years. The existence of such very important graves lays the foundation of ***"ERE"*** for the family and relatives. The family members, off-springs and relatives will always make strenuous effort to have active permanent residence *"manyatta"* within and around the grave site. The family will endeavours to make the grave area a territory where it can be identified and links to the deceased prominent person since such persons are believed to be existed in spirit ***–"living died".*** The living died remains strategically accessible for consultations by family members and age-set (especially a seer) whenever things go wrong. The moral convictions to the deceased eminent person are absolute and it never erodes out of the mental acceptance of the Turkana people.

2. Female persons

The family members' traditionally do not visit and preserve the graves of their deceased female persons. These graves are less than always, but more than occasionally abandoned making it difficult for anyone to recognize and appreciate. It is in this regard that we can comfortably say that upcoming young people lack automatic flow of memories about their female fore-parent, female grandparents and female relatives who passed over before they were born. The fabric stitches between generations cannot clasp any data about graves of the female persons making History helpless to that end. The graves of female persons among Turkana unfortunately go un-preserved. The notion has been nothing but subordinating the roles of female Turkana person making them equals to poor persons and as well as children in the society. No one has ever recognized and valued extreme important role played by Turkana female persons. The Female Turkana class play a sombre role to be specific on traditional medicinal knowledge, caring for the elderly as well as children; some are talented prophets; divine inspiration, without forgetting the science of midwifery role.

As a matter of fact, whenever a woman dies Turkana people run into less pain. Once buried under a traditionally shelter built by herself when she was a life, soil heaped and stones piled on the grave and rituals performed and observed, little is done to keep the memories fresh about her any more. The rest of family can migrate away without plans to visit the grave yard at any one point. Little is done to update and uphold the relationship between the "living" and the "living died"-women. Less is projected in remembering of female contribution on bearing children, watering and providing secure environment for livestock, caring for the family and preparing for the girl child for marriage in future. Instead, women are just treated as subsidiaries to Turkana man's life. The attitude is what makes female Turkana person not to receive a worthy of respect burial hence their graves being not placed in traditional plan of continued visitation alike to the male counter parts. They are buried, forgotten like poor persons and/or children.

The reality of such grave sites can only be ascertained through social interactions and searching for information from the senior members of **"ERE"** who might have witnessed the

burials of some female Turkana individuals if need be. More information is required on the graves in general so as to avoid future conflict during EOPs development.

3. The Poor persons

The people referred as poor according to the Turkana community are those with less population of livestock. For instance a person with cows **0-10,** camel **0-12**, goats **10-25** and sheep **3-6** falls under in this class.

In terms of family size, such persons have one wife with 0-2 children. Their children are not any way married to persons from richer class. The poor persons are seen as persons without value to the community. They are not allowed to participate in public matters like decision making. In gatherings where serious judgements are considered, these persons are ordinarily seen sited at the back of the crowd with women and children. And in worst scenarios, these persons are not entirely accepted in gatherings of purposeful focus. The purposeful focus meetings where the seers and supreme elders conduct traditional rituals such as traditional prayers the poor, women and children participation or presence is outlawed.

Of the time of their death and burial of the poor persons, none of the community members singles out an interest to share with others about this death occurrence. The poor persons are buried only by family members that comprise the wife and children. There is no traditional designated site within the homestead for burying the bodies of the poor persons. Instead, the grave site decision is left solely on the hands of the family members. The family may decide to dig a grave anywhere within the family vicinity or throw the body to the bush with the relationship being cut off fully. In this state of affair, the body is left un-buried on an open ground for vultures, hyenas, foxes and wolves to feed on.

The relationship between the “living” and the poor deceased person ends there. Because of the status of the family and the class of the deceased, there is no fledged celebrations undertaken whatsoever as a sign of honour and chivalry in remembering the late. The grave therefore remains un-reserved and permanently grows fainter from memories of all persons in an epoch not less **4-8** years if on rocky surface environment and **2-4** years in softer soil environment.

4. The children

This class includes foetus, children up to an age of 18. These persons are not yet identified and classified as important members of the Turkana community. They have no rights of property ownership; instead they only depend on their parents in full provision of life necessities.

When children pass away (die), their biological parents, brothers, sisters, closer relatives and family friends gather together to bury the deceased child. The grave is dug at any

location within the family homestead; especially at the western axis of the home enclosure. The grave after immersing the body is covered with soil, some stones and twigs. The only traditional rituals undertaken; is the shaping of the fore-hairs of the rest of children. The family can after while migrate to a new site and life moves on with no plans of any celebrations in future. Children's grave disappeared in a period of not less than **2 -3** years if was placed on rocky/hardy surface environment and **1** years in sandy or loose soil environment.

5. Persons killed in cattle rustling raids,

These are individuals who always meet their death agonies during cattle theft or rustling. A cattle rustling is a traditional exercise practiced by pastoralist whose main livelihood depends on livestock rearing. They wander freely from place to place searching for pasture and water. During times of severe drought, the pastoralists loose several heads of livestock due to acute shortage of pasture and water resulting to ruthless livestock starvation.

However, at any time within the rain seasons the pastoralists' warriors; heavily armed youth go out to attack or raid neighbouring ethnics groups in order to replenish the lost "stock" at moments of unkind deficiency of pasture and water for the survival of livestock. At times of the raids any human being come into is never out of danger. Persons manning the targeted livestock are taken un-aware, killed to get rid of any possible resistance to the raiding "friends." Herdsmen and cattle scouts are outermost targets during such raids because their main function is to clear/killed anyone forcefully coming to away stock.

Both the raiders and the cattle defence forces (cattle scouts) killed during raiding exercise are not buried. Their bodies are left un-buried in battle fields at the mercy of **vultures, hyenas, foxes and wolves**. As the successful raiders or "friends" celebrate the loot, the predators on other hand celebrate human flesh resulting from counter less ammunition fired to and fro but in the direction of calculated destinations. On the areas of **Tullow oil** and **gas project in Turkana**, there is no single grave for those who succumbed to the force of the bullet. Not even one. But on enquiry into this situation, one can easily discover several bones leftovers and remains of human skulls, cartridges from a round of ammunition from places of Kakog'u. Kaptir, Kainuk the list long BUT NO GRAVES.

SYNOPSIS

The burial practices are divided into three categories as described here below:-

Category 1: Honourable burial practices,

These are burial for respected individuals with profound contribution to the well-being of the family and equally to that of the clan. Their graves are preserved and several traditional celebrations performed time to time in remembrance of their excellent contributions. Upcoming generations are kept informed of these individuals to reduce chance of losing

recollections on their diligent efforts. These persons include seers, successful warriors and rain makers.

Category 2: Insubstantial burial practices,

These are burials of less valued persons who have not in any way contributed to community prosperity. There death or burial never capture the attention of the clan. They are buried by the family members with zero appreciation, gratitude and/ or remembrance, notably a social event adhered to the Turkana customs. No traditional social rite organized thereafter in admiration of the work of the deceased person.

The graves of these persons are not preserved resulting to rapid disappearance of the same. The candidates in this class include children and poor persons.

Category 3: Detestable burial practice,

These are shocking deaths to the family or clan members. It occurs un-expectedly to defence forces namely “cattle herders.” The victims of cattle rustling died bodies are left un-buried for predators to feast. The traditions have no records of rituals observed in respect to their fixed functions as members of community defence force.

Date: 15/09/2016.

Day: Thursday 2016.

Time: 10:45 am

Editor: Ariong Lucas

Traffic

C8

1 Traffic Data

Summary of traffic count at C46 road Lokichar-Lokori

Date: 14/04/2021

Time: from 6am to 7pm

Location (where the data was collected from): coordinates – N 2.36716° E 35.66560° Elevation – 2641ft

Time	6am-7am	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm	Total
Bicycles														
C46 East Bound	1	1	-	-	-	1	-	-	1	-	-	-	1	5
C46 West Bound	-	-	-	2	3	1	-	-	-	1	-	-	-	7
Total	1	1	-	2	3	2	-	-	1	1	-	-	1	12
Motorcycles														
C46 East Bound	3	3	3	10	10	6	4	3	4	7	5	6	21	85
C46 West Bound	3	-	7	4	12	9	5	4	2	9	6	8	8	77
Total	6	3	10	14	22	15	9	7	6	16	11	14	29	162
Light vehicles														
C46 East Bound	-	1	3	-	4	-	2	4	-	1	4	5	1	25
C46 West Bound	-	-	3	4	-	3	2	1	5	1	4	2	3	28
Total	-	1	6	4	4	3	4	5	5	2	8	7	4	53
Buses, commercial vehicles														
C46 East Bound	-	2	-	-	-	-	2	-	-	-	1	-	-	5
C46 West Bound	1	-	-	-	-	-	-	-	-	2	1	2	1	7
Total	1	2	-	-	-	-	2	-	-	2	2	2	1	12
Tractors, farm vehicles														
C46 East Bound	-	-	-	-	-	-	-	1	-	-	-	-	-	1
C46 West Bound	-	-	-	-	-	-	-	-	1	-	-	-	-	1
Total	-	-	-	-	-	-	-	1	1	-	-	-	-	2
Articulate trucks														
C46 East Bound	-	-	-	1	-	-	-	-	-	-	-	-	-	1
C46 West Bound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Road construction trucks														
C46 East Bound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C46 West Bound	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	8	7	16	21	29	20	15	13	13	21	21	23	35	242

Summary of traffic count at A1 road North of Lokichar

Date: 15/04/2021

Time: from 6am to 6pm

Location (where the data was collected from): coordinates – 2° 23’58.66’’N 35 ° 38’57.45’’ E Elevation – 700M

Time	6am-7am	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	Total
Bicycles													
A1 North Bound	-	-	-	-	-	-	-	-	-	3	-	-	3
A1 South Bound	-	-	-	-	-	-	-	-	-	1	-	-	1
Total	-	-	-	-	-	-	-	-	-	4	-	-	4
Motorcycles													
A1 North Bound	6	5	3	2	3	6	3	6	5	3	10	7	59
A1 South Bound	1	3	2	5	5	8	10	4	3	6	11	9	67
Total	7	8	5	7	8	14	13	10	8	9	21	16	126
Light vehicles													
A1 North Bound	7	11	12	5	13	4	7	3	14	8	10	3	97
A1 South Bound	4	10	15	11	10	12	14	7	1	7	7	10	108
Total	11	21	27	16	23	16	21	10	15	15	17	13	205
Buses, commercial vehicles													
A1 North Bound	9	1	3	6	1	7	6	5	7	2	5	5	57
A1 South Bound	2	6	8	2	4	9	4	10	7	11	7	9	79
Total	11	7	11	8	5	16	10	15	14	13	12	14	136
Tractors, farm vehicles													
A1 North Bound	-	-	-	-	-	-	1	-	-	-	-	1	2
A1 South Bound	-	-	-	-	-	-	1	-	-	-	-	-	1
Total	-	-	-	-	-	-	2	-	-	-	-	1	3
Articulate trucks													
A1 North Bound	2	1	1	-	-	-	1	1	-	-	2	1	9
A1 South Bound	-	2	1	1	-	-	1	2	2	2	3	2	16
Total	2	3	2	1	-	-	2	3	2	2	5	3	25
Road construction trucks													
A1 North Bound	2	7	4	-	-	2	1	1	5	-	-	1	23
A1 South Bound	1	1	-	1	1	2	6	2	2	-	1	7	24
Total	3	8	4	1	1	4	7	3	7	-	1	8	47
Grand Total	34	47	49	33	37	50	55	41	46	43	56	55	546

Summary of traffic count at A1 road south of Lokichar

Date: 15/04/2021

Time: from 6am to 6pm

Location (where the data was collected from): coordinates – N 2.36946° E 35.63803° Elevation – 2747ft

Time	6am-7am	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	Total
Bicycles													
A1 North Bound	2	4	1	3	1	2	-	2	1	7	2	-	25
A1 South Bound	2	1	1	2	-	2	-	1	2	-	1	1	13
Total	4	5	2	5	1	4	-	3	3	7	3	1	38
Motorcycles													
A1 North Bound	5	10	13	19	22	16	20	10	18	12	19	17	181
A1 South Bound	7	4	16	18	15	14	23	17	16	20	14	13	177
Total	12	14	29	37	37	30	43	27	34	32	33	30	358
Light vehicles													
A1 North Bound	1	1	4	2	7	6	4	5	5	10	11	9	65
A1 South Bound	6	5	17	4	14	5	8	7	1	4	8	7	86
Total	7	6	21	6	21	11	12	12	6	14	19	16	151
Buses, commercial vehicles													
A1 North Bound	3	-	2	2	6	4	3	5	4	4	6	3	42
A1 South Bound	1	3	7	4	3	8	6	10	6	9	5	6	68
Total	4	3	9	6	9	12	9	15	10	13	11	9	110
Tractors, farm vehicles													
A1 North Bound	-	-	-	-	1	-	-	-	-	-	-	-	1
A1 South Bound	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	-	-	1	-	1	-	-	-	-	-	-	-	2
Articulate trucks													
A1 North Bound	1	1	1	-	1	-	2	-	-	1	1	-	8
A1 South Bound	-	-	2	1	-	-	-	-	3	2	1	3	12
Total	1	1	3	1	1	-	2	-	3	3	2	3	20
Road construction trucks													
A1 North Bound	-	-	-	-	-	-	-	-	-	-	-	-	-
A1 South Bound	-	-	-	-	-	-	-	-	-	1	-	-	1
Total	-	-	-	-	-	-	-	-	-	1	-	-	1
Grand Total	28	29	65	55	70	57	66	57	56	70	68	59	680

ANNEX I

D

Impact Assessment Supporting Information

1 Air Quality

2 Noise

3 Water

4 Biodiversity

5 Cultural Heritage

Air Quality

D1

1 Air Quality Modelling Report

1.0 TECHNICAL MEMORANDUM

DATE August 2021 **Reference No.** 1433956.716.A0

TO Alex Mayhook-Walker, Project Oil Kenya

FROM Rachel Lansley **EMAIL** rjlansley@golder.com

SUMMARY OF REVIEW AND UPDATE OF AIR QUALITY MODELLING ADDITIONAL INFORMATION

The following information relates to the Golder review and update of the Air Dispersion Modelling (ADM) Assessment undertaken by Worley Parsons (Worley Parsons, 2019. Tullow Kenya B.V. South Lokichar Foundation Project, Kenya: Air Dispersion Modelling Report) undertaken as part of Front-End Engineering Design (FEED) in 2019.

An update of the model sources, input emission data and building height and location data was undertaken using updated FEED data provided by Xodus.

Golder has not independently verified the data used in the assessment; however Golder has adopted the data completed by a recognised competent consultancy, with the assumption that Quality Assurance (QA) checks were completed by Xodus.

1.0 MODEL SCENARIOS

Scenario 1: Normal operations scenario including the operation of the WHRUs on the GTGs (supplementary firing with gas) plus wellpad operations and IWMF incinerator.

- 3 x SGT-700 Gas turbines (including WHRUs);
- 1 x fired heater;
- IWMF incinerator; and
- Well test operations at 3 wellpads[1] (including one diesel generator per wellpad).

Scenario 2: Abnormal operations scenario including the operation of the WHRUs on the GTGs (with no supplementary firing with gas) plus wellpad operations and IWMF incinerator.;

- 3 x SGT-700 Gas turbines (including WHRU's);
- 4 x fired heaters;
- IWMF incinerator; and

[1] Although three wellpads were included in the assessment, there are very limited cumulative emissions from the wellpad drilling activities, therefore more units could operate simultaneously providing the wellpads are not adjacent.

- Well test operations at 3 wellpads (including one diesel generator per wellpad).

2.0 MODEL INPUT DATA

2.1 Stack Parameters

The stack parameter information was provided by Xodus.

Table 1 and Table 2 present the stack parameters and emission rates of the modelled emissions points.

Table 1: Specifications of the Emissions Sources Used in the ADM

Source Description	Stack Height (m)	Stack Diameter (m)	Flue Gas Temperature (K)	Flue Gas Velocity (m/s)
SGT-700 GTG (WHRU)	16.6	2.6	473(a)	6.5
SGT-700 GTG (WHRU with Supplementary Firing)	16.6	2.6	399.7(a)	18.5
Fired Heater	26	1.6	473	3.5
Diesel Generator (well pads)	10	0.635	771.6	33.0

Notes:

a) Temperature at Waste Heat Recovery Unit (WHRU) exit.

Table 2: Emission Rates of the Combustion Equipment in ADM

Source Description	Scenario	Emission Rates				
		NO_x	SO_2	CO	PM_{10}	$PM_{2.5}$
SGT-700 GT	All scenarios	11.32	0.12	2.90	0.07	0.17
Fired Heater	All scenarios	1.85	0.01	1.12	0.05	0.15
IWMF incinerator	All scenarios	0.15	0.14	0.12	0.32	0.74
Diesel Gen (well pads)	All wellpads (all scenarios)	8.2	1.4	3.5	-	0.4

2.2 Emission Point Locations

Table 3 presents the location of the emission sources represented in the model.

Table 3: Location of Emissions Sources

Source Description	Coordinates in UTM System (Zone 36 N)	
	Easting	Northing
SGT-700- 1 plus WHRU	808360	247599
SGT-700- 2 plus WHRU	808338	247618
SGT-700- 3 plus WHRU	808315	247636
Fired Heater 1	808387	247639
Fired Heater 2[a]	808371	247653
Fired Heater 3 [a]	808355	247666
Fired Heater 4 [a]	808340	247679
Waste incinerator	808034	247048
NG-09 Diesel Power Gen	807153	243530
NG-16 Diesel Power Gen	806524	245455
AM-10 Diesel Power Gen	812218	240310

Notes:

a) Scenario 2 only.

2.3 Meteorological Data

The modelling was undertaken using the Mesoscale Model Interface program (MMIF) meteorological data used in the original ADM undertaken by Worley Parsons, covering 2014 to 2018. A windrose of the data is presented in Figure 1.

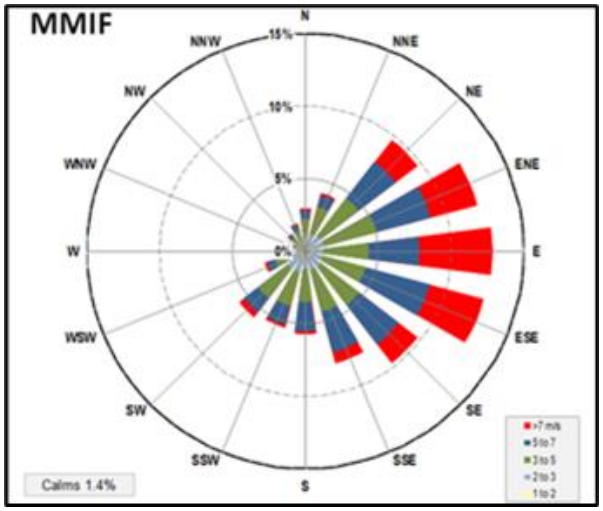

Figure 1: MMIF Meteorological Data 2014 - 2018

3.0 MODEL OUTPUT

Table 4, Table 6, Table 7, Table 8 and Table 9 present the maximum Predicted Concentration (PC) for each of the modelled pollutants and relevant averaging periods. The PC reported is the maximum concentration anywhere in the modelled domain, which includes on-Site. Therefore the offsite concentrations are predicted to be much lower than those quoted in the assessment.

Table 4: Contribution of the Project and Maximum Predicted Ground Level Concentration of NO_x in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
Annual	40	Project Contribution (µg/m³)	19.4	n/a[a]
		% of AQS	32.4	
24-hour	188	Project Contribution (µg/m³)	48.0	
		% of AQS	60.0	

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Table 5: Contribution of the Project and Maximum Predicted Ground Level Concentration of NO_2 in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
Annual	40	Project Contribution (µg/m³)	13.6	n/a[a]
		% of AQS	34.0	
24-hour	188	Project Contribution (µg/m³)	16.8	
		% of AQS	8.9	
1-hour	200	Project Contribution (µg/m³)	89.0	159.4
		% of AQS	44.5	79.7

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Table 6: Contribution of the Project and Maximum Predicted Ground Level Concentration of SO_2 in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
Annual	50	Project Contribution (µg/m³)	4.5	n/a[a]
		% of AQS	3.0	
24-hour	20	Project Contribution (µg/m³)	6.1	
		% of AQS	30.5	
10-minute	500	Project Contribution (µg/m³)	54.3	61.7
		% of AQS	10.9	12.3

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Table 7: Maximum Raise Ground Level Concentration of CO in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
8-hour	2000	Project Contribution (µg/m³)	38.21	86.6
		% of AQS	1.9	4.3
1-hour	4000	Project Contribution (µg/m³)	108.56	143.9
		% of AQS	2.7	3.6

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Table 8: Contribution of the Project and Maximum Predicted Ground Level Concentration of $PM_{2.5}$ in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
Annual	10	Project Contribution (µg/m³)	3.08	n/a[a]
		% of AQS	30.8	
24-hour	25	Project Contribution (µg/m³)	12	
		% of AQS	48.0	

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Table 9: Contribution of the Project and Maximum Predicted Ground Level Concentration of PM_{10} in Operational Scenarios 1 & 2

Period	Standard µg/m³	Unit	Scenario	
			1	2
Annual	10	Project Contribution (µg/m³)	1.31	n/a[a]
		% of AQS	6.6	
24-hour	25	Project Contribution (µg/m³)	5.18	
		% of AQS	10.4	

Notes:

a) If this abnormal operating is scenario is required, it will only operate for short durations (a maximum duration of 12 hours) and will not operate twice in any 24-hour period. Therefore, only averaging periods less than 24 hours are applicable.

Golder Associates (UK) Ltd

Rachel Lansley
ESIA Practitioner

Andrew Morsley
Project Director

SW/RL/mb

Air Quality

D1

2 Greenhouse Gas assessment

REPORT

Project Oil Kenya - Upstream

Greenhouse Gas Assessment

Submitted to:

Tullow Kenya BV

Submitted by:

Golder Associates (UK) Ltd

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1433956.716.A.0.

August 2021

Distribution List

Table of Contents

TABLES

FIGURES

1.0 INTRODUCTION

Project Oil Kenya - Upstream has considered the potential impact it may make to climate change throughout the construction and operational periods. This report presents an assessment and quantification of the greenhouse gas (GHG) impact from a collection of different gases which will potentially be produced by the Project.

It is typical to report the collective impact as carbon dioxide equivalent (CO_2e) units to facilitate comparison. The term 'CO_2e' is a measure used to compare the emissions from various GHGs based on their Global Warming Potential (GWP). The scope of this assessment is to estimate the annual CO_2e emissions associated with the Project and provide recommendations for mitigation where applicable.

The six key GHG produced by human activities and covered by the Kyoto Protocol Agreement are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). Carbon Dioxide is the most significant of GHG emissions accounting for 77% of the world's anthropogenic emissions (IFC, 2012a).

Recorded national emissions of CO_2 in Kenya during 2019 were estimated to be around 19.8 million tonnes (KNOEMA, 2021). The 2019 dataset is the most recent publicly available data.

The calculation of GHG emissions for use in this assessment has been generated by a combination of Xodus Group (undertaking FEED review) and the Operator team. Golder has not independently verified the data used in the assessment however Golder has adopted the outputs of the assessment completed by a recognised competent consultancy, with the assumption that Quality Assurance (QA) checks were completed by both Xodus Group and the Operator.

2.0 STUDY AREA AND RECEPTORS

Emissions of Greenhouse Gases have the potential to impact globally, therefore the study area for this assessment is global.

3.0 KEY GUIDELINES AND STANDARDS

The International Finance Corporation (IFC) Performance Standard 3 - Resource Efficiency and Pollution Prevention requires projects to estimate annual GHG emissions from developments that are expected to generate in excess of 25,000 tpa of CO_2e.

Performance Standard 3 also requires that the client considers alternatives and implements technically feasible and cost-effective options to reduce project related GHG emissions. These could include alternative project locations, adoption of low carbon energy sources, the reduction of fugitive emissions and the reduction of flaring.

4.0 GHG EMISSIONS ASSESSMENT

4.1 Method

The assessment of GHG emissions normally focuses on the following three emission areas:

- Scope 1 covers direct emissions from sources within the boundary of an organisation such as fuel combustion and manufacturing processes. Scope 1 emissions will arise from such activities as the combustion gas for power generation and of diesel fuels for vehicles and plant.

- Scope 2 covers indirect emissions from the consumption of purchased electricity, steam or heat produced by another organisation as required; and
- Scope 3 includes all other indirect emissions that are a consequence of an organisation's activities but are not from sources owned or controlled by the organisation; that is, emissions from off-site waste disposal, emissions associated with the production of fuels, and emissions from the generation of purchased electricity.

The calculation of Scope 1 and 2 emissions is required by IFC Performance Standard 3. Data for well drilling during years 1 to 3, flare and turbine emissions were obtained from HYSYS[1] simulations. In this assessment, Scope 1 and 2 emissions relating to the planned construction, commissioning and normal operation of the CPF have been quantified and provided to Golder. Data relating to well drilling post year 3 and commissioning emissions are currently unavailable and these will be quantified by the EPC contractor and drilling contractor, once appointed.

Scope 3 emissions (the calculation of which is optional according to the IFC), are those which occur outside the project boundary. They have not been included in the assessment at this stage as the EPC contractor will select equipment and processes based on supply chain and logistics considerations at EPC stage.

4.1.1 Scope Boundaries

The quantification of construction and operational emissions and the reporting of annual emissions (for both the construction and operational phases) will be the responsibility of the Operator.

4.2 Source of Effects

Sources of effects are identified below in the following sections.

4.2.1 Qualitative GHG Emissions Baseline

Existing GHG emissions sources in the local area include:

- Road transportation: A recent 2021 road traffic survey for the C46 and A1 estimate Annual Average Daily Traffic (AADT) at 425 to 1284);the most common modes of transport reported in the surveys are motorcycles on the C46 and A1;
- Homestead and pastoralist related activities include burning of wood fuel, charcoal and the use of diesel or other liquid fuels;
- Light aircraft using the Kapese Airstrip; and
- Pastoralist farming.

4.2.2 Construction Phase

During the construction phase, based on the Project Description the sources of GHG associated with the Project are listed in Table 1.

Table 1: Construction Phase Greenhouse Gas Emission Sources

Emission Sources	Commentary
Road Vehicles	Exhaust emissions will be emitted from construction vehicles and equipment, which will likely utilise diesel fuel. Specific sources include on-site vehicles such

[1] Process simulation software

Emission Sources	Commentary
	as light vehicles, trucks, lifting and loading machinery, and drilling and digging equipment, as well as vehicle travel to the site. Construction traffic movements associated with the Project are approximately 85 AADT which is equivalent to approximately 25% of the traffic on the least travelled surveyed road (C46).
Mobile & Static Plant	Combustion emissions will be generated from fuel used in mobile and static plant. These will most likely utilise diesel fuel.
Generators	Combustion emissions will be emitted from generators which will be used for construction activities and during well drilling.
Waste Management	Emissions will be generated associated with the transportation, management and treatment of both construction and drilling wastes.
Land Clearance	Emissions of carbon dioxide through vegetation clearance associated with land clearance have been scoped out of the assessment due to the limited vegetation present in the Project footprint.

4.2.3 Commissioning and Operations Phase

The operational phase relates to Project Year 4 (First Oil) onwards. Based on the Project Description, the sources of GHG associated with the Project are listed in Table 2.

Table 2: Operations Phase Greenhouse Gas Emission Sources

Emission Sources	Commentary
Road Vehicles	Exhaust emissions will be emitted from vehicles and equipment associated with the operations phase, which will likely utilise diesel fuel. Specific sources include on-site vehicles such as light vehicles, trucks, lifting and loading machinery, and drilling and digging equipment, as well as vehicle travel to the site.
Mobile & Static Plant	Combustion emissions will be emitted from fuel use in mobile and static plant.
Generators	Combustion emissions will be emitted from generators that will be used for ancillary tasks. Diesel generators on-site will be used as an emergency back-up and are not considered as part of the assessment of GHG emissions.
Waste Management	Emissions will be generated associated with the transportation, management and treatment of operations wastes.
Turbine Emissions	Emissions will be generated by three dual fuel gas turbine generators (GTGs), burning fuel gas with waste heat recovery units (WHRU) present, with supplementary firing using fuel gas to meet the heat demand as required. Gas

Emission Sources	Commentary
	turbines were selected over steam turbines as they were found to provide greater efficiency for converting fuel burnt into megawatt (MW) power. They also generate less emissions for the power that they deliver.
Gas Fired Heaters	Up to 4 gas fired heaters will be used during the operational phase to generate additional heat to supplement the GTGs.
Grid Power	It is envisaged that the facility will be likely be powered by electricity purchased from the Grid from First Oil (Year 4) onwards, which will supplement power generated by the GTGs. A fully grid powered solution was not considered appropriate as it would not maximise utilization of associated gas which can be used by the GTGs to generate heat and power. The use of grid power will result in direct emissions and indirect emissions which are included in the assessment calculations. The indirect emissions results from the production of the energy off site.
Fugitive Emissions	Potential sources of fugitive emissions for the Project include cold vents, leaking pipes and tubing, valves, connections, flanges, packings, open-ended lines, pump seals, compressor seals, pressure relief valves, tanks or open pits / containments, and hydrocarbon loading and unloading operations. Potential emissions from crude storage tanks have also been included in the assessment.
Flare Emissions	There is one enclosed ground flare located in the central processing facility (CPF) containing a main flare with a flare purge and pilot. There will be no continuous flaring, only emergency flaring.

4.2.4 Decommissioning Phase

Greenhouse Gas emissions relating to the decommissioning phase will be dependent on the decommissioning plan developed prior to decommissioning. It is likely that the sources of GHG emissions will be similar to those identified for the construction phase.

4.3 Results

4.3.1 Construction Phase

The GHG emissions anticipated to be generated during construction have been estimated by the Operator and are presented in Table 3 below. The use of diesel generators is predicted to be the largest source of GHG emissions during the construction phase and annual emissions are predicted to reduce each year.

Table 3: Predicted Annual CO_2e from Construction Years (Years 1 – 3).

	Construction Traffic ktpa CO_2e	Diesel Generators ktpa CO_2e	Total ktpa CO_2e
Year 1	28.8	81.6	110.4

	Construction Traffic ktpa CO_2e	Diesel Generators ktpa CO_2e	Total ktpa CO_2e
Year 2	21.5	81.6	103.1
Year 3	13.8	73.4	87.3

4.3.2 Operations Phase

The assessment covers emissions directly and indirectly generated from the Project during a typical operational year. The data from the year of maximum emissions, Year 8 (Fourth year of Operational Phase), has been used in this assessment for conservatism.

The operational GHG assessment considers the greatest emissions relating to the Project, which are generated from GTG and flare emissions. Table 4 presents the calculated CO_2e emissions data for the year of maximum annual combined Scope 1 and 2 emissions (Year 8: 2028 – Fourth full operational year) and Table 5 details the predicted total Scope 1 and 2 CO_2e emissions from the total operational phase of the Project.

The greatest contributions to the emissions are from the Gas Turbines (approximately 66% in Year 8 and 88% of the total operations) and Gas Fired Heaters and WHRU supplementary firing (approximately 29% in year 8 and 10% of the total operations). The composition of the annual operational CO_2e emissions is presented graphically in Figure 1.

Table 4: Approximate Predicted Annual CO_2e from Maximum Year of Emissions (Year 8)

GHG Emission	Gas Turbines ktpa CO_2e	Gas Fired Heaters & WHRU Supplementary Firing ktpa CO_2e	Main Flare (purge and pilot) ktpa CO_2e	Crude Storage ktpa CO_2e	Fugitive Emissions ktpa CO_2e	Grid Power ktpa CO_2e
CO_2e	387.7	169.6	4.3	<0.1	<0.1	27.7
% of Total	65.8	28.8	0.7	<0.1	<0.1	4.7
Total Annual CO_2e (kt)	589.3					

Table 5: Approximate Predicted Total CO_2e from Project Operations (Year 4 to Year 28)

GHG Emission	Gas Turbine kt CO_2e	Gas Fired Heaters kt CO_2e	Main Flare (purge and pilot) kt CO_2e	Crude Storage kt CO_2e	Fugitive Emissions kt CO_2e	Grid Power kt CO_2e
CO_2e	8,768.2	922.6	107.5	0.2	0.6	176.3
% of Total	87.9	9.2	1.1	<0.1	<0.1	1.8
Total Annual CO_2e (kt)	9,975.5					

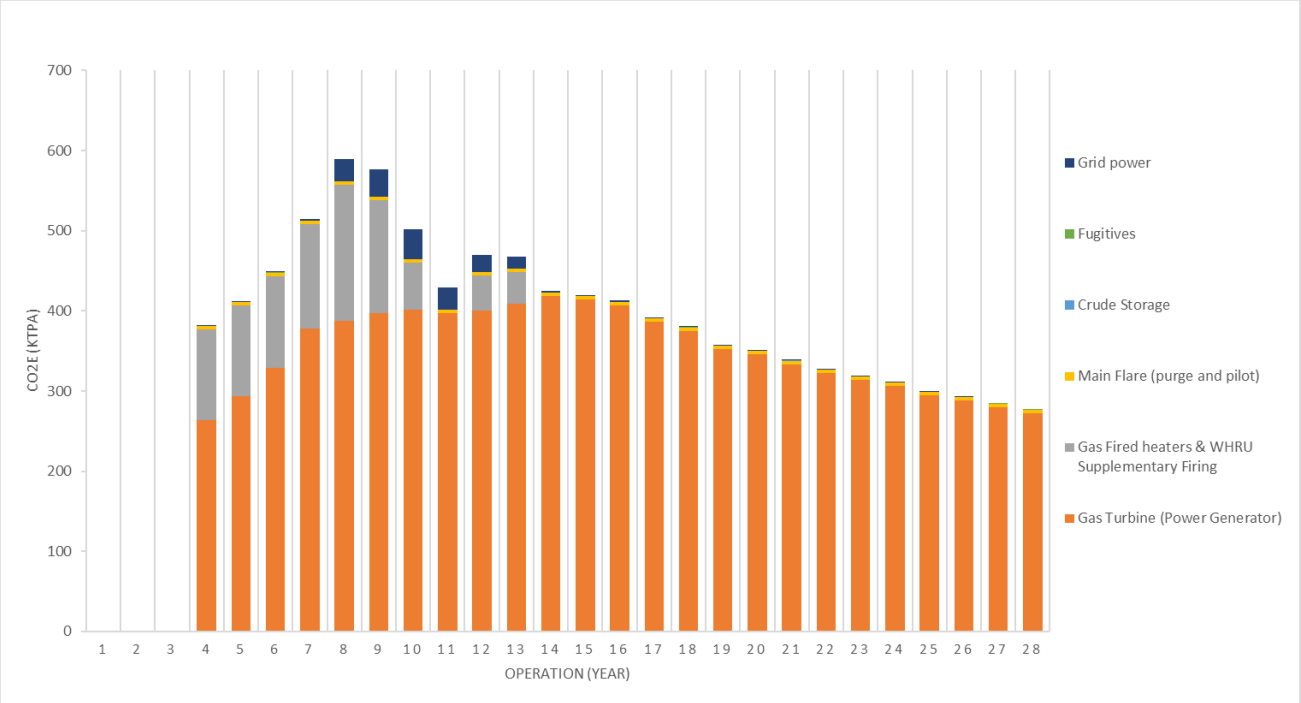

Figure 1: Composition of the operational CO_2e emissions per year.

5.0 BEST AVAILABLE TECHNIQUES

Best Available Techniques for reducing GHG emissions will be reviewed and incorporated during the EPC phase with regard to identifying and incorporating technically feasible and cost-effective options for GHG reduction measures. This may include, but not be limited to, the optimisation of heat and power, the selection of equipment with consideration to performance and energy efficiency and the reduction of fugitive emissions.

6.0 MITIGATION

Consideration of GHG emissions has been central to Project planning and strategy and will continue to inform decisions throughout the lifecycle of the Project. The Operator has undertaken significant work to minimise the emission of greenhouse gases related to the production of crude oil. This has related to management of produced gas and minimisation of GHG emissions. This has decreased emissions from an initial 30 $kgCO_2$/bbl to approximately 19 $kgCO_2$/bbl.

Mitigation and management measures relating to the Project are outlined below and follow an avoidance, minimization and management approach.

6.1 General Measures

The following general management and mitigation measures are not related to specific aspects of the construction and operations phase but will be undertake as good practice:

- Record keeping and documentation to aid the quantification of GHG emissions.
- Implementation of energy efficiency measures, for example insulation and lighting design.

- Optimising construction personnel to minimise footprint.
- Maximising local content to minimise travel to and from site.
- During EPC, reducing flanged connections and replacing with welded connections, where possible.
- Increased use of low carbon or renewable energy and fuel sources, such as those used to power construction vehicles and equipment, and light vehicles on site, where possible. This can also be applied to power supplies for any on site accommodation.
- Maintenance and operation of vehicles and machinery in accordance with manufacturers specifications.
- Idling of vehicles to be avoided where possible (i.e. engines must be switched off when not in use).
- Employees to be educated and encouraged to follow energy saving measures.

The Project will evaluate the following factors which will be reviewed and reported on an annual basis:

- The Project will quantify and compare greenhouse gas emissions relative to the host country total national emissions to understand the magnitude of its own emissions.
- The Project will assess its greenhouse gas emissions performance relative to the good international practice performance / host country national average performance.
- The annual trend of the Project's greenhouse gas emissions performance will be assessed over time to monitor changes from the originally designed performance.

  Opportunities to further improve the Project's greenhouse gas emissions performance will be considered on an ongoing basis.

6.2 Project Specific Measures

The following management and mitigation measures relate to specific aspects of the construction and operational phase.

6.2.1 Avoidance

6.2.1.1 Flaring

The Project does not include continuous flaring as a method for excess gas management and flaring will only be undertaken during abnormal or non-routine operations.

6.2.1.2 Venting

Venting to the atmosphere is not considered good practice[2], therefore the Project will avoid venting of emissions unless in an emergency scenario.

6.2.2 Minimization

6.2.2.1 Turbine and Waste Heat Recovery Units

The Project is applying Best Available Techniques (BAT) through the use of three SGT-700 GTGs (or equivalent) which will utilise the associated gas to provide all required power for the Project. Provision has been made to minimize energy use and increase efficiency and design facilities in line with IFC PS3. Air emission specifications will be achieved through the application of BAT. The turbines also have an integrated control

[2] WBG EHS Guideline for Onshore O&G (draft 2017 art.19)

system which can be used to optimize combustion. Waste heat recovery will be used to provide heating demand from the turbine exhausts, therefore reducing overall energy demand and GHG emissions.

In addition to the GTGs, the use of waste heat recovery units helps to minimize the use of imported grid power through the heating of the water required for injection. Without the WHRUs, additional power from the grid would be required to undertake the heating, which is of lower efficiency than the GTGs and WHRUs.

6.2.2.2 Solar Power Generation

The use of solar power has been identified as an option to reduce GHG emissions from the Project during both the construction and operation phases of the Project, as it will offset gas burn in the GTGs and power import from the grid when needed.

In the current design, the airfield will be powered by a diesel generator and from Year 2 by the CPF. The permanent camp, offices and area lighting are to be powered by temporary diesel generators during construction, and the CPF during operation. Solar power is a viable option from the early stages of the Project, as it would reduce the need for diesel generators and minimize GHG emissions.

The benefits of utilizing solar power have been identified by the Operator and will be considered further in the next phase of the Project.

6.2.2.3 Crude Storage Emissions

In order to prevent or, where that is not practicable, reduce diffuse VOC emissions to air from liquid hydrocarbon storage, double deck floating roof tanks are recommended due to their insulation properties to minimize wax formation. The formations of wax residues above the roof when the roof is low will be managed by wax scrapers on the floating roof.

6.2.3 Management

6.2.3.1 Gas Injection

A review of reservoir modelling was recently completed by the Operator subsurface team, which concluded that gas injection was deemed a feasible disposal method for gas in the initial operational years as the gas production rate will be greater than the demand.

Gas will be reinjected into sub-surface geological formations and will be available for use via gas flowback when the facility is gas deficient. This will reduce the need for power import as the reinjected gas will be able to flow to the CPF and be used in the GTGs to generate power when required.

The potential GHG emissions associated with power import will therefore be reduced or eliminated by managing excess gas by reinjection for subsequent use when necessary.

6.3 Offsetting

The Operator is currently evaluating a range of potential carbon dioxide sequestration projects to be used to offset its residual Scope 1 GHG emissions.

7.0 PROCESS ALTERNATIVES

A number of process alternatives for the Project were considered in this assessment in terms of their impact on GHG emissions.

The wellpad design incorporate multiple wells co-located on a single pad. This means that a factory drilling approach can be taken, whereby specialized rigs can be employed which are designed to maximise efficiency and reduce drilling time and costs. This leads to shorter drilling times and therefore a lesser demand for power

and fuel, which reduces the emissions likely to arise when compared with other approaches, such as single well pads which would require greater drilling effort and time.

Gas turbines will utilise gas produced from the reservoir to generate heat and power for the facility. This will supplement purchased grid power at various ratios throughout the operation of the facility. Gas reinjection also offers a source of gas for the turbines when demand outweighs production and reduces the need to use imported power from the grid, therefore reducing potential GHG emissions. As described inTable 2, GTGs were selected over steam turbines for power generation as they offer greater efficiency and lower emissions for the amount of power that they would generate.

Waste heat recovery units are to be used to recover waste heat from the gas turbines. This increases efficiency and reduces losses, making use of the recovered heat for other process requirements such as heating of make-up water and produced water streams. This reduces the requirement for generated heat, which in turn reduces emissions from primary heat generation.

8.0 CONCLUSION

The assessment has considered the key related emissions to calculate the GHG emissions of Project activities and identified ways in which the Project is reducing and committed to manage its GHG emissions.

The most significant Project related emissions are the Scope 1 emissions resulting from GTG and gas fired heater (with WHRU supplementary firing) use. The assessment has estimated that during operations, up to 589.3 ktpa CO_2e has the potential to be emitted annually from the Site (including Scope 1 and Scope 2 emissions). This is approximately 3.0% of the 2019 Kenyan total annual emissions (19,800 ktpa CO_2).

Emissions are projected to decrease over time, with annual emissions reducing by 50% from a maximum 589.3 ktpa CO_2e in the Year 4 of operation (2028) to 292.7 ktpa CO_2e by 2036. The overall trend is a sharper decline in annual emissions within the first 11 years of operation, with a slight increase in Year 12, followed by a steady continued decline in the proceeding years. The composition of the CO_2e emission sources are also predicted to change into the future. After 2033, gas fired heaters and associated WHRU supplementary firing are no longer in use and therefore the associated emissions end. The GTGs will continue to contribute the majority of emissions.

Assessed GHG emissions are estimated to be above the IFC reporting threshold in IFC PS3 of 25,000 tpa of CO_2e. Therefore, the Operator will prepare an annual emissions report using operational data.

9.0 REFERENCES

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Signature Page

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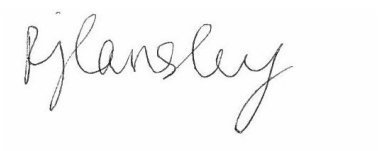

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Noise

D2

1 Review of IFC Noise Guideline and Kenya Noise Regulation Sound Level

DATE November 11, 2016 **PROJECT No.** 1654017.511_B.0

TO Paul Mowatt
Tullow Kenya B.V

CC Oliver Patricia Arroyo; Paul Coward

FROM Stefan Cicak; Danny da Silva; Andrew Morsley **EMAIL** scicak@golder.com; Danny_daSilva@golder.com; amorsley@golder.com

REVIEW OF IFC NOISE GUIDELINE AND KENYA NOISE REGULATION SOUND LEVEL LIMITS - SOUTH LOKICHAR BASIN PROJECT

Introduction

Golder Associates Ltd. (Golder) was retained by Tullow Kenya B.V. (Tullow) to carry out a review of the *International Finance Corporation -Environmental, Health and Safety (EHS)Guidelines - Noise Management dated April 30, 2007* (IFC Noise Guidelines) and *Kenya Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations dated 2009* (Kenya Noise Regulations) with respect to the baseline noise monitoring carried out to date by Golder for the South Lokichar Basin (the Project). This technical memorandum will provide the following;

- Overview of the IFC Noise Guidelines and Kenya Noise Regulations sound level limits;
- Summary of the baseline noise monitoring carried out to date by Golder at the Ngamia and Amosing locations;
- Comparison of IFC Noise Guidelines and Kenya Noise Regulations with the baseline noise monitoring data; and
- Recommendation on IFC Noise Guidelines and Kenya Noise Regulations to the Project.

IFC Noise Guidelines and Kenya Noise Regulation Summary

The IFC Noise Guideline and Kenya Noise Regulation are documents that provide guidance in managing sound levels at specific locations. Noise is defined as unwanted sound; however, the terms noise and sound are often used interchangeably, including presenting acoustic values. Key concepts and terminology used in the assessment of outdoor acoustics is presented in Appendix A.

The following table summarizes the sound level limits presented in the IFC Noise Guideline and Kenya Noise Regulation;

Table 1: Overview of IFC Noise Guideline and Kenya Noise Regulation Sound Level Limits

	IFC		Kenya Sound Level Limit		Kenya Noise Rating Level (NR)	
	Daytime	**Nighttime**	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**
Time Period Duration	0700 - 2200 (15 hrs)	2200 - 0700 (9 hrs)	0601 - 2000 (14 hrs)	2001 - 0600 (10 hrs)	0601 - 2000 (14 hrs)	2001 - 0600 (10 hrs)
Noise Metric	1 Hour LAeq (dBA)	1 Hour LAeq (dBA)	14 Hour Leq (dBA)	10 Hour Leq (dBA)	14 Hour Leq (dBA)	10 Hour Leq (dBA)
Residential; institutional; educational [1]	55 [2]	45 [2]	n/a	n/a	n/a	n/a
Industrial; commercial	70 [2]	70[2]	n/a	n/a	n/a	n/a
Maximum increase in background levels at the nearest receptor location off-site	3	3	n/a	n/a	n/a	n/a
Zone A - Silent Zone	n/a	n/a	40	35	30	25
Zone B - Places of Worship	n/a	n/a	40	35	30	25
Zone C - Residential; Indoor	n/a	n/a	45	35	35	25
Zone C – Residential Outdoor	n/a	n/a	50	35	40	25
Zone D - Mixed residential (with some commercial and places of entertainment)	n/a	n/a	55	35	50	25
Zone E - Commercial	n/a	n/a	60	35	55	25

The receiving environment for EOPS is best categorised as Residential under the IFC Noise Guideline and *Zone C Residential; Indoor* under the Kenya Noise Regulation. The *Zone C-Residential; Indoor* was selected as opposed to the *Zone C-Residential; Outdoor* since it has a lower daytime limit. However, it should be noted that the indoor noise levels will likely be achieved if the outdoor noise levels are also met.

For the purposes of this review, only the Kenya Noise Regulation *Kenya Sound Level Limit* will be compared with the IFC Noise Guidelines. Golder has assumed the Kenya Noise Regulation *Kenya Noise Rating Level* is for indoor purposes and takes into account the WHO Guidelines for Community Noise assumption that a 15 dB reduction is obtained from outdoors to indoors with a window partially open.

1 For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO (1999)
[2] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

In regards to the IFC Noise Guideline, it allows for either the sound level limits presented in the table or a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Since noise is expressed on a logarithmic scale (i.e., 5 dB + 5 dB = 8 dB) and not a linear scale (i.e., 5 + 5 = 10), a 3 dB increase is equivalent to twice the acoustical energy. The 3 dB maximum increase in background levels considers the option for one to produce no more noise than already exists at a receptor. For example, if the existing daytime background sound level without a project is 60 dBA based on a 1-hour Leq, then the project will be limited to a noise level of 60 dBA at the receptor (i.e., 60 dBA $_{\text{Existing Background}}$ + 60 dBA $_{\text{Project}}$ = 63 dBA $_{\text{Total}}$). Therefore, if the existing background sound levels are lower than the sound level limits presented in the Table 1.7.1 in the IFC Noise Guideline, the sound level limits in the table are applied, otherwise the existing background sound levels may be applied.

Finally, it is important that the sound level limits are compared against sound levels within the same period of time and metric. The IFC Noise Guideline consists of 1-hour Leq in dBA for both the daytime and nighttime periods. The Kenya Noise Regulation consists of a 14-hour Leq in dBA for the daytime period and a 10-hour Leq in dBA for the nighttime period. A 1-hour Leq compared to 14-hour Leq considers a shorter time period. Therefore an activity that is intermittent (e.g., occurs for 3 hours out of a 14-hour period) and not constant across a 14-hour period, will result in a higher 1-hour Leq compared to a 14-hour Leq since the acoustical energy associated with the activity is restricted to a smaller time period and not averaged over a longer period of time.

Baseline Noise Monitoring Overview

Golder carried out baseline noise monitoring for the Project at various locations. For the purposes of this review, the Ngamia and Amosing sites were selected to evaluate the IFC Noise Guideline and Kenya Noise Regulation sound level limits with respect to the Project. The table below summarizes the field campaigns at these two locations.

Table 2: Baseline Noise Monitoring Field Campaign Summary

Field Campaign	Location	Period
1	Amosing	October 2015
2	Amosing	January 2016
3	Amosing & Ngamia	October 2016

Comparison of Baseline Noise Summary to IFC Noise Guidelines and Kenya Noise Regulations

The baseline noise monitoring data collected was analyzed and processed such that both the IFC Noise Guideline and Kenya Noise Regulation could be evaluated. Table 3 and 4 below summarize the key baseline noise monitoring parameters associated with either the IFC Noise Guideline or Kenya Noise Regulation and the resulting Project Sound Level Limit when compared to the key baseline noise monitoring parameter.

Table 3: Summary of Baseline Noise Monitoring following IFC Noise Guideline

Period	IFC Noise Guideline Applicable Sound Level Limit (dBA)	Baseline Noise Monitoring Minimum $Leq_{1\ hr}$ (dBA)	Project Sound Level Limit (dBA) [1]
Daytime (7h-22h)	55	34 – 39	55
Nighttime (22h-7h)	45	33 – 34	45

[1] IFC Noise Guideline allows for either the sound level limits presented within it in Table 1.7.1 or a maximum increase in background levels of 3 dB at the nearest receptor location off-site. Therefore, the higher level between Baseline Noise Monitoring Minimum $Leq_{1\ hr}$ and IFC Noise Guideline Sound Level Limit was selected.

Table 4: Summary of Baseline Noise Monitoring following Kenya Noise Regulation

Period	Kenya Noise Regulation Applicable Sound Level Limits (dBA)[1]	Baseline Noise Monitoring Average Leq_{Period} (dBA)[2]	Project Sound Level Limit (dBA)[3]
Daytime (6h-20h)	45	46 – 63	45
Nighttime (20h-6h)	35	34 – 45	35

[1] Zone C Residential - Indoor applied
[2] Period averages based on data available. Some periods did not contain data for the entire daytime or nighttime period
[3] Kenya Noise Regulation sound level limits are described as maximum permissible and does not include an option to consider existing background sound levels. Therefore the Kenya Noise Regulation Sound Level Limits was selected.

Recommendation

Golder recommends the use of the IFC Noise Guideline for the Project.

The Kenya Noise Regulation sound level limits are definitive whereas the IFC Noise Guideline provides the opportunity for the baseline sound levels to be considered in defining the Project sound level limits. When baseline data is processed for comparison against Kenyan Noise regulations, the baseline noise monitoring data indicates higher average Leq noise levels during the daytime and nighttime period than defined in the Kenya Noise Regulation and there is no option to take baseline into consideration. Golder has direct experience implementing the IFC Noise Guideline for other projects in Africa and as a result, we are confident that it is also suitable for use on this project.

Furthermore, the comparison between the baseline noise monitoring, the IFC Noise Guideline and Kenya Noise Regulation, resulted in higher Project sound level limits should the IFC Noise Guideline be used. The higher sound level limits may provide the Project the opportunity to consider other design options, including the level of noise mitigation controls, if any, to be implemented.

Finally, it is important to note that compliance with sound level limits does not guarantee that noise complaints will not occur and it would be best that a process be put in place to address noise complaints in the event they do occur.

Appendix A – Definition of Technical Terms

- "**Noise**" or "**noise levels**" refers to the levels that can be heard or measured at a Point of Reception (POR).
- A noise "**receptor**" or POR is a location where an assessment, measurements or predictions of noise levels are made.
- The "**level**" of a noise is expressed on a logarithmic scale, in units called decibels (dB). Since the scale is logarithmic, a noise that is twice the noise level as another will only be three decibels (3 dB) higher.
- Noise emissions and noise levels have an associated frequency. The human ear does not respond to all frequencies in the same way. Mid-range frequencies are most readily detected by the human ear, while low and high frequencies are harder to hear. Environmental noise levels used in this assessment are presented as "**A weighted decibels**" (or dBA), which incorporates the frequency response of the human ear.
- The "**percentile noise level**", designated Ln, is the noise level exceeded "n" percent of a specified time period and is measured in dBA. The L_{90}, for instance, is the noise level exceeded 90% of the time. It is a noise level index that commonly refers to the baseline noise level and is most often referenced in a rural setting.
- Outdoor noise is usually expressed as an "**equivalent noise level**" ($L_{eq, T}$), which is a logarithmic average (i.e., energy average) of the measured or predicted noise levels over a given period of time (T). An equivalent noise level measured or predicted over the nighttime period would be referred to as Leq, night.
- Environmental noise levels vary throughout the day and it is therefore important to distinguish between the time of day (i.e., daytime / nighttime). The IFC Noise Guideline and Kenya Noise Regulation both are divided into the daytime and nighttime period but with different time period durations, see Table 1.

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Noise

D2

2 FEED Worley Parsons Noise Modelling Study

1.0 TECHNICAL MEMORANDUM

DATE 08/06/2020 **Reference No.** 1433956.648.A0.

TO Paul Mowatt, Oliver McCredie Tullow KBV,

FROM Andrew Morsley, Rachel Lansley **EMAIL** amorsley@golder.com

NOISE MODELLING ADDITIONAL INFORMATION

The quantitative noise modelling referred to in the ESIA was developed based on the results of noise modelling conducted as part of the Front End Engineering Design (FEED) Worley Parsons Noise Study (Annex I). The following information relates to the noise modelling undertaken by Worley Parsons (Worley Parsons, 2019. Tullow Oil Kenya B.V. Kenya South Lokichar Foundation Project: Noise Modelling Study) as part of FEED using the SoundPLAN software tool.

Golder has not independently verified the data used in the assessment, however Golder has adopted the outputs of the assessment completed by a recognised competent consultancy, with the assumption that Quality Assurance (QA) checks were completed by Worley Parsons. The Noise Study represents the final proposed design of the Project, including noise mitigation. The modelled equipment is representative of the most significant noise sources relating to the Project.

The Golder assessment detailed in Chapter 7.2 is based on the Worley Parsons assessment scenarios and associated outputs. Golder have used the Worley Parsons FEED noise model to undertake further quantitative noise prediction modelling using the Computer Aided Noise Attenuation (CadnaA) noise modelling software, applying the modelling algorithms based on *ISO 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (International Organization for Standardization 1993 and 1996)* [ISO 1993 and 1996].

The following data relate to the Worley Parsons Assessment.

1.0 MODEL SCENARIOS

The following scenarios were considered:

Scenario A: Routine operation of the CPF

Scenario A1: Routine Operation of the IWMF

Scenario B: Drilling Operations at a Generic Wellpad

Scenario C: Operational Phase at a Generic Wellpad

Scenario D: Operational Phase at Turkwel Dam Pontoon and Chemical Injection AGI

2.0 MODEL INPUT DATA

2.1 Topography & Terrain

The study area was assumed to be flat, which most closely approximates the actual topography in the modelling domain. To account for ground effects on sound propagation, the following ground absorption factors (G) were used:

- G = 0.7 - Hard terrain (compacted field and gravel) was assumed within the industrial area and the well pad.
- G = 1.0 - Soft terrain was assumed across the remaining modelling domain, typical of non-compacted ground and pasture field.

2.2 Obstacles Modelling

Obstacles of large volume within the wellpad, CFA and IWMF, such as buildings and large tanks, were introduced into the model as building elements to account for the screening and reflection effects of sound . Modelled elements and their corresponding heights are listed in Appendix C. Obstacles to noise propagation located outside of the CFA or the wellpad, such as residential buildings in settlements, were not considered. Small elements, such as pipes and racks, were not included as noise sources or sound barriers in this assessment. Golder undertook a sensitivity analysis of alternative obstacle dimensions, where applicable, and incorporated these into the assessment.

Table 1: Obstacles Included in the Model

Description	No.	Worley Parsons Model Dimensions (m)		
		Length	Width	Height
Tanks				
T-2901 Water Injection Buffer Tank	1	--	48.0	9.0
T-3301 On-Spec Crude Oil Storage Tank 1	1	--	46.0	9.0
T-3302 On-Spec Crude Oil Storage Tank 1	1	--	46.0	9.0
T-3304 On-Spec Crude Oil Storage Tank 1	1	--	30.0	9.0
T-4101 On-Spec Crude Oil Storage Tank 1	1	--	11.5	9.0
T-4401 Produced Water Settling Tank 1	1	--	21.0	9.6
T-4402 Produced Water Settling Tank 2	1	--	21.0	9.6
T-4404 Off-Spec Water Tank	1	--	42.0	10.0
Buildings				
CFA				

Description	No.	Worley Parsons Model Dimensions (m)		
		Length	Width	Height
Main CFA Gatehouse / Security Building	1	6.0	11.0	3.0
CFA Ancillary				
Gatehouse – 2 (South)	1	6.0	5.5	2.6
Warehouse – 1	1	50.0	30.0	7.0
Warehouse – 2	1	50.0	30.0	7.0
Workshop – 1	1	24.0	24.0	6.0
Workshop – 2	1	24.0	24.0	6.0
Permanent Camp				
Admin Office – 1	1	24.0	18.0	3.0
Religious Facilities – 1	1	24.0	20.0	3.5
Permanent Camp- can be used by construction				
Gatehouse – 1 (South of permanent camp)	1	6.0	5.5	2.6
Management Cabin	120	12.0	3.0	2.6
Junior Staff Cabin	60	12.0	3.0	2.6
Mess Hall / Kitchen / Diner	1	35.0	15.0	3.0
Laundry – 1	1	12.0	9.0	3.7
Medical Centre – 1	1	36.0	18.0	3.5
Mini-Market	1	12.0	6.0	2.6
Clubhouse	1	20.0	12.0	3.5
Multisport Hall	1	45.0	25.0	7.0
Gym & Fitness Room	1	24.0	12.0	3.7
CFA Construction Camp				
Admin Office – 3	1	24.0	18.0	2.6
Workshop	1	25.0	20.0	6.5
Religious Facilities – 1	1	24.0	20.0	2.6

Description	No.	Worley Parsons Model Dimensions (m)		
		Length	Width	Height
Management Cabin	564	12.0	3.0	2.6
Junior Staff Cabin				
Labour Cabin				
Ablutions Block for Labour Cabin				
House Keeping Store Rooms				
Laundry	4	12.0	6.0	3.7
Drillers Warehouse				
Warehouse	8	72.0	24.0	7.0
CFA – IWMF Integrated				
Hazardous Material Storage	1	24.0	24.0	2.6
CPF – Central Processing Facility				
Gatehouse (South)	1	6.0	5.5	2.6
Main Substation – 1	1	51.0	38.0	8.0
Water Injection Pump Shelter	2	12.0	6.0	2.6
Substation – 2	1	32.0	19.0	8.0
LP / MP / HP Booster Compressor Shelter	2	24.0	24.0	2.6
Well pad				
Chemical Injection Pumps Shelter	1	6.0	4.0	4.0

2.3 Emissions Data

Table 2: Noise Emission Rates used in the Model

Description	Source Type	Height (m)	Lw (dBA)
Compressors[(1)]			
Train 1 Booster Compressor	Linear	3.5	104.6
Train 2 Booster Compressor	Linear	3.5	104.6

Description	Source Type	Height (m)	Lw (dBA)
Make-up Water Filter Air Blower	Point	1.5	96
Compressor and Instrument Air Dryer Package	Linear	3.5	104.6
Water Injection Booster Pump	Point	1.5	93
Water Injection Pump	Point	1.5	93
Oil Recovery Transfer Pump	Point	1.5	78
IGF Package Feed Pump	Point	1.5	93
IGF Sludge Transfer Pumps	Point	1.5	93
IGF Recycle Water Pumps	Point	1.5	93
IGF Solids Transfer Pumps	Point	1.5	93
Filtration Package Recycle Water Pump	Point	1.5	93
Filtration Package Recycle Water Pump	Point	1.5	93
Filtration Package Sludge Transfer Pump	Point	1.5	93
Filtration Package Sludge Transfer Pump	Point	1.5	93
Water Injection Booster Pump	Point	1.5	93
Air Coolers[2]			
Oil Storage Air Cooler (4 bays in parallel/4 fans per bay)	Point	15.0	81.0
Train 1 Booster Compressor LP Stage Inlet Cooler (1 bay/3 fans per bay)	Point	15.0	96.0
Train 1 Booster Compressor MP Stage Inlet Cooler (1 bay/2 fans per bay)	Point	15.0	96.0
Train 1 Booster Compressor HP Stage Inlet Cooler (1 bay/2 fans per bay)	Point	15.0	96.0
Train 1 Booster Compressor Discharge Air Cooler	Point	15.0	96.0

Description	Source Type	Height (m)	Lw (dBA)
Train 2 Booster Compressor LP Stage Inlet Cooler (1 bay/2 fans per bay)	Point	15.0	96.0
Train 2 Booster Compressor MP Stage Inlet Cooler (1 bay/2 fans per bay)	Point	15.0	96.0
Train 2 Booster Compressor HP Stage Inlet Cooler (1 bay/2 fans per bay)	Point	15.0	96.0
Train 2 Booster Compressor Discharge Air Cooler	Point	15.0	96.0
Heating Medium Return Dump Cooler (3 bays in parallel/3 fans per bay)	Point	5.0	96.0
Fired Heaters[3]			
Fired Heater 1	Point	1.5	88.0
Fired Heater 2	Point	1.5	88.0
Pumps[4]			
Dehydrator / Desalter Feed Pump	Point	1.5	78.0
Hot Water Recycle Pump	Point	1.5	93.0
Oil Storage Feed Pump	Point	1.5	78.0
Ngamia high CO_2 pump	Point	1.5	78.0
Train 1 Booster Compressor LP Scrubber Pump	Point	1.5	78.0
Train 1 Booster Compressor MP Scrubber Pump	Point	1.5	78.0
Train 1 Booster Compressor HP Scrubber Pump	Point	1.5	78.0
Train 2 Booster Compressor LP Scrubber Pump	Point	1.5	78.0
Train 2 Booster Compressor MP Scrubber Pump	Point	1.5	78.0
Train 2 Booster Compressor HP Scrubber Pump	Point	1.5	78.0
Water Injection Booster Pumps	Point	1.5	93.0

Description	Source Type	Height (m)	Lw (dBA)
Water Injection Pumps	Point	1.5	93.0
Oil Export Booster Pumps	Point	1.5	93.0
Heating Medium Circulation Pumps	Point	1.5	93.0
Mineral Oil Supply Pump	Point	1.5	93.0
Corrosion Inhibitor Injection Pump	Point	1.5	78
Scale Inhibitor Injection Pump	Point	1.5	78
Oxygen Scavenger Injection Pump	Point	1.5	78
Antifoam Injection Pump	Point	1.5	78
Demulsifier Injection Pump	Point	1.5	78
Biocide Injection Pump	Point	1.5	78
Water Clarifier Injection Pump	Point	1.5	78
Hypochlorite Injection Pump	Point	1.5	78
IGF Package Feed Pumps	Point	1.5	93.0
Oil Recovery Transfer Pump	Point	1.5	78.0
IGF Sludge Transfer Pump	Point	1.5	93.0
Recycle Water Pumps	Point	1.5	93.0
Off-Spec Tank Pumps	Point	1.5	93.0
Make-up Water Pumps	Point	1.5	93.0
Deaerated Make-up Water Transfer Pumps	Point	1.5	93.0
Flare Knock Out Drum Pump	Point	1.5	78.0
Service Water Pump	Point	1.5	93.0

Description	Source Type	Height (m)	Lw (dBA)
Potable Package Water Pump	Point	1.5	78.0
Process Open Drains Sump Pump No. 1	Point	1.5	78.0
Process Open Drains Sump Pump No. 2	Point	1.5	78.0
Utilities Open Drains Sump Pump No. 1	Point	1.5	78.0
Utilities Open Drains Sump Pump No. 2	Point	1.5	78.0
Closed Drains Pump (reduced to 1 off)	Point	1.5	78.0
Diesel Storage Pump	Point	1.5	78.0
Primary Sludge Decant Pump	Point	1.5	93.0
Sanitary Waste Pump	Point	1.5	78.0
Power Generation Units[5]			
Gas Turbine (GT) Power Generation System			
Enclosure Walls - Each (GT Length)	Area	4.4	101.1
Enclosure Walls - Each (GT Width)	Area	4.4	96.2
Enclosure Roof	Area	4.4	102.4
Air Intake	Area	12.5	97.6
Ventilation Inlet	Area	6.5	89.3
Waste Heat Recovery Unit (WHRU)			
Walls Radiated – Each (WHRU Length)	Area	12.0	102.8
Walls Radiated – Each (WHRU Width)	Area	12.0	98.8
WHRU Stack Exit[6]	Point	21.0	96.0
Valves[7]			

Description	Source Type	Height (m)	Lw (dBA)
Valves at Water Injection Pumps	Point	1.2	96.0
Flares[8]			
Main CPF Flare & Acid Gas (CO_2) Flare	Point	(8, 9)	(8, 9)
LEF[10]			
Crude oil pipeline pumps (2 working)	Point	1.5	96
IWMF			
Incinerator [9]	Point	1.0	96.0
Anaerobic Digestor (small pump)	Point	1.0	78.0
Effluent Treatment Package (small pump)	Point	1.0	78.0
Recycling Shelter [10]	Point	1.0	78.0
Wellpad Operation			
Chemical Injection Pump	Point	0.8	78.0
Flow Reduction Valve/ Multi-stage Restriction Orifice [11]	Point	0.8	96.0
Wellpad Drilling			
Drilling Equipment [12]	Point	2.0	104.9
Turkwel Dam			
Pontoon Pumps (part of PM11-A-5001A/B) [13]	Point	1.0	93.0
Hypochlorite Injection Pump (part of PM11-A-4201)	Point	1.0	78.0

Notes:

1. Modelled to fit 85 dB(A) SPL measured 1 m from a linear (8.5 m long) source. Calculated sound power: 104.6 dB(A).

2. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 96 dB(A), assuming spherical sound propagation from each fan, which is elevated from the floor.

3. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 93 dB(A), assuming spherical sound propagation from equipment placed on the floor.

4. Fired heaters operating at 50% capacity (if at all), burners at grade; modelled to fit 80 dB(A) SPL measured at 1m from source. Calculated sound power: 88 dB(A).

5. The GT and the Waste Heat Retrieval Unit (WHRU) were modelled as area sources (except the WHRU stack exit) and the sound power was adjusted to generate the maximum allowable emission based on project requirements (85 dB(A) measured 1 m from each piece of equipment).

6. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 96 dB(A), assuming spherical sound propagation. The effect of sound directivity was incorporated into the modelled noise propagation from the WHRU stack exit.

7. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 96 dB(A), assuming spherical sound propagation from each valve, which is elevated from the floor.

8. For ground flare purging (operating) condition is from 0 to 7 mmscfd, and for CO2 flare 0 to ½ mmscfd. Ground flares are co-located. Ground flare is modelled to fit 58 dB(A) SPL measured 50 m beyond vendor's wind shield.

9. Incinerator is in a building. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 96 dB(A), assuming spherical sound propagation, which is elevated 1.0m from grade.

10. Intermittent noise as operators sort waste.

11. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 96 dB(A), assuming spherical sound propagation from each valve, which is elevated 0.8 m from grade.

12. As indicated, noise emitted values were between 51.3 and 56.9 dB(A) as measured at 100 m from a similar operating exploration rig. Assuming spherical sound propagation from equipment placed at grade, the calculated sound power is 99.3 – 104.9 dB(A). The highest value was modelled.

13. Modelled to fit 85 dB(A) SPL measured 1 m from the source. Calculated sound power: 93 dB(A), assuming spherical sound propagation from pumps located at grade.

3.0 MODEL OUTPUT

The following mitigated outputs are taken from the assessment:

Table 3: Summary of Results

	Boundary			
	North	**South**	**East**	**West**
CFA including IWMF (Mitigated- Case B.2.12)				
SPL at CFA Fence-line (dBA)	54	45 (49 at SW corner)	43	42
Distance from Fence-line to 45 dBA	0	0 (218 m to SW corner)	0	0
Wellpad Drilling (mitigated)				
SPL at CFA Fence-line (dBA)	<30	<30	<30	45
Distance from Fence-line to 45 dBA	0	0	0	0
Wellpad Drilling (unmitigated)				
SPL at CFA Fence-line (dBA)	49- 52	49- 52	49- 52	49- 52
Distance from Fence-line to 45 dBA	114	114	114	114
Turkwel Dam[(1)]				

Notes:

1. The 45 dB(A) isophone from the pontoon pumps just encroaches on the shoreline, and majority of that is within the land allocation, and there is no concern that manyattas could be impacted as the high-water level is just above the 40 dB(A) isophone. Chemical injection pump noise contour just exceeds land allocation and enclosure could be retro fitted if required. No further mitigation is required.

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Noise

D2

3 Xodus Noise Modelling report

South Lokichar Development Foundation Phase Upstream FEED Update

Noise Modelling Study Report

Project Oil Kenya

Assignment Number: L200545-S00
XODUS Document Number: L-200545-S00-A-REPT-001

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Noise Modelling Study Report

L200545-S00

Client: Project Oil Kenya
Document Type: Report
Document Number: L-200545-S00-A-REPT-001

			MAF		MAF	
A01	08/07/2021	Issued for Use	MAF	AG	MAF	-
Rev	**Date**	**Description**	**Issued By**	**Checked By**	**Approved By**	**Client Approval**

CONTENTS

EXECUTIVE SUMMARY

As part of the South Lokichar Foundation Project FEED, a noise modelling assessment of the development facility was performed to predict the Sound Pressure Levels (SPLs) for:

- Routine operation of the Central Processing Facility (CPF) – Scenario A;
- The Integrated Waste Management Facility (IWMF) – Scenario A.1;
- Drilling operations at a generic wellpad – Scenario B;
- Operational phase at a generic wellpad – Scenario C;
- Operation of pumps located at Turkwel Dam – Scenario D.

Post completion of the FEED, Project Oil Kenya re-evaluated the subsurface data, and:

- Increased the CPF crude oil processing nameplate from 80 Mbopd to 130 Mbopd.
- Revised the number of wells (producers and injectors) to be provided at Amosing, Ngamia and Twiga.
- Included development of Ekales, Agete and Etom fields:

In addition, the FEED was based on using associated gas for power and heat generation within the facility, with excess gas flared. However, there has been an increased focus by the partners to minimise Green House Gas (GHG) emissions from all facilities. Consequently, operational flaring of gas is no longer considered acceptable.

As a result of these changes, Xodus has updated selected FEED deliverables to reflect the revised subsurface data, and the noise modelling was re-assessed in accordance with the design modifications to ensure compliance with the environmental standards for the night-time period (45 dB(A)) along all boundaries of the CFA, and the 55 dB(A) maximum allowable level for the daytime.

Scenario A: Routine Operation of the CPF

The recommended FEED noise model (which included ground flare, ground flare sound barrier and GT&WHRU sound barrier) was modified for FEED Update, as there is no continuous flaring. As such, the recommended mitigation measure for FEED Update is based on inclusion of the sound barrier for the GTs and WHRUs only, and the noise contour plot is shown in Appendix D.

The noise levels are considered conservative as they are based on guaranteed values, and the expectation is that COMPANY will seek NEMA approvals to have the land designated as a noise buffer.

Sound levels predicted beyond the limits of the CFA facilities with sound screens are as follows:

- CFA North boundary: The maximum predicted SPL is 53 dB(A) north of the GT/WHRU. The 45 dB(A) isophone extends up to 500 m north of the fence line.
- CFA South boundary: The maximum predicted SPLs are 49 dB(A) at the south-western boundary and 47 dB(A) along the southern boundary. The 45 dB(A) isophone extends up to 200 m south of the fence line.
- CFA East boundary: The maximum predicted SPL is 44 dB(A) to the East of the permanent camp.
- CFA West boundary: The maximum predicted SPL is 43 dB(A) to the West of the construction laydown area.

Scenario A.1 Routine Operation of the IWMF

As the IWMF design is as per FEED, this has not been remodelled. Moreover, the IWMF noise modelling recommendation (i.e. relocating closer to CPF) was incorporated as part of FEED, so no further mitigation is required.

Scenario B: Drilling operations at a generic wellpad

As drilling equipment noise data is not available for the FEED Update project, this scenario has not been remodelled, and the FEED results have been retained.

Scenario C: Operational phase at a generic wellpad

The modifications made to the well pad design as part of FEED Update does not affect the FEED noise modelling results, therefore this scenario has not been remodelled, and the FEED results have been retained.

Consequently, as per FEED, for the well pads which have operating jump-overs during the early years of operation, it is recommended to provide acoustic enclosures around the multi-stage orifices as a practical and cost-effective solution.

Scenario D: Operation of pumps located at Turkwel Dam

The FEED noise model included 3 off pontoon pumps, where the 45 dB(A) isophone just encroaches on the shoreline, although the majority of that was within the land allocation and all of it was below the high water line.

Additionally, the chemical injection pump noise contour just exceeds the land allocation, and an enclosure could be added in the unlikely event it is required.

However, no further mitigation was envisaged, and this is retained for FEED Update.

Further Work

The following is required to be undertaken during the next phases of design:

- Reassessment of baseline levels.
- Remodelling of all scenarios using actual equipment noise emission data.
- Determination of cost for provision of noise emission mitigation for all equipment, as well as enclosures for the GTs and WHRUs.
- Confirmation of flare type and whether continuous flaring is required during early years of operation.
- Determination of jump over requirements.
- Investigate feasibility of purchasing surrounding land up to the point where the 45 dB(A) isophone is met.

1 INTRODUCTION

1.1 General

The South Lokichar Development Project is focused on producing resources from a number of fields located within the South Lokichar Basin (in Northern Kenya) from blocks 10BB and 13T. In 2019, Worley completed the Foundation Phase Upstream FEED with the following key components:

- Production from Amosing, Ngamia and Twiga fields.
- Daily crude oil production of 72 Mbopd (annualised), 80 Mbopd (nameplate capacity) at the Central Processing Facility (CPF).
- Peak crude oil export of 80 Mbopd via midstream pipeline to Lamu Port.

Post completion of the Foundation Phase Upstream FEED, Project Oil Kenya re-evaluated the subsurface data, and revised the field development strategy to:

- Increase the daily production of crude oil from 72 Mbopd (annualised) to 120 Mbopd (annualised), which assumes a "plant availability", from the wellheads to the loading arm at the point of export in Lamu Port, of 92%. The revised CPF crude oil processing nameplate is therefore 130 Mbopd.
- Revise the number of wells (producers and injectors) to be provided at Amosing, Ngamia and Twiga. The number of wellpads and peak production rates from each wellpad will reflect the updated subsurface approach.
- Maintain the plateau production rate of 120 Mbopd (annualised), for as long as possible through tie-in of Ekales, Agete and Etom fields to the production from the Twiga, Amosing and Ngamia (TAN) fields as per the following sequence of development:
    - Amosing, Ngamia and Twiga 1st Oil - year 3, (36 months after FID);
    - Ekales 1st Oil - year 4;
    - Agete 1st Oil - year 5;
    - Etom 1st Oil - year 7.

Water treatment and injection facilities at the CPF shall be developed in a phased approach, allowing for capacity increase to accommodate the new fields being brought online.

In addition, the FEED was based on using associated gas for power and heat generation within the facility, with excess gas flared. However, post completion of the FEED, there has been an increased focus by the partners to minimise Green House Gas (GHG) emissions from all facilities. Consequently, operational flaring of gas is no longer considered feasible or acceptable.

As a result of these changes, Xodus has updated selected FEED deliverables to reflect the revised subsurface data (wellfluid flowrate, wellfluid composition, production profiles), wellpad count and the addition of the Ekales, Agete and Etom fields to provide a consistent and unambiguous EPCC Tender Package.

1.2 Purpose of Document

The purpose of this document is to provide an overview of the noise modelling assessment for the revised design of the South Lokichar Development facility.

1.3 Abbreviations

Abbreviation	Definition
CPF	Central Processing Facility
CRA	Corrosion Resistant Alloy
CS	Carbon Steel
dB(A)	Decibels (A-weighted)
EHS	Environment, Health and Safety
EOPS	Early Oil Pilot Scheme
EPCC	Engineering, Procurement, Construction and Commissioning
ESD	Emergency and ShutDown system
ESIA	Environmental and Social Impact Assessment
ESP	Electrical Submersible Pump
FEED	Front End Engineering Design
F&G	Fire and Gas
FFD	Full Field Development
FID	Final Investment Decision
GHG	Green House Gas
HPU	Hydraulic Power Unit
IBC	Intermediate Bulk Container
ICSS	Instrumentation, Control and Safety Systems
IFC	International Finance Corporation
LAeq	Equivalent continuous A-weighted sound level
Mbopd	Thousand Barrels of Oil Per Day
Mbwpd	Thousand Barrels of Water Per Day
MPFM	Multi Phase Flow Meter
NEMA	National Environment Management Authority
PCP	Progressing Cavity Pump
PCS	Process Control System
POK	Project Oil Kenya
SIMOPS	Simultaneous Operations
SPL	Sound Pressure Level (or L_p), dB re 20 µPa
SWL	Sound Power Level (or L_w) dB re 1 pW
TAN	Twiga, Amosing and Ngamia
UPS	Uninterruptible Power Supply
VSD	Variable Speed Drive

WHCP	Wellhead Control Panel
WHSIP	Well Head Shut In Pressure

2 NOISE STANDARDS

The following applicable national and international standards, as well as the WorleyParsons project standards, were used as references to evaluate the compliance of the project with noise regulations. This information is as per the FEED Noise Modelling Study [Ref. 1].

2.1 Environmental Noise Standards

The International Finance Corporation (IFC) Health and Safety (EHS) Guidelines (2007) and the Kenya Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Regulations (2009) are documents relevant to this project. The maximum permissible noise levels per type of area and the project standards are listed in Table 2.1. IFC and project standards establish that noise impacts should not exceed the levels presented below or result in a maximum increase in background levels of 3 dB at the nearest off-site receptor location. As requested per FEED, the sensitive receptor has been conservatively assumed to be at CFA boundary in case a residential property is constructed there.

Receptor Classification	IFC Standard	Kenyan Standard	Project Standard
Residential, Institutional and Educational Receptors	Daytime: 55 $dB_{LAeq,1hr}$	Daytime (Residential, outdoor): 50 $dB_{LAeq,14hr}$	Daytime (Residential, outdoor): 55 $dB_{LAeq,1hr}$
	Night-time: 45 $dB_{LAeq,1hr}$	Night (Residential, outdoor): 35 $dB_{LAeq,14hr}$	Night (Residential, outdoor): 45 $dB_{LAeq,1hr}$
	-	Daytime (Residential, indoor): 45 $dB_{LAeq,14hr}$	-
		Night (Residential, indoor): 35 dBLAeq,14hr	
Industrial and Commercial Receptors	Daytime: 70 $dB_{LAeq,1hr}$	Daytime (Commercial): 60 $dB_{LAeq,14hr}$	-
	Night-time: 70 $dB_{LAeq,1hr}$	Night (Commercial): 35 $dB_{LAeq,14hr}$	

Table 2.1 – Maximum Allowable Environmental Noise Levels

Note: IFC and project standards define daytime and night-time as the periods from 07:00 to 22:00 and 22:00 to 07:00, respectively. Kenyan regulation defines daytime and night-time as the periods from 06:00 to 20:00 and 20:00 to 06:00, respectively.

2.2 Occupational Noise Standards

IFC EHS Guidelines (2007) establish noise limits for different working environments. In the national level, Kenya Occupational Health and Safety Act (2007) includes requirements for the control of noise in workplaces and the Factories and Other Places of Work (Noise Prevention and Control) Rules (2005) require that where the noise level is above 90 dB(A), the employer shall put in place a noise conservation programme that includes posting conspicuous signs reminding employees that hearing protection must be worn, supply hearing protection and ensure all employees wear hearing protection.

The applicable national and international standards, as well as project standards, are summarized in Table 2.2, below.

Receptor Classification	IFC Standard	Kenyan Standard	Project Standard
Heavy Industry (no demand for oral communication)	85 $dB_{LAeq8hr}$ 110 $dB_{LAMax(fast)}$	90 $dB_{LAeq,24hr}$	85 $dB_{LAeq8hr}$ 110 $dB_{LAMax(fast)}$
Light industry (decreasing demand for oral communication)	50-65 $dB_{LAeq8hr}$ 110 $dB_{LAmax\ (fast)}$	90 $dB_{LAeq,24hr}$	50-65 $dB_{LAeq8hr}$ 110 $dB_{LAmax(fast)}$
Open offices, control rooms, service counters or similar	45-50 $dB_{LAeq8hr}$	-	45-50 $dB_{LAeq8hr}$
Residential portion of permanent camp	-	-	40-45 $dB_{LAeq8hr}$
Individual offices (no disturbing noise)	40-45 $dB_{LAeq8hr}$	-	40-45 $dB_{LAeq8hr}$
Classrooms, lecture halls	35-40 $dB_{LAeq8hr}$	-	35-40 $dB_{LAeq8hr}$
Hospitals	30-35 $dB_{LAeq8hr}$ 40 $dB_{LAmax(fast)}$	-	30-35 $dB_{LAeq8hr}$ 40 $dB_{LAmax(fast)}$

Table 2.2 – Maximum Allowable Occupational Noise Levels

3 BASELINE CONDITIONS

The Early Oil Pilot Scheme (EOPS) Environmental and Social Impact Assessment (ESIA) (Golder 2018) presents the results of the noise survey that was developed as part of the Full Field Development (FFD) ESIA activities. This survey was conducted during three separate field visits (October 2015, January 2016 and October 2016), and data from four monitoring locations were included to characterise the baseline noise environment in Lokichar, Amosing-5, Ngamia-5/6, and Kapese.

The Ngamia-5/6 location is 2.9 km south-west of the centre of the CPF. Lokichar, Amosing-5 and Kapese are more than 6.0 km from the CPF area. Therefore, if the project standard (45 dB(A)) is not exceeded at the CFA fence line, the sound levels produced during operation of the facilities will not be noticeable at the locations of these four receptors.

Measurements were recorded during a 24-hour period at each location to obtain daytime (07:00 to 22:00 h) and night-time (22:00 to 07:00 h) equivalent sound levels (LAeq). The measured baseline noise levels are summarised in Table 3.1.

Location	Coordinates (UTM 36N)	Monitoring Period	Daytime dB $L_{Aeq,day}$	Night-time dB $L_{Aeq,night}$
Lokichar	794168; 263794	October 2015	65.7	62.3
Amosing-5 (Note 1)	809673; 241418	January 2016	46.2	34.4
Ngamia-5/6	807014; 244742	October 2016	59.9	43.4
Kapese Camp	800931; 261631	October 2015	55.0	30.0

Table 3.1 – Measured Baseline Noise Levels (Golder 2018, EOPS ESIA)

Note 1: Although measurements were taken at Amosing-5 during each of the three data gathering periods, the January 2016 field program resulted in the lowest recordings, which were selected for the effects analysis for a more conservative assessment.

It is noted in Golder's report that the absence of natural noise sources (e.g., watercourse or wind induced vegetation noise) and the dispersed nature of the settlements contributed to low background noise levels. Higher noise levels were recorded in the village of Lokichar, where noise from human activities, including road traffic, human interaction, and light engineering/construction activities, contributed to the measured levels.

Traffic from Lokichar contributed to the elevated baseline noise levels in Ngamia-5/6, which is located within 200 m of the road.

4 STUDY BASIS AND METHODOLOGY

4.1 Objective

The objective of this noise modelling assessment was to predict the Sound Pressure Levels (SPLs) during routine operation of the revised Central Processing Facility (CPF), including the IWMF as a standalone, and during the drilling and operational phases of a generic wellpad. For FEED, these SPLs were predicted under the following modelling scenarios:

- Scenario A: Routine operation of the CPF
- Scenario A.1: Routine operation of the IWMF
- Scenario B: Drilling operations at a generic wellpad
- Scenario C: Operational phase at a generic wellpad
- Scenario D: Operation of pumps located at Turkwel Dam

4.2 Basis

The basis for the revised noise modelling study is as per the FEED noise modelling study [Ref. 1], and the key points are summarised below:

- Residential noise standards of 45 dB(A) during the night and 55 dB(A) during daytime should be met at the boundaries in the residential portions of the permanent camp.
    - Note: For convenience, the noise standards are included in Section 2 of this report.
- Baseline noise conditions are as per FEED (i.e. background noise levels have not been used in this assessment).
    - Note: For convenience, the baseline noise conditions are included in Section 3 of this report.
- Routine operation of the IWMF is as per FEED.
- Noise emission data for the drilling equipment is as per FEED.
- Operational phase at a generic wellpad is as per FEED.
- Assessment of noise levels produced by construction activities, emergency situations, transient sources, and start-up and shutdown activities are excluded from this study.

4.3 Modelling Methodology

4.3.1 Modelling Software

As per FEED, SoundPLAN noise prediction software was used to calculate sound pressure levels and to generate noise maps, which graphically represent the calculated SPLs by including reflections and diffractions of sound and screening effects of barriers and buildings, ground attenuation, topography and atmospheric absorption. SPLs are calculated or interpolated for each point within the modelling domain and a contour map is generated showing isophones (lines of equal sound pressure) at 5 dB(A) intervals.

SoundPLAN uses the calculation methods given by standard ISO 9613 noise propagation.

4.3.2 Modelling Approach

SoundPLAN includes a database module that prompts for all input data required for the calculations made by the noise model, including geometrical data (layout, shape and height) of all objects relevant to the investigation, noise emission levels, and noise absorption and reflective properties. The calculation area is also defined.

Industrial noise modelling describes every source in terms of its sound power (Lw or SWL) and frequency spectra. If spectral data is unknown and the project has an industrial nature, as in this case, the noise pressure in each cell can be calculated using a default central frequency of 500 Hz (typical industrial standard) or a different value if the choice is supported.

Noise sources can be of four types: point sources, line sources, area sources and industrial buildings. The industrial building is a specialized building where all outside surfaces can radiate sound. The radiating SPL can either be entered directly as a numerical value or calculated from the noise level inside and the sound reduction index of the outside building shell. Sound power over frequency, absorption spectra, transmission spectra and other properties are used to simulate the acoustic environment inside the building and to generate SPLs inside, while automatically transforming them into SPLs for the exterior noise propagation.

The SoundPLAN library module contains information from different standards and publications related to noise emission levels per source type, absorption coefficients, and transmission loss spectra for different materials. Libraries are used to provide industrial standard inputs for the model in the absence of project-specific data.

The calculation module generates a grid of receptors over the calculation area defined in the database. Grid spacing is chosen to accommodate the model resolution requirements.

Noise model interpretation is used to predict the level of compliance with industry standards and ambient noise regulations and, when applicable, to verify the efficiency of noise mitigation measures to reduce the SPLs at the receptor locations.

5 FEED UPDATE – IMPACT ON NOISE EMISSION

The revised CPF processing nameplate has increased from 80 to 130 Mbopd (peak), [Ref. 2]. The processing equipment at the CPF was therefore resized to accommodate the additional capacity.

Due to the transportation envelope limitations, most of the key equipment from the FEED were already at maximum size. Therefore, most of the FEED equipment sizes were retained for the FEED Update with an increase in the number of trains [Ref. 3].

The main changes reflected in the updated noise model include the addition of:

- 1 off Gas Turbine / WHRU has been added (Increased from 2 to 3);
- 2 off Fired Heaters has been added (Increased from 2 to 4);
- 1 off LP/MP/HP Booster Compression Train has been added (Increased from 2 x 50% to 3 x 33%);
    - The design is based on 3 x 33%, however, the compressor supplier indicated that there may be benefits in increasing the compressor package sizes with a 2 x 50% arrangement.
- 1 off Excess Gas Injection Compression Train has been added (1 x 100%);
- 1 off Oil Separation Train has been added (Increased from 1 to 2);
- 1 off Oil Stabilisation Train has been added (Increased from 1 to 2);
- 1 off PWT Train has been added (Increased from 220 Mbwpd to 330 Mbwpd);
- 3 off On-spec Crude Oil Storage Tanks have been added (Increased from 2 to 5);
- High CO_2 Separator and Acid Gas Flare have been removed. All trunklines from the fields (high and low CO_2) are now commingled into one common manifold at the front end of the facility.
- Enclosed Ground Flare used for emergencies only (i.e. not normally operating).

6 NOISE MODEL

The noise model developed during FEED was used as the starting point, with modifications made in accordance with the FEED Update design changes. As such, the inputs and assumptions made to complete the model are as per FEED, and are described below. Additionally, the details of the applied modelling options used for this study are listed in Appendix A.

6.1 Topography and Terrain

The study area was assumed to be flat, which most closely approximates the actual topography in the modelling domain. To account for ground effects on sound propagation, the following ground absorption factors (G) were used:

- G = 0.7 Hard terrain (compacted field and gravel) was assumed within the industrial area and the well pad.
- G = 1.0 Soft terrain was assumed across the remaining modelling domain, typical of noncompacted ground and pasture field.

6.2 Facility Layout

The noise model of the CPF and CFA was based on FEED, with modifications made as per the FEED Update CPF and CFA Plot Plans [Ref. 4 and Ref. 5, respectively].

6.3 Obstacles Modelling

Obstacles of large volume, such as buildings and large tanks, were introduced into the model as building elements to account for screening and reflection effects of sound within the plant. Modelled elements and their corresponding heights are as per FEED. Obstacles to noise propagation located outside of the CFA or the well pad, such as residential buildings in settlements, were not considered. Small elements, such as pipes and racks, were not included as noise sources or sound barriers in this assessment.

6.4 Noise Emission Sources

The characteristics of the modelled noise sources of the CPF, IWMF and generic well pad are detailed in Appendix B. Operating units were assumed to be running continuously throughout the daytime and night-time periods except for the IWMF which operates during daytime only. The descriptions below relate to the unmitigated designs.

6.4.1 Scenario A: Routine Operation of the CPF

As the ground flare is for emergency use only, its operation has not been included in the base case noise model.

The Waste Heat Recovery Units (WHRUs) are supplied with splitter type silencers after the gas turbine as standard. All ducting / casing will be typically internally lined with 128kg/m^3 insulation, internal liner and 6mm thick external plate. During FEED, the guaranteed maximum noise emission, as indicated by vendor (BHGE) is 85 dB(A) measured 1 m from the unit. This has been adopted for FEED Update.

As per FEED, in the absence of noise data sheets or technical specifications for other pieces of equipment in the CPF, the sound power was calculated based on the project noise requirement during routine operations (85 dB(A) measured 1 m from the source). For example, the sound power (Lw) of a point source generating 85 dB(A) at 1 m corresponds to 96 dB(A). The sound power for line, area or industrial building sources generating 85 dB(A) at 1 m would depend on the source dimensions. A mean frequency of 500 Hz was assumed (typical industrial standard).

Pumps under 1.4kW or VS6 type were assumed to generate 80 dB(A) measured 1 m from the source.

6.4.2 Scenario A.1: Routine Operation of the IWMF

During FEED, the IWMF was modelled as a standalone facility (Scenario A.1) to evaluate the suitability of its location in the design. The facility comprises an effluent treatment plant, anaerobic digester, incinerator and receiving, sorting and storage areas. The facility only operates during the day, and many of the activities will become intermittent in the operations phase. The screening model assumed two central point sources, such as incinerator and pump at 1 m height and which generate 85 dB(A) measured at 1 m distance.

As the IWMF design is as per FEED, this has not been remodelled.

6.4.3 Scenario B: Drilling Operations at a Generic Wellpad

During FEED, the drilling operations were considered to be a temporary source of noise. However, as the acoustic emission data of the drilling equipment was not available, noise monitored data taken from a similar operating exploration rig, as provided by COMPANY, was used to reverse calculate the sound power. This approach is susceptible to some inaccuracies because the measured sound pressure levels depend on the noise emission from the source, the propagation pathway, and the presence of other sources of noise.

As drilling equipment noise data is not available for the FEED Update project, this scenario has not been remodelled, and the FEED results have been retained.

6.4.4 Scenario C: Operational Phase at a Generic Wellpad

For FEED, the noise sources at the generic well pad during routine operation included a chemical injection pump (dosing pump with low noise emission value, assumed sound power was 78 dB(A)) and a flow reduction valve/ multi-stage restriction orifice (RO) on the jump-over line on 6 of the well pads. Noise emission from multi-stage RO was defined to generate 85 dB(A) at 1 m from the source (Solartron), nevertheless, it is expected that generated sound levels will be lower based on flowrate.

Consequently, the modifications made to the well pad design as part of FEED Update will not affect the FEED results, therefore this scenario has not been remodelled, and the FEED results have been retained.

Note, during FEED, the jump over valve/ restriction orifice was deemed to be a potential source of noise as it is located between the 230 barg water injection system and the production system which operates at 25 barg. There is therefore a large pressure drop across this valve/ restriction orifice.

Jump overs were installed on:

- Wellpads at the end of the gathering trunk lines with permanent pig launchers installed.
- Single wellpad for operational line flushing purposes.
- Wellpads due to drilling sequencing.

As part of FEED Update, the revised field architecture has resulted in jump overs being required on wellpads AM-01, NG-20, NG-23, EM-03, ET-09 and TW-07 to enable flushing of the trunklines.

However, further work is required during the next engineering phase to confirm jump over requirements.

6.4.5 Scenario D: Operational Phase at Turkwel Dam

The noise sources at the Turkwel Dam include pontoon pumps located out in the dam at the end of 200m long walkway and the sodium hypochlorite pump located inland in the chemical injection package. The pontoon pumps are specified as 85dB(A) at 1m which correlates to a sound power level of 93 dB(A). The chemical injection pump is a small dosing pump and has an assumed SPL of 78 dB(A).

Although the FEED had two pontoon pumps at the dam, the FEED noise model contained 3 pontoon pumps, as the requirement for only two pontoon pumps was confirmed post initial modelling of the facility.

Consequently, as 3 pontoon pumps are required for FEED Update, there was no need to remodel this scenario, and the FEED results have been retained.

7 MODEL RESULTS BEFORE MITIGATION

The result of the model of routine operation before mitigation of the CPF (Scenario A), is graphically presented in Appendix C.

As previously stated, since Scenario A.1 (routine operations of the IWMF), Scenario B (drilling operations at a generic wellpad) and Scenario C (operational phase at a generic wellpad) are as per FEED, they have not been remodelled, and the FEED results [Ref. 1] have been retained for FEED Update.

The noise contour maps for Scenario A were generated from a colour-coded noise level distribution grid chosen to depict low values of sound pressure as cool colours (green) and high values as warm colours (red). Contour lines (isophones) are representative of noise pressure intervals of 5 dB(A).

The noise contour maps only represent the SPLs predicted in each area based on the proposed project emission sources. The operations of the CPF are intended to be continuous (24 hours/day, 7 days/week); noise predictions and contours will thus apply for any period of the day.

The predicted SPLs were compared to the project standards described in Section 2.

7.1 Scenario A: Routine Operation of the CPF

7.1.1 Plant Boundaries

The results of the model indicate that the noise emissions from the project, under the assumptions described in this report, will exceed the environmental standards for the night-time period (45 dB(A)) along all boundaries of the CFA, and the 55 dB(A) maximum allowable level for the daytime will be exceeded at the northern boundary. As per FEED, the boundary is taken as being the sensitive receptor along with residential portion of the permanent camp. Background noise has not been modelled.

Sound levels predicted beyond the limits of the CFA facilities with sound screens are as follows:

- CFA North boundary: The maximum predicted SPL is 53 dB(A) north of the GT/WHRU. The 45 dB(A) isophone extends up to 500 m north of the fence line.
- CFA South boundary: The maximum predicted SPLs are 49 dB(A) at the south-western boundary and 47 dB(A) along the southern boundary. The 45 dB(A) isophone extends up to 200 m south of the fence line.
- CFA East boundary: The maximum predicted SPL is 44 dB(A) to the East of the permanent camp.
- CFA West boundary: The maximum predicted SPL is 43 dB(A) to the West of the construction laydown area.

7.1.2 Working Areas within CFA and Permanent Camp

The SPLs within the limits of the CFA are predicted to be above the 85 dB(A) occupational standard near the power generation units (GT and WHRU). The sound power of the GT (without enclosure) and the WHRU was modelled to fit the 85 dB(A) requirement at 1 m from each piece of equipment, based on vendor guaranteed data. The combined effect of several sources causes noise levels to exceed 85 dB(A).

At the permanent camp area, predicted SPLs range between 45 and 49 dB(A) with levels below the target SPL of 40-45 dB(A) (see Table 2.2) at the eastern end of the accommodation block.

7.2 Scenario A.1: Routine Operation of the IWMF

During FEED, the IWMF was initially modelled as four point sources namely a small incinerator, a small pump on the anaerobic digestor, a small pump on the effluent treatment package and activity in the recycling shelter. SPLs from the IWMF operation were predicted to generate 53 dB(A) at the west fence line. As the noise sources at IWMF will be operational during daytime only, and many of the operations are intermittent, the applicable environmental noise limit is 55 dB(A).

Additionally, post the initial modelling as part of FEED, the IWMF was relocated between the construction laydown area and the crude tanks at the Western end of the CFA. This maintains a large degree of separation to the main noise contributors (GTs, WHRUs) and from the permanent camp, and the noise level at the fence line will therefore be lower than 53 dB(A), as the IWMF is now located further away from potential sensitive receptors.

The IWMF was not remodelled as part of FEED Update, and the FEED results were retained. IWMF location will be confirmed on agreement of construction laydown area, drilling and midstream requirements during detailed engineering.

7.3 Scenario B: Drilling Operations at a Generic Well pad

As part of FEED, the sound levels along the boundaries of a generic well pad were predicted to be between 49 and 52 dB(A), which is above the project standard. Nevertheless, the acoustic impact will depend on the distance to sensitive receptors, such as residential dwellings or natural protected areas.

The 45 dB(A) isophone extends beyond the fence line by 114m. Background noise has not been modelled.

On Ngamia and Amosing, this will potentially be an issue, as manyattas/ buildings were shown on the pads.

Twiga appears to be unaffected at this time as the nearest occupied manyatta is shown as 180m away from TW-04.

Note that this is a snapshot in time, based on LiDAR survey data obtained in 2016, and the locations of manyattas will vary on an inter / intra year basis. Whilst drilling is considered a temporary activity, the potential acoustic impact will still need to be re-assessed based on the specific location of each well pad and the distances to sensitive receptors prior to drilling.

7.4 Scenario C: Operational Phase at a Generic Well pad

As part of FEED, the modelled noise emissions during operational phase at a generic well pad indicated that the environmental standard for the night-time period (45 dB(A)) will be exceeded along the west boundaries, and the main noise contributor will be the flow reduction valve / multi-stage RO, which was present on 3 of the well pads where the water injection line continually flows into the trunk line prior to completion of all well pads. The other well pads are already compliant at the fence line for operational phase. Further work is therefore required during the next engineering phase to confirm requirement, application and noise emission for the multi-stage ROs.

7.5 Scenario D: Operational Phase at Turkwel Dam

The FEED noise model included 3 off pontoon pumps, where the 45 dB(A) isophone just encroaches on the shoreline, although the majority of that was within the land allocation and all of it was below the high water line.

Additionally, the chemical injection pump noise contour just exceeds the land allocation, and an acoustic enclosure could be added in the unlikely event it is required.

However, no further mitigation was envisaged, and this is retained for FEED Update.

8 ASSESSMENT OF NOISE CONTROL MEASURES

8.1 Scenario A – FEED Mitigation Measures

The mitigation measures proposed during FEED to reduce noise contributions from project sources included one or more of the following:

- Location of equipment away from sensitive receptors, although this may not be possible due to process, hydraulics, wind direction etc.
- Selection of equipment with lower guaranteed emission levels: This could be accomplished through the technical specifications for equipment acquisition, in which the maximum allowed noise emission levels for the equipment are stated.
- Acoustic treatment: In cases where stringent technical specifications cannot be met, the unit could be appropriately treated to adequately mitigate the generated sound pressure levels.
- Noise barriers: Installing barriers between the noise-generating equipment and the receptors can effectively reduce noise levels.

The modelled noise emissions during routine operation of the CPF (Scenario A) indicated that the environmental standard for the night-time period (45 dB(A)) will be exceeded along all boundaries of the CFA, and the impact will be greater at the northern limit.

During FEED, SoundPLAN was used to identify sources that contributed higher SPLs to the overall non-compliant noise levels at the project boundaries and evaluated the attenuation required to mitigate the sound levels produced by these sources. Table 8.1 below, shows the independent contribution of sources that produced SPLs above 35 dB(A) at a receptor located at northern boundary (R), to the north of the flares location, where the maximum noise impact was predicted (location R shown in Figure 8-1 below).

Source	Contribution in dB(A) at Receptor R
WHRU Wall	45.2
GT Enclosure Wall	43.5
WHRU Wall	43.5
GT Enclosure Roof	42.3
WHRU Wall	42.0
K-2321 Train 2 Booster Compressor	40.7
K-2311 Train 1 Booster Compressor	40.0
GT Enclosure Roof	39.4
GT Enclosure Wall	38.7
GT Enclosure Wall	38.6
GT Enclosure Wall	38.0
GT Enclosure Roof	37.9
GT Enclosure Wall	37.8

Source	Contribution in dB(A) at Receptor R
GT Air Intake	37.5
GT Enclosure Wall	36.7
GT Air Intake	36.7
GT Enclosure Wall	36.6
GT Air Intake	35.6
WHRU Wall	35.1

Table 8.1 – Main Sources of Noise at North Fence Line and Independent Contributions in dB(A) at a Receptor (R)

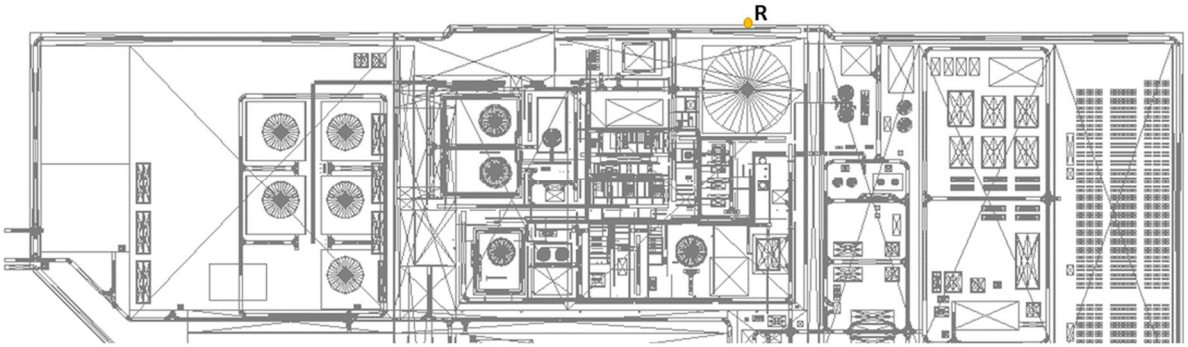


Figure 8-1 – Location of Receptor R

Additionally, the FEED study found that, based on the model inputs and the assumptions considered (see Section 6), without an operational flare, the noise sources that contributed higher sound levels at the boundaries of the project were, in order of magnitude: 1) the WHRUs; 2) the GTs and 3) the compressors. However, general compliance with the residential noise standards of 45 dB(A) at the CFA fence line would require most of the equipment in the facility to be acoustically treated, because all equipment in the CPF contribute to the overall SPLs (i.e. if only the sources with contributions above 40 dB(A) are mitigated, the overall SPL will still be above 45 dB(A)).

The scenarios and mitigations modelled for the CFA (as part of FEED) are shown in Table 8.2.

Figure/ Scenario	Elevated Flare	Ground Flare	Equipment Enclosures	GT & WHRU Enclosure	GT Building	Ground Flare Sound Barrier	GT & WHRU Sound Barrier	Perimeter Wall	Remarks
A.1	✓								
B.1	✓		✓						
B.2.1	✓		✓	✓					
B.2.2		✓	✓	✓					
B.2.3		✓	✓	✓		✓			
B.2.4			✓	✓		✓	✓		
B.2.5		✓	✓	✓	✓	✓			
B.2.6		✓							
B.2.7		✓				✓	✓		
B.2.8		✓				✓	✓	✓	
B.2.9		✓	✓			✓	✓		
B.2.10		✓	✓						
B.2.11		✓		✓					
B.2.12		✓				✓	✓		Cost challenge + IWMF + LEF
B.2.13		✓				✓	✓		Case 1-2C year 5
B.2.14		✓				✓	✓		Case 1-2C year 8

Table 8.2 – Scenarios and mitigations modelled for CFA (as part of FEED)

This noise model was used to evaluate the acoustic impacts of the main noise sources of the CPF, and to assess the proposed mitigation measures based on the results of these evaluations that should be implemented to comply with the applicable noise standards. Considering the stringent maximum allowable noise levels with which the project operation must comply at the property boundaries, the results of this assessment enables the identification of areas of potential conflict and the possible solutions despite the limitations posed by the absence of accurate noise data.

Table 8.3 below includes a high level comparison summary of the mitigations modelled.

Mitigation	Advantages	Disadvantages
Ground Flare vs Elevated	Lower noise level Less visible when lit Easier to maintain Impacts neighbours less – elevated flare impacts a number of manyattas to the NW of CFA	High CAPEX CO_2 burner may need to be elevated within chimney Staged valving to be HAZOPed
Addition of equipment enclosures	Lower noise level	High CAPEX Impedes operability
Provision of building	Lower noise level	Very high CAPEX – requires blast panels, fire protection and HVAC Reduces operability for major maintenance
Sound barriers for GT & Ground Flare	Lower noise level for low cost Flexible - can be added at later stage if required	Need to ensure panels cannot become projectiles Need to ensure that potential overpressure is not increased by containment of explosion
Perimeter wall	Lower noise level	High CAPEX Limited benefit Need to ensure panels cannot become projectiles
Land purchase	Lowest CAPEX	COMPANY trying to minimise land take

Table 8.3 – Mitigation advantages and disadvantages

The effectiveness of applying noise abatement measures for compressors, air coolers, pumps and power generation units (including construction of a building to house the GTs and WHRUs) was assessed during FEED. The FEED study found that sound pressure levels would not be sufficiently reduced in the areas of potential non-compliance unless noise emissions from the flares were significantly mitigated.

The lowest cost solution (scenario A.1, US$ 4.2m) was to keep the unmitigated design, maintain the elevated flare and purchase surrounding land up to the point the 45 dB(A) isophone was met. However, as continual

flaring was required for the first few years of operation and COMPANY's preference was to minimise visual impact and land take, an enclosed ground flare was adopted, despite the increase in CAPEX.

The only solution that met the residential limit of 45 dB(A) at fence line was scenario B.2.5. For this scenario ground flare was used, all equipment sources were mitigated, the GTs and WHRUs were provided with enclosures and installed inside a blast proof building. Furthermore, the ground flare was provided with 8m high sound screen to the N, E and W of the ground flare. This solution was however by far the most expensive (US$ 20m+) and impacts operational requirements.

Provision of a 1500m perimeter fence to the north did not provide sufficient noise attenuation and was not cost effective.
Scenarios B.2.6 and B.2.7 appear to be the most attractive with regards to reducing impact on surroundings at a reasonable cost and of these scenario B.2.7 was recommended.

8.2 Scenario A: FEED Update Mitigation Measures

The recommended FEED noise model (i.e. Scenario B.2.7), which included ground flare, ground flare sound barrier and GT&WHRU sound barrier was modified for FEED Update, as there is now no continuous flaring. As such, the mitigation measure for FEED Update is based on inclusion of the sound barrier for the GTs and WHRUs only, and the noise contour plot is shown in Appendix D.

Sound levels predicted beyond the limits of the CFA facilities with sound screens are as follows:

- CFA North boundary: The maximum predicted SPL is 53 dB(A) north of the GT/WHRU. The 45 dB(A) isophone extends up to 500 m north of the fence line.
- CFA South boundary: The maximum predicted SPLs are 49 dB(A) at the south-western boundary and 47 dB(A) along the southern boundary. The 45 dB(A) isophone extends up to 200 m south of the fence line.
- CFA East boundary: The maximum predicted SPL is 44 dB(A) to the East of the permanent camp.
- CFA West boundary: The maximum predicted SPL is 43 dB(A) to the West of the construction laydown area.

9 CONCLUSION

9.1 CFA

Provision of sound barriers by the GTs and WHRUs is the recommended solution for noise mitigation as part of FEED Update. The noise levels are considered conservative as they are based on guaranteed values, and the expectation is that COMPANY will seek NEMA approvals to have the land designated as a noise buffer.

9.2 Permanent Camp

The modelling shows that the predicted noise levels vary between 45 and 49 dB(A) for the accommodation block (Appendix D) with the eastern end of the permanent camp achieving the 45 dB(A) limit. If found to be an issue during operations, additional screening would be located between the GTs and the southern accommodation containers (if constructed – they are only required if camp requires more than 400 personnel), and currently operational manning is below 350. Alternatively, the facilities within the accommodation block should be designed to locate sleeping areas furthest from the plant with intervening structures (e.g. offices/canteens) to act as natural screens.

The construction camp has been placed to the south of the CFA. If part of the camp is retained post first-oil, then the south eastern section can be retained to comply with the night time outdoor limit of 45 dB(A).

9.3 IWMF

The IWMF noise modelling recommendation (i.e. relocating closer to CPF) was incorporated as part of FEED, therefore no further mitigation is required.

9.4 Wellpad

As per FEED, for the well pads which have operating jump-overs during the early years of operation, it is recommended to provide acoustic enclosures around the multi-stage orifices as a practical and cost-effective solution.

9.5 Turkwel Dam

The 45 dB(A) isophone from the pontoon pumps just encroaches on the shoreline, and majority of that was within the land allocation, and there was no concern that manyattas could be impacted as the high-water level is just above the 40 dB(A) isophone.

Chemical injection pump noise contour just exceeds land allocation and enclosure could be retro fitted if required.

No further mitigation is therefore required.

10 FURTHER WORK

The following is required to be undertaken during the next phases of design:

- Reassessment of baseline levels.
- Remodelling of all scenarios using actual equipment noise emission data.
- Determination of cost for provision of noise emission mitigation for all equipment, as well as enclosures for the GTs and WHRUs.
- Confirmation of flare type and whether continuous flaring is required during early years of operation.
- Determination of jump over requirements.
- Investigate feasibility of purchasing surrounding land up to the point where the 45 dB(A) isophone is met.

11 REFERENCES

1. Kenya South Lokichar Foundation Project, Noise Modelling Study, KSLFP-0000-ES-STU-0005.
2. Revised Surface Facilities Basis of Design, L-200545-S00-Y-BODS-001, Rev A01, June 2021.
3. Master Equipment List, L-200545-S00-P-LIST-001, Rev A01, June 2021.
4. Plot Plan CPF Overall, L-200545-S00-L-DRAW-001, Rev A01, June 2021.
5. CFA Site Plan, L-200545-S00-L-PLAN-001, Rev A01, June 2021.

APPENDIX A MODEL OPTIONS

Run Description	
Calculation	Grid Noise Map
Run Parameters	
Reflection order	3
Maximal reflection distance to receiver	200 m
Maximal reflection distance to source	50 m
Search radius	10,000 m
Weighting	dB(A)
Tolerance	0.1 dB
Standard	
Industry	ISO 9613-2:1996
Air Absorption	ISO 9613
Limitation of Screening Loss: single/multiple	20 dB / 25 dB
Environment (1)	
Air Pressure	1013.3 mbar
Humidity	44.0%
Temperature	28.9ºC
VDI-Parameters for diffraction	C2=20
Dissection Parameters	
Distance to diameter factor	8
Minimum Distance [m]	1 m
Max. Difference GND + Diffraction	1 dB(A)
Max. Number of Iterations	4
Assessment	Leq
Map	
Grid Spacing	5 m
Height above ground	1.5 m
Grid Interpolation	
Field Size	9 x 9 (interpolation block maximal with 81 receivers)
Min/Max	10 dB
Difference	0.1 dB

Note (1): Annual average humidity and temperature used for the Project Air Dispersion Modelling assessment for the period 2014-2018 were obtained from AERMET Surface data. ISO 9613-2:1996 default wind conditions were selected, corresponding to soft wind blowing in all directions at constant speed. This assumption generates minimum attenuation over the modelling domain, i.e., a conservative approach.

APPENDIX B MODEL INPUTS – OBSTACLES AND NOISE EMISSION SOURCES BEFORE MITIGATION

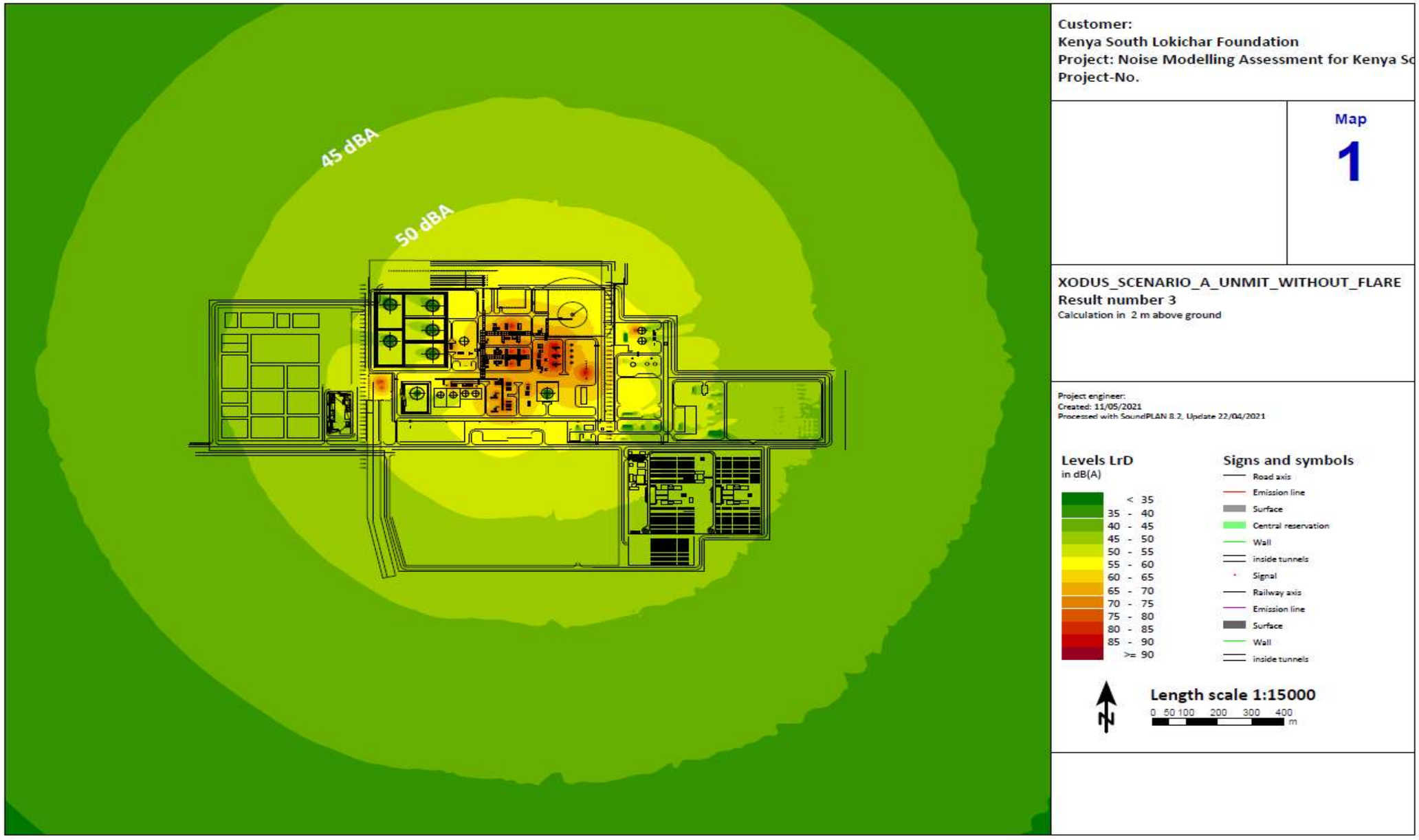
Description	No.	Relative Coordinates (Note 1)	Dimensions (m)		
			Length	Width	Height
Tanks					
T-2901 Water Injection Buffer Tank	1	E 502; N 202	--	48.0	9.0
T-3301 On-Spec Crude Oil Storage Tank 1	1	E 168; N 423	--	46.0	9.0
T-3302 On-Spec Crude Oil Storage Tank 1	1	E 168; N 335	--	46.0	9.0
T-3304 On-Spec Crude Oil Storage Tank 1	1	E 264; N 394	--	30.0	9.0
T-4101 On-Spec Crude Oil Storage Tank 1	1	E 496; N 365	--	11.5	9.0
T-4401 Produced Water Settling Tank 1	1	E 251; N 196	--	21.0	9.6
T-4402 Produced Water Settling Tank 2	1	E 282; N 196	--	21.0	9.6
T-4404 Off-Spec Water Tank	1	E 179; N 200	--	42.0	10.0
Buildings					
CFA					
Main CFA Gatehouse / Security Building	1	E -597; N 175	6.0	11.0	3.0
CFA – Ancillary					
Gatehouse – 2 (South)	1	E -366; N 106	6.0	5.5	2.6
Warehouse – 1	1	E -430; N 317	50.0	30.0	7.0
Warehouse – 2	1	E -30; N 402	50.0	30.0	7.0
Workshop – 1	1	E -61; N 527	24.0	24.0	6.0

Description	No.	Relative Coordinates (Note 1)	Dimensions (m)		
			Length	Width	Height
Workshop – 2	1	E -31; N 527	24.0	24.0	6.0
Permanent Camp					
Admin Office – 1	1	E 926; N 98	24.0	18.0	3.0
Religious Facilities – 1	1	E 933; N 60	24.0	20.0	3.5
Permanent Camp – Can be used by construction					
Gatehouse – 1 (South of permanent camp)	1	E 961; N 36	6.0	5.5	2.6
Management Cabin	120	E 1040; N 405	12.0	3.0	2.6
Junior Staff Cabin	60	E 1040; N 290	12.0	3.0	2.6
Mess Hall / Kitchen / Diner	1	E 946; N 149	35.0	15.0	3.0
Laundry – 1	1	E 1082; N 101	12.0	9.0	3.7
Medical Centre – 1	1	E 923; N 119	36.0	18.0	3.5
Mini-Market	1	E 985; N 145	12.0	6.0	2.6
Clubhouse	1	E 985; N 145	20.0	12.0	3.5
Multisport Hall	1	E 1055; N 507	45.0	25.0	7.0
Gym & Fitness Room	1	E 959; N 445	24.0	12.0	3.7
CFA Construction Camp					
Admin Office – 3	1	E 1146; N 65	24.0	18.0	2.6
Workshop	1	E 1139; N 376	25.0	20.0	6.5
Religious Facilities – 1	1	E 933; N 60	24.0	20.0	2.6
Management Cabin					

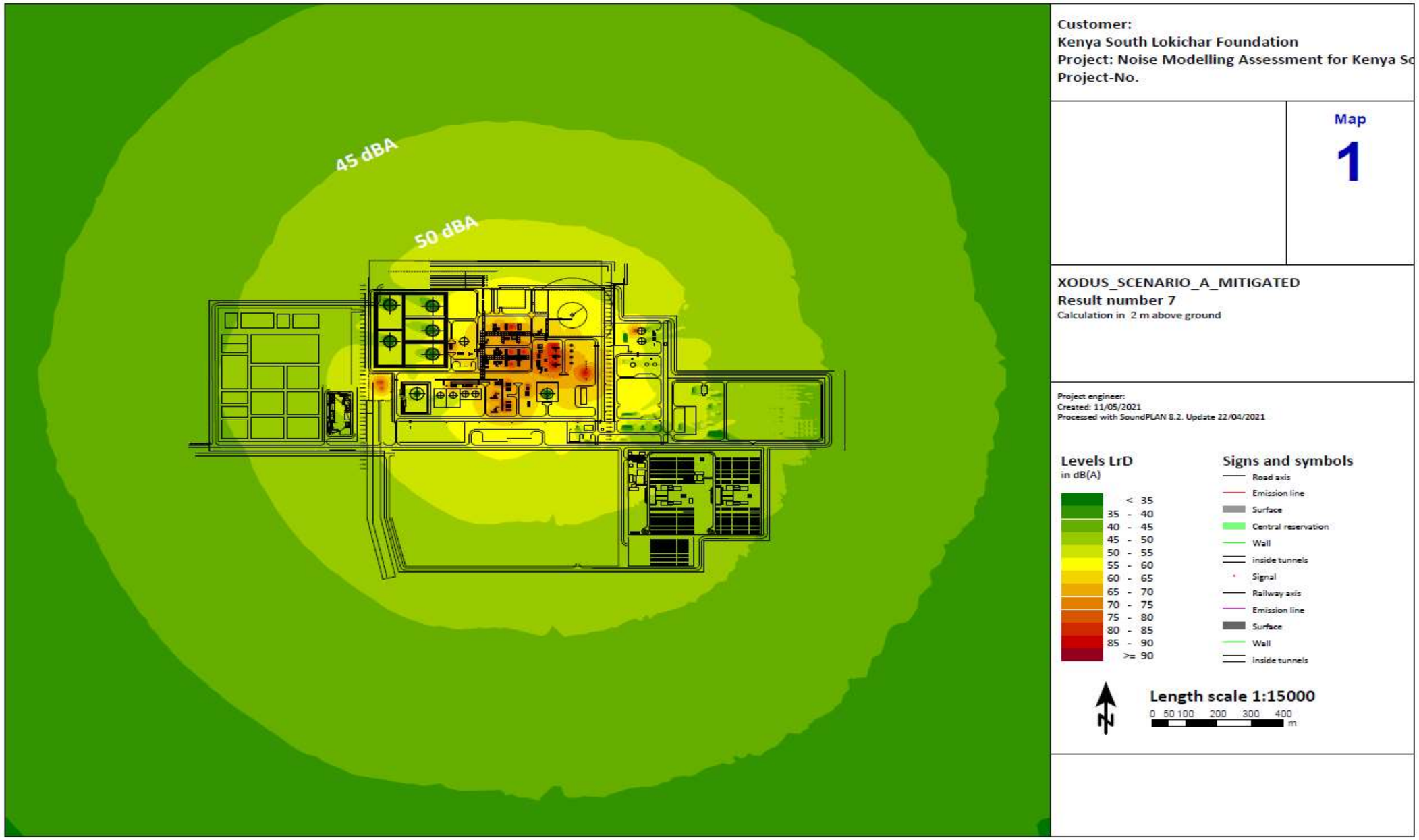
Description	No.	Relative Coordinates (Note 1)	Dimensions (m)		
			Length	Width	Height
Junior Staff Cabin					
Labour Cabin	564	E 1235; N 290	12.0	3.0	2.6
Ablutions Block for Labour Cabin					
House Keeping Store Rooms					
Laundry	4	E 1146; N 168	12.0	6.0	3.7
Drillers Warehouse					
Warehouse	8	E -244; N -342	72.0	24.0	7.0
CFA – IWMF Integrated					
Hazardous Material Storage	1	E -528; N 273	24.0	24.0	2.6
CPF – Central Processing Facility					
Gatehouse (South)	1	E 680; N 102	6.0	5.5	2.6
Main Substation – 1	1	E 630; N 194	51.0	38.0	8.0
Water Injection Pump Shelter	2	E 385; N 230 E 436; N 209	12.0	6.0	2.6
Substation – 2	1	E 269; N 295	32.0	19.0	8.0
LP / MP / HP Booster Compressor Shelter	3	E 403; N 304 E 448; N 304	24.0	24.0	2.6
Well pad					
Chemical Injection Pumps Shelter	1	E 125; N 194	6.0	4.0	4.0

Note 1: Co-ordinates should be confirmed during the next engineering phase.

APPENDIX C SCENARIO A NOISE MAP: ROUTINE OPERATION OF THE CPF – BEFORE MITIGATION



APPENDIX D SCENARIO A NOISE MAP: ROUTINE OPERATION OF THE CPF – AFTER MITIGATION



Water

D3

1 Flood Risk Report - Worley Parsons

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resources & energy

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Kenya South Lokichar Foundation Project

Flood Risk Assessment

Document No KSLFP-0000-EG-STU-0001

05 Feb 2019

1.1 Synopsis

This document details the updated flood risk assessment to support land acquisition at the well pads, central facilities area and airstrip.

1.2 Disclaimer

This report has been prepared on behalf of and for the exclusive use of Tullow Oil Kenya B.V., and is subject to and issued in accordance with the agreement between Tullow Oil Kenya B.V. and WorleyParsons. WorleyParsons accepts no liability or responsibility whatsoever for it in respect of any use of or reliance upon this report by any third party. Copying this report without the permission of Tullow Oil Kenya B.V. or WorleyParsons is not permitted.

Contents

Appendices

1. Introduction

1.1 Purpose

The purpose of this document is present and discuss the updated flood modelling results, incorporating Lidar data, to allow the determination of potential land take requirements for Company's south Lokichar development in Kenya.

1.2 Scope

The scope of the document is to update the Digital Elevation Model for the area of interest; undertake flood modelling of the inflows to the site area baseline (no development); and, flood modelling of the inflows to the site area with the proposed facilities and infrastructure with suggested mitigation options.

1.3 Definitions

Company	Tullow Kenya B.V
Contractor	WorleyParsons Europe Ltd and/or its associate companies
Shall	indicates a mandatory requirement
Should	indicates that a provision is not mandatory, but recommended as good practice
Subcontractor	Any person or persons, firm, partnership, corporation or combination thereof engaged by Contractor to perform any part of the work
Supplier	A company identified in a Purchase Order to supply equipment and/or materials and technical data pertaining thereto

1.4 Abbreviations

Abbreviation	Description
2D Model	Model flow is in 2 directions along the main flow route (upstream and downstream) but also out of bank and overland.
AD	Above datum
CFA	Central Facilitates Area
DTM / DEM	Digital Terrain Model / Digital Elevation Model
FEED	Front End Engineering Design
FRA	Flood Risk Assessment

Abbreviation	Description
GIS	Geographical Information System
Q100	1 in 100 year return period peak flow

1.5 References

Document No.	Document Title
305008-51692-00-EN-REP-0102	Water Management, Flood Risk Assessment Site Report
305008-51692-00-GM-REP-0102	Topographic Survey Report
305008-51692-00-CI-REP-0005	Access Roads Concept Report (infield and Access to Site)
3050008-51692-00-GE-BOD-0101	Infrastructure and Logistics Concept Study - Phase 1 Development Kenya Basis of Design
KSLFP-WPR-EG-STU-0004-B	Site Selection Study
USDA (2004a)	National Engineering Handbook, Part 630 Hydrology, Estimation of Direct Runoff from Storm Rainfall, Chapter 10
USDA (2004b)	National Engineering Handbook, Part 630 Hydrology, Hydrologic Soil Cover Complexes, Chapter 9
USDA (2004c)	National Engineering Handbook, Part 630 Hydrology, Hydrographs, Chapter 16

2. Methodology

The methodologies followed in this updated flood risk assessment (FRA) were developed in line with technical guidance documents such as USDA, 2004 (a-c).

The approach used has been to update the existing hydraulic model to predict the design flood level (1 in 100 year for fluvial flooding) to incorporate the more refined topographical data (Lidar) and revised development and infrastructure locations. This has been used to Identify any necessary mitigation measures (e.g. flood defences) and residual flood risks post mitigation.

The development of the unit hydrograph for use in the flood modelling has used the rainfall and flood hydrograph calculations developed at Concept Phase as described in 305008-51692-00-EN-REP-0101 Rev0 Water Management, Flood Risk Assessment Report (Advisian, 2015). This was done for four catchment areas (a to d) as shown in Figure 1.

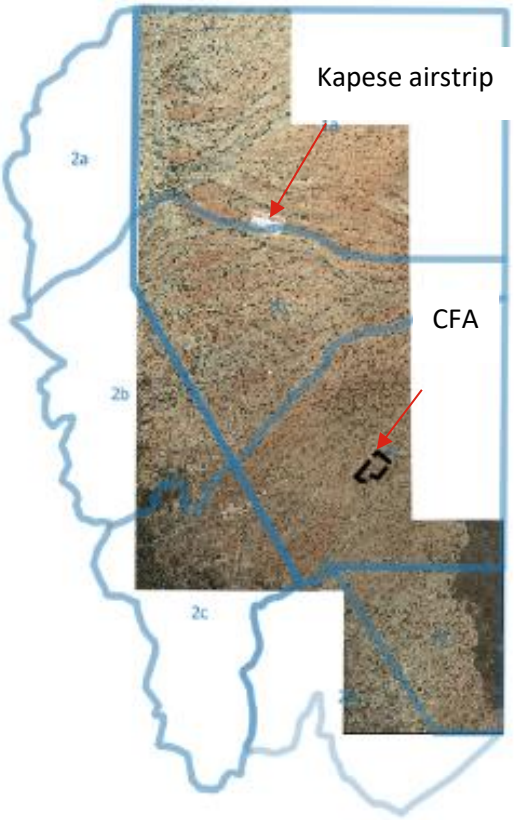


Figure 1 Catchment Areas

Within this updated flood risk assessment (FRA), the following steps where followed.

1. Update of Digital Elevation Model for the area of interest
2. Flood modelling of the inflows to the site area baseline (no development)
3. Flood modelling of the inflows to the site area with the proposed facilities and infrastructure and suggested mitigation options

Flood modelling has used the 2-dimensional modelling code, TUFLOW.

As identified in the previous Concept Phase executed in 2015 (Doc. Ref. 305008-51692-00-EN-REP-0101), the lack of locally measured long-term datasets limits the accuracy of the flood modelling results. This is not unusual in remote areas. Predictions of flooding parameters e.g. flood levels, flow velocities, are inherently less accurate in remote areas, when compared to areas where measurements have been made over several years. Therefore, care needs to be taken when interpreting the results of the analysis. The results need to be kept in context of the data used to drive the models. This means that flood mitigation options need to be designed more conservatively than in areas that are data rich.

3. Model Update

3.1 Topographic Data

LiDAR data was acquired for a subsection of the modelled area as shown in Figure 2. This has been merged with the existing DTM (described in 305008-51692-00-EN-REP-0101) for the wider area. The addition of the LiDAR has increased the resolution across the areas of interest, with better defined lugga channels.

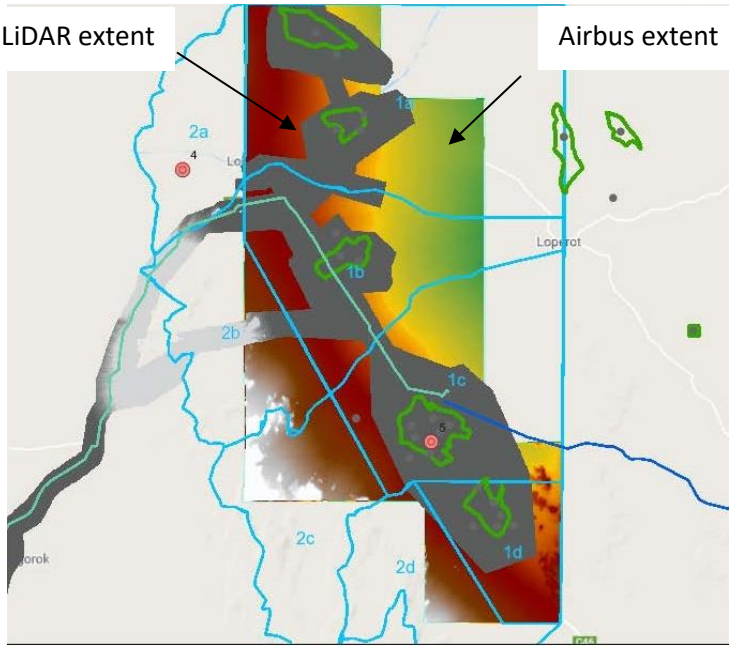


Figure 2 Extent of LiDAR data

However, processing of the Lidar data from the Digital Surface Model to create a Digital Terrain Model (DTM) has resulted in rounding to a metre, removing all decimal places. This has created a stepped effect across the LiDAR area as shown in Figure 3. The impact on the overall model results is considered to be insignificant but it should be taken into account when looking at the results in more detail. The effect can be seen as ripple on the flood model results presented in latter sections. It is recommended that reprocessing is undertaken to include the decimal places and remove the step, creating a smoother profile.

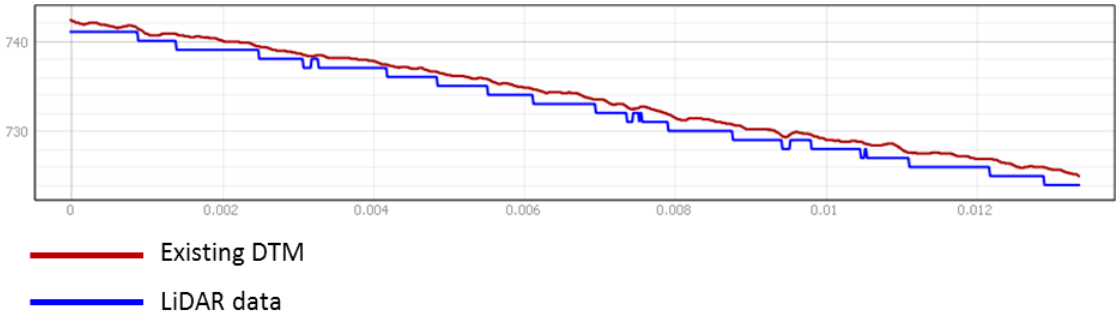


Figure 3 Stepping in the new LiDAR data

3.2 Development Locations

The locations of the Central Facility Area (CFA) and well pads have been confirmed or changed between Concept and Front-End Engineering Design (FEED) stages. The locations of the firm and contingent well pad locations, CFA and airstrip have been updated in the model.

3.2.1 Central Facility Area

A site selection study for the CFA was conducted in the FEED phase 1 (KSLFP-WPR-EG-STU-0004-B). The selected location and shape of the CFA is shown in Figure 1.

3.2.2 Firm Well Pads

The revised locations of the firm wells pads are described in Table 1.

Table 1 Locations of firm well pads

Field	Pad	Manifold Centre Location		Notes
		Easting	Northing	
Ngamia (NG)	NG-01	807071.94	244275.58	Unchanged from BOD rev 3A
	NG-02	805719.95	245412.04	Moved from Contingent to firm
	NG-03	807192.35	245879.36	Unchanged from BOD rev 3A
	NG-04	805957.84	244563.53	Unchanged from BOD rev 3A
	NG-07	808330.46	245431.52	Unchanged from BOD rev 3A
	NG-08	807660.70	244856.39	Unchanged from BOD rev 3A
	NG-09	807052.82	243430.30	Unchanged from BOD rev 3A
	NG-11	806839.07	245205.80	Unchanged from BOD rev 3A
	NG-12	806444.56	244309.20	Formerly NG-18
	NG-13	806182.50	245951.27	Formerly contingent pad NG-45
	NG-14	807795.74	244036.41	Formerly NG-15
	NG-15	807831.39	245670.58	Formerly NG-16
	NG-16	806424.39	245355.07	Formerly contingent pad NG-33

Field	Pad	Manifold Centre Location		Notes
		Easting	Northing	
	NG-17	808125.76	244542.39	Formerly NG-12
	NG-18	807698.78	246263.33	Formerly contingent pad NG-39 - Moved ~ 266m South
	NG-19	806837.33	246394.36	Formerly NG-13
	NG-20	806014.01	243845.24	Formerly contingent pad NG-35
	NG-21	805747.50	246421.37	Formerly contingent pad NG-22
	NG-22	806276.77	246907.58	Formerly NG-14
Amosing (AM)	AM-01	811935.29	239074.52	Unchanged from BOD rev 3A
	Am-03	811487.90	240005.78	Unchanged from BOD rev 3A
	Am-04	812812.63	238428.03	Unchanged from BOD rev 3A
	AM-07	811792.96	238345.49	Minor change (~2m) in pad centre coordinates
	AM-08	812662.31	239352.97	Unchanged from BOD rev 3A
	AM-09	810509.70	240660.16	New pad location added post BOD Rev 3A
	AM-10	812117.55	240209.69	Formerly AM-09
	AM-11	812406.80	237411.68	Formerly contingent pad AM-13
Twiga (TW)	TW-04	801368.75	266468.1	

3.2.3 Contingent Well Pads

The locations of the contingent well pads are described in Table 2.

Table 2 Locations of contingent well pads

Field	Pad	Manifold Centre Location		Notes
		Easting	Northing	
Ngamia (NG)	NG-10	805556.43	243127.97	Unchanged from BOD rev 3A
	NG-23	806362.99	242769.28	Formerly NG-27
	NG-24	805428.19	244429.52	Formerly NG -31
	NG-25	805119.29	243682.26	Formerly NG-36
	NG-26	805251.67	245177.03	Formerly NG-32
	NG-27	805061.65	245717.98	Formerly NG-34
	NG-28	804538.34	245409.24	Formerly NG-23
	NG-29	804315.71	246113.75	Formerly NG-24
	NG-30	804555.01	246715.61	Formerly NG-21
	NG-31	803618.05	246376.91	Formerly NG-25
	NG-32	805643.47	242308.36	Formerly NG-28
	NG-33	806451.09	242295.27	Formerly NG-29
	NG-34	806057.51	241668.33	Formerly NG-30
	NG-35	807149.94	242866.68	Formerly NG-26
	NG-36	807743.12	243142.64	Formerly NG-19
	NG-37	808280.36	245994.61	Formerly NG-17
	NG-38	809070.70	244974.96	Unchanged from BOD rev 3A
	NG-39	808901.42	245759.04	Formerly NG-37
	NG-40	809728.16	245311.03	Unchanged from BOD rev 3A
	NG-41	810299.28	244512.40	Unchanged from BOD rev 3A
	NG-42	810540.35	245269.32	Unchanged from BOD rev 3A

Field	Pad	Manifold Centre Location		Notes
		Easting	Northing	
	NG-43	808766.53	243782.42	Unchanged from BOD rev 3A
	NG-44	804994.70	242106.25	Unchanged from BOD rev 3A
	NG-45	805226.20	246997.80	Formerly NG-20
	NG-46	805022.31	246559.73	Unchanged from BOD rev 3A
Amosing (AM)	AM-05	810382.16	241008.08	Unchanged from BOD rev 3A
	AM-06	809944.64	238317.86	Unchanged from BOD rev 3A
	AM-12	810853.50	241420.75	New pad location added post BOD Rev 3A
	AM-13	810798.28	242253.98	Formerly AM-16 - Moved ~ 350m South
	AM-14	811260.00	237348.75	Unchanged from BOD rev 3A
	AM-15	809770.61	239733.79	Unchanged from BOD rev 3A
	AM-16	811100.15	238921.99	Formerly AM-10
	AM-17	810513.54	239762.06	Formerly AM-11
	AM-18	809766.42	240386.61	Formerly AM-12
Twiga (TW)	TW-01	802064.3	265933.31	
	TW-02	800467.06	265919.31	
	TW-03	802398.55	266967.4	1

3.2.4 Kapese Airstrip

At the Concept stage a number of options for the Airstrip were identified. Modification of the existing Kapese airport has been selected as the preferred option to carry forward in FEED. The location is shown in Figure 1.

4. Flood Modelling Results

Based on the methodology outlined in Section 2, the TUFLOW hydraulic models were simulated for the 1 in 100 year return period rainfall events (Q100).

4.1 Baseline Scenario Results

Baseline Scenario flood behaviour within the study area was shown to be variable due to the topographic variation of the luggas. Areas of both shallow expansive flooding, as well as discrete regions of deeper flow depths and higher velocities are evident within the study area. The following sections summarise the general flow conditions in more depth around the Central Facility location, the proposed airstrip, and the well pad locations.

It should be noted that the depths and velocities described below are highly variable across the project site. This is due to the undulating nature of the terrain across the floodplain and in particular, the overbank areas, and the processing of the Lidar data to create the DTM.

Figure 4 shows the baseline model Q100 results for the entire study area. The proposed facilities and infrastructure have been superimposed on the figure to indicate their locations with respect to the baseline flood extents.

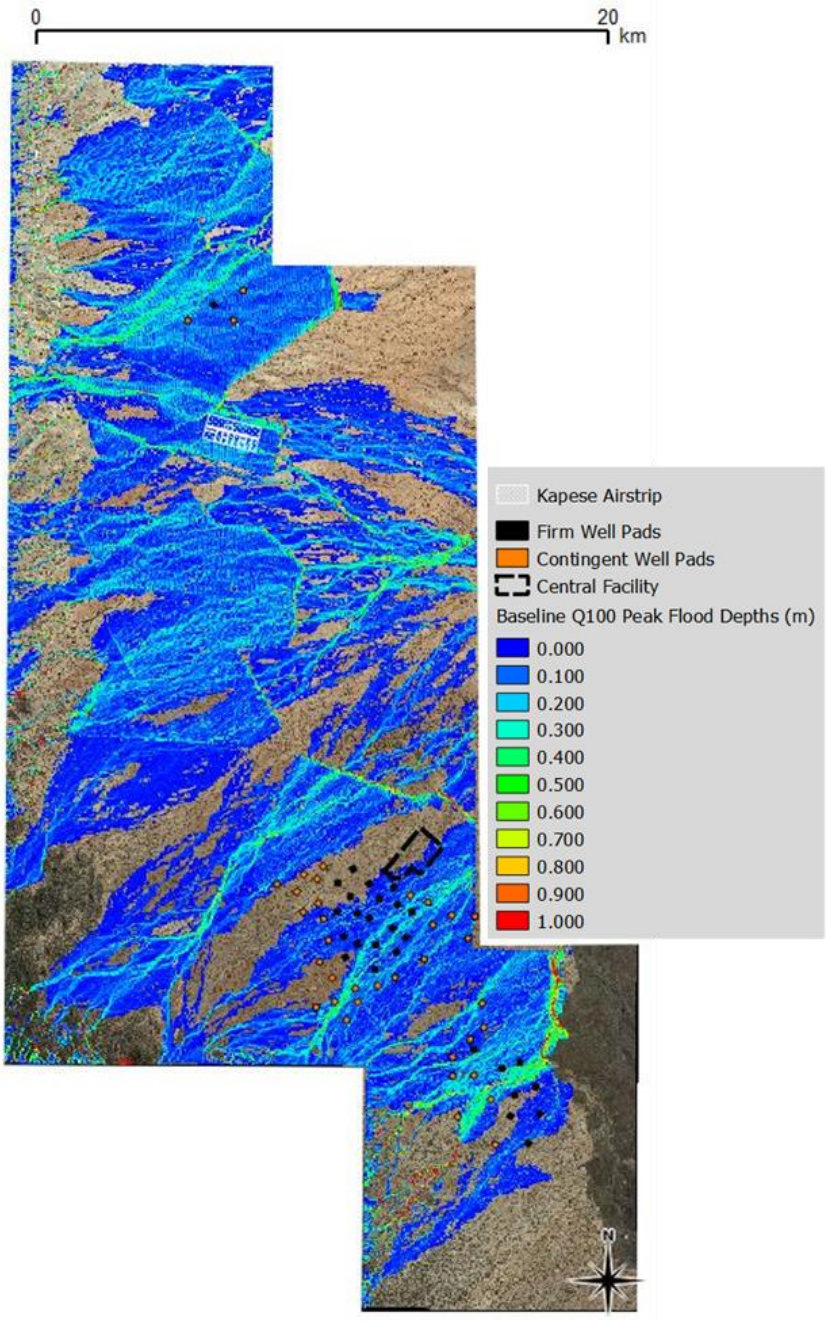


Figure 4 Overview of the Q100 Baseline Scenario flood results over the study area

4.1.2 Central Facility Area

The location for the CFA is shown in Figure 5. This shows it is located between two major luggas.

Modelling results suggest that the majority of surface water flow will be contained within luggas to the south of the site. However, at high flows it is expected that there will be a significant amount of very shallow expansive flooding which will occur in the south and east of the CFA (see Figure 5).

Peak flooding depths in the CFA are predicted to reach 0.2 m in the Q100 event, with peak velocities of approximately 0.3 $m.s^{-1}$.

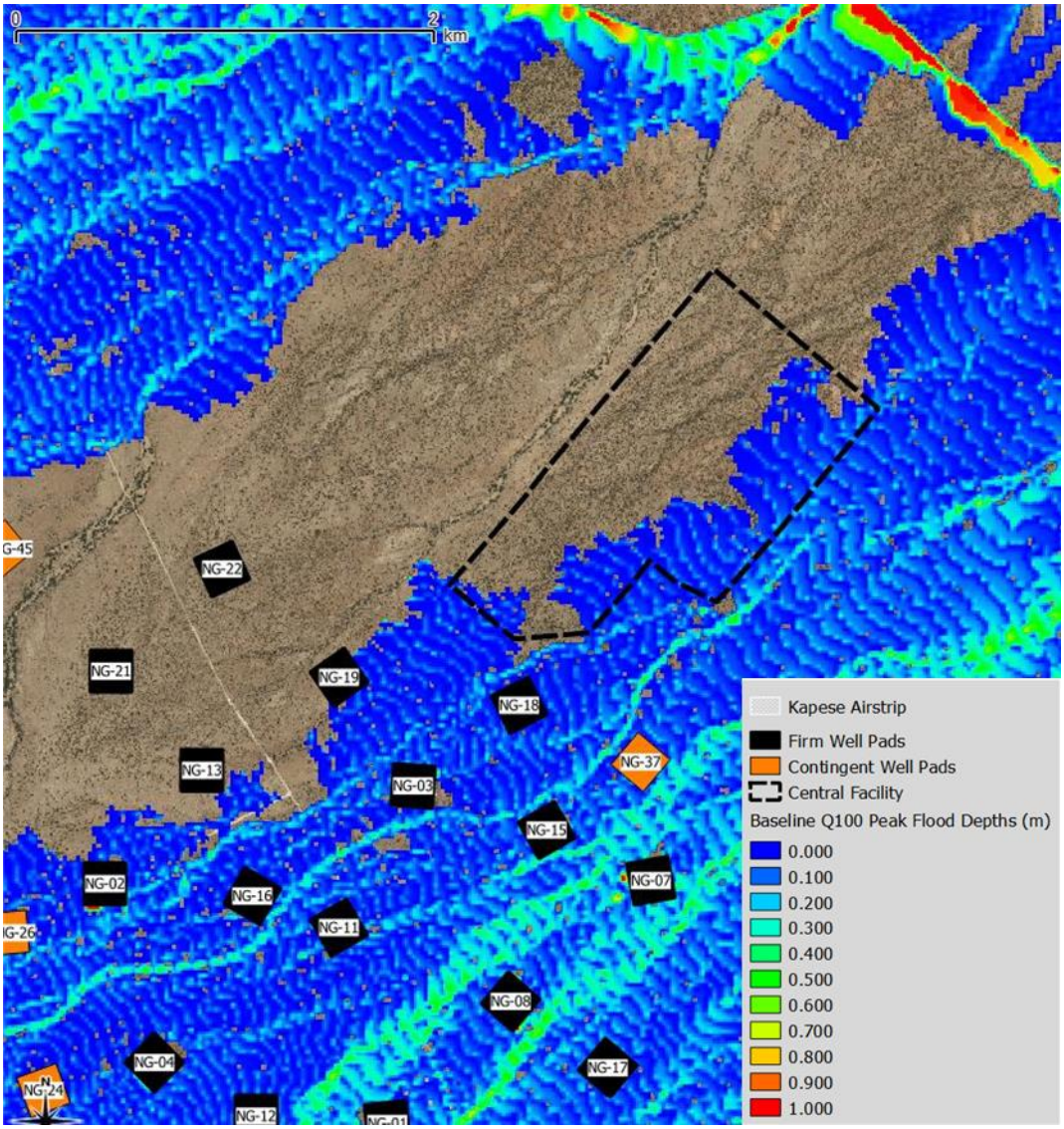


Figure 5 Q100 Baseline Scenario flood depths at the CFA

4.1.3 Firm Well Pads

The modelling results indicate that some of the firm well pads are located on naturally flood free ground and would need very little, if any, flood protection. These are detailed in Table 3. Other firm well pads are in areas of low to moderate flooding. For the well pads at risk, the peak flooding depths and peak flooding velocities are highlighted in

Table 4.

Figure 6, Figure 7 and Figure 8 show the flood model results for the three well fields.

Table 3 Firm well pads not at risk from flooding.

Field	Pad	Manifold Centre Location	
		Easting	Northing
Ngamia (NG)	NG-13	806182.50	245951.27
	NG-19	806837.33	246394.36
	NG-20	806014.01	243845.24
	NG-21	805747.50	246421.37
	NG-22	806276.77	246907.58
Amosing (AM)	AM-01	811935.29	239074.52
	AM-07	811792.96	238345.49
	AM-08	812662.31	239352.97

Table 4 Peak flood depths and velocities – firm well pads

Field	Pad	Peak flood depth (m)	Peak flood velocity ($m.s^{-1}$)
Ngamia (NG)	NG-01	1.78	1.40
	NG-02	0.91	0.27
	NG-03	2.85	0.59
	NG-04	0.65	0.62
	NG-07	0.66	1.98
	NG-08	1.30	0.94
	NG-09	0.91	1.24
	NG-11	0.25	1.15
	NG-12	0.21	0.79

Field	Pad	Peak flood depth (m)	Peak flood velocity ($m.s^{-1}$)
	NG-14	0.22	1.07
	NG-15	0.38	1.99
	NG-16	0.26	0.71
	NG-17	0.30	0.55
	NG-18	0.19	0.18
	NG-19	0.09	0.01
	Am-03	1.05	1.39
	Am-04	0.49	0.44
	AM-08	0.18	0.005
	AM-09	0.30	0.71
	AM-10	0.73	1.98
	AM-11	0.22	0.18
Twiga (TW)	TW-04	0.27	0.67

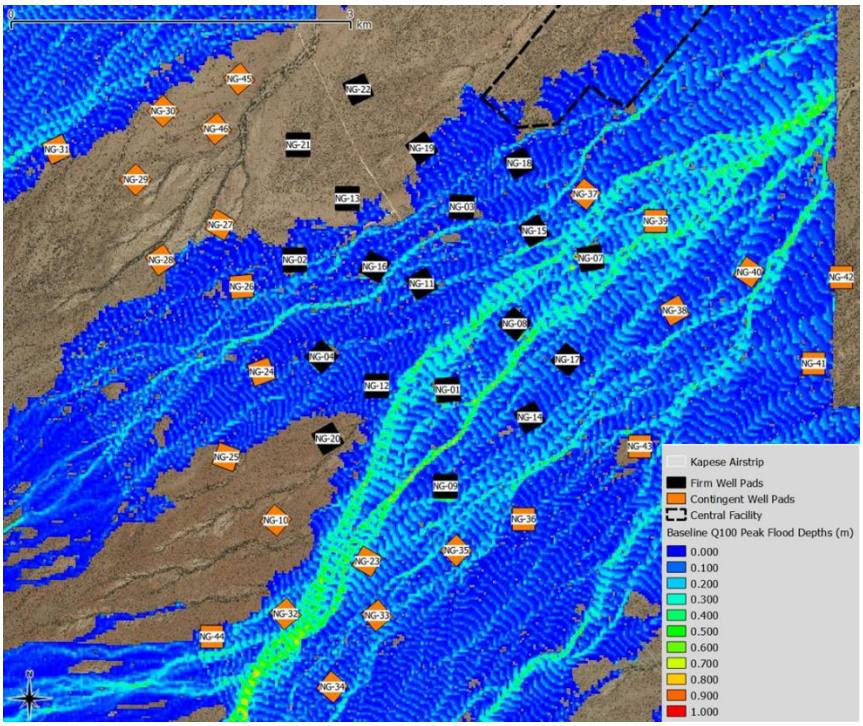


Figure 6 Baseline Q100 flood depths at the Ngamia well pads

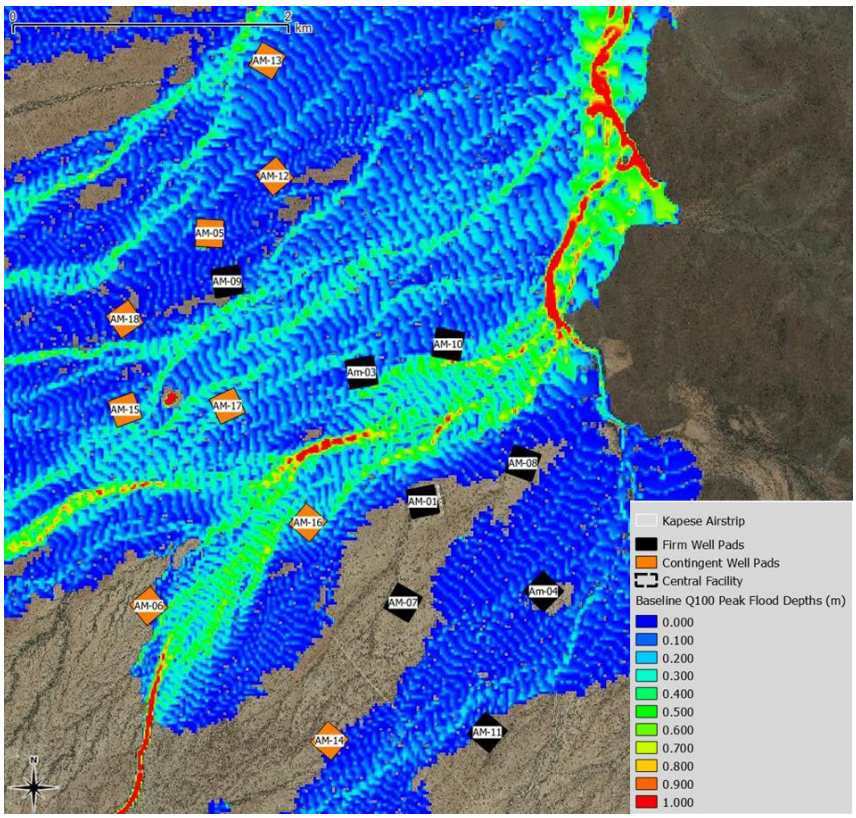


Figure 7 Baseline Q100 flood depths at the Amosing well pads

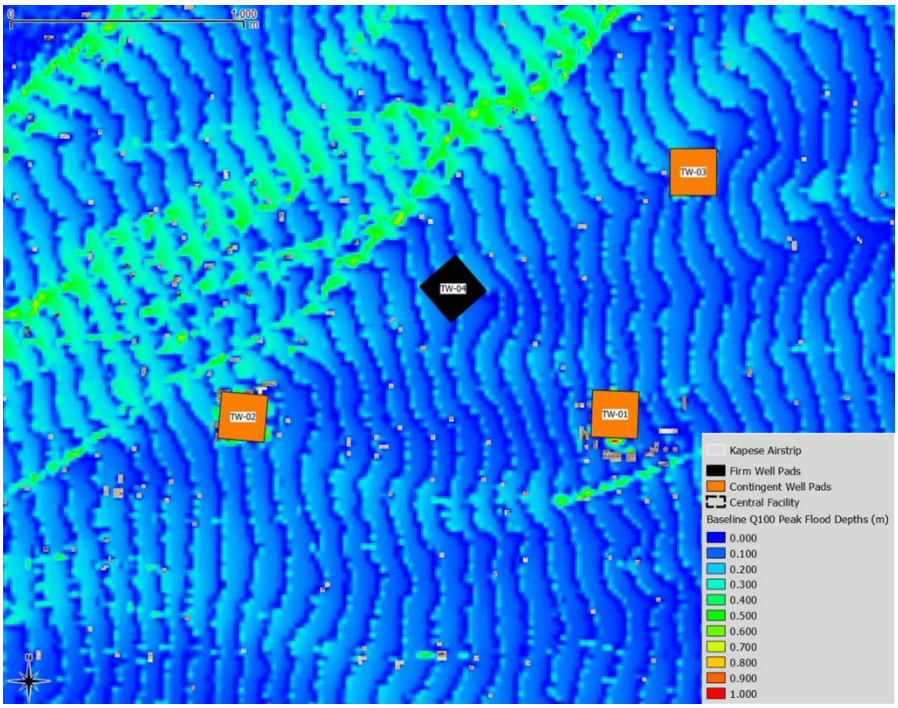


Figure 8 Baseline Q100 flood depths at the Twiga well pads

4.1.4 Contingent Well Pads

The model results suggest that some of these well pads are in areas not at risk from flooding (see Table 5) whilst the rest are in areas of low to moderate flooding.

Table 5 Contingent well pads not at risk from flooding

Field	Pad	Manifold Centre Location	
		Easting	Northing
Ngamia (NG)	NG-10	805556.43	243127.97
	NG-29	804315.71	246113.75
	NG-30	804555.01	246715.61
	NG-45	805226.20	246997.80
	NG-46	805022.31	246559.73

For the well pads at risk, the peak flooding depths and peak flooding velocities are highlighted in Table 6. Figure 6, Figure 7 and Figure 8 show the model results for the three groups of contingent well pads.

Table 6 Peak flood depths and velocities – contingent well pads

Field	Pad	Peak flood depth (m)	Peak flood velocity ($m.s^{-1}$)
Ngamia (NG)	NG-23	0.34	1.74
	NG-24	0.18	0.15
	NG-25	0.18	0.13
	NG-26	0.34	0.81
	NG-27	0.02	0.0006
	NG-28	0.2	0.06
	NG-31	0.22	0.41
	NG-32	0.43	1.41
	NG-33	0.35	1.20
	NG-34	0.22	0.52
	NG-35	0.31	1.13
	NG-36	0.26	0.37
	NG-37	0.32	1.09
	NG-38	0.20	0.30
	NG-39	0.43	1.51
	NG-40	0.23	0.79
	NG-41	0.24	0.36
	NG-42	0.32	0.16
	NG-43	0.18	0.56
	NG-44	0.34	1.10

Field	Pad	Peak flood depth (m)	Peak flood velocity ($m.s^{-1}$)
Amosing (AM)	AM-05	0.94	0.43
	AM-06	0.37	1.83
	AM-12	0.19	0.15
	AM-13	0.27	0.42
	AM-14	0.23	0.12
	AM-15	0.36	2.5
	AM-16	0.40	2.12
	AM-17	0.37	2.77
	AM-18	0.28	0.21
Twiga (TW)	TW-01	0.49	0.76
	TW-02	1.62	0.79
	TW-03	0.87	0.58

4.1.5 Kapese Airstrip

The Kapese airstrip is located between two major luggas. Model results suggest that the airstrip is at risk from flooding (see Figure 9) in the 1 in 100-year event with a simulated flood depth of 0.8 m and a peak flood velocity of approximately 2.3 $m.s^{-1}$.

It should be noted that the airstrip is located close to the boundary of the LiDAR data, where water has pooled within the model as an effect of the LiDAR and DTM merging process. This will have the effect of over-estimating the flood depth due to water being “held-up” at this point.

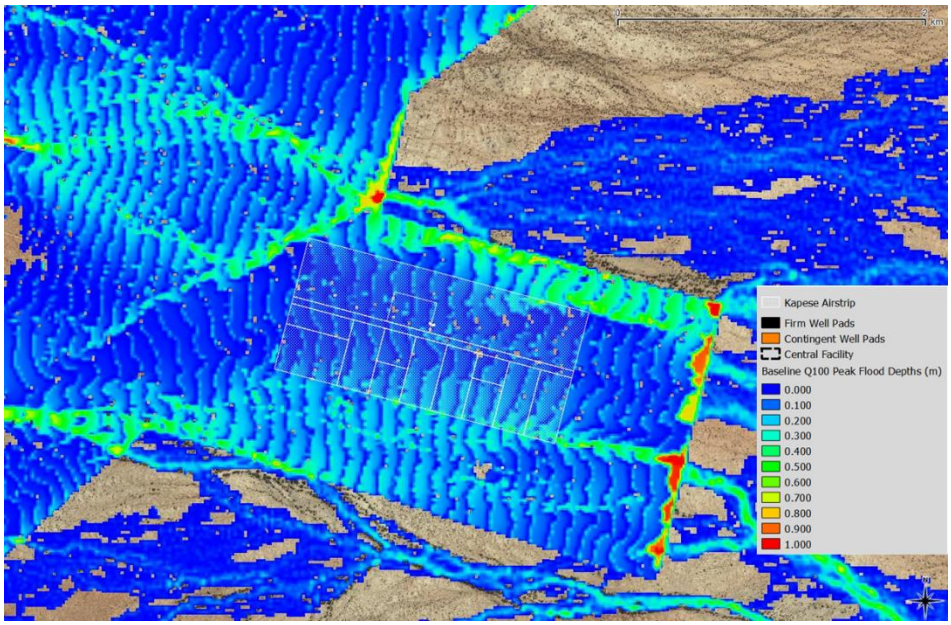


Figure 9 Baseline Q100 flood depths at the Kapese airstrip

4.2 Mitigation Scenario Results

Modelling results suggest that the facilities and infrastructure have been located in areas of shallow expansive flooding. Mitigation measures can be designed to significantly reduce the impact of flood events on the proposed infrastructure. These consist of flood diversion channels and flood protection bunds on affected boundaries of the CFA, well pads and Kapese airstrip.

4.2.1 Central Facility Area

The planned re-graded profile of the CFA is shown in Figure 10. The DTM was modified to include this data and re-run to define the potential flood risk and mitigation options.

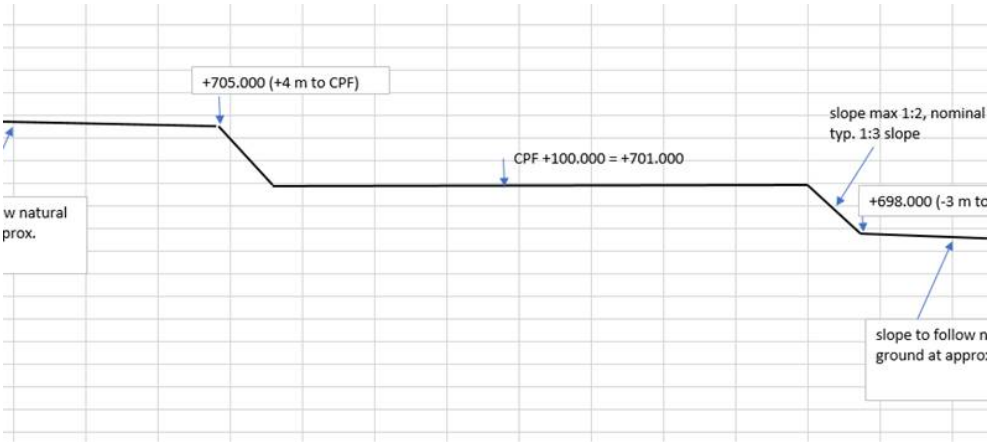


Figure 10 Site preparation level

A 0.5 m flood diversion channel with a 0.5 m flood protection bund along the south and west sides of the site is suggested to provide sufficient flood protection for the proposed CFA.

However, it should be noted road drainage associated with the access road to the CPF may modify this to a certain extent.

Impacts on surface water flows downstream of the CFA due to the mitigation are not expected to result in significant changes to the flow regime as it is deflecting away from the south-eastern edge rather than flow diversion.

4.2.2 Firm Well Pads

Firm well pads in flooded areas have been evaluated on an individual basis to ensure the required flood protection is designed. The general approach to flood protection has been to divert the flood waters, using bund walls and/or localised channel diversions, around the well pads to minimise flow disruption.

For the firm well pads a 0.5 m deep channel with a 0.5 m high bund, providing a total flood defence height of 1 m, around the upstream side of the pads has been proposed as sufficient flood protection in the 1 in 100 year event. The design calculations for this mitigation are detailed Appendix A. These calculations demonstrate that the peak flow can be dealt with by the diversion channel. The flood protection mitigation was then simulated within the model. Figure 11 shows the model results for this mitigated scenario at well pad NG-08.

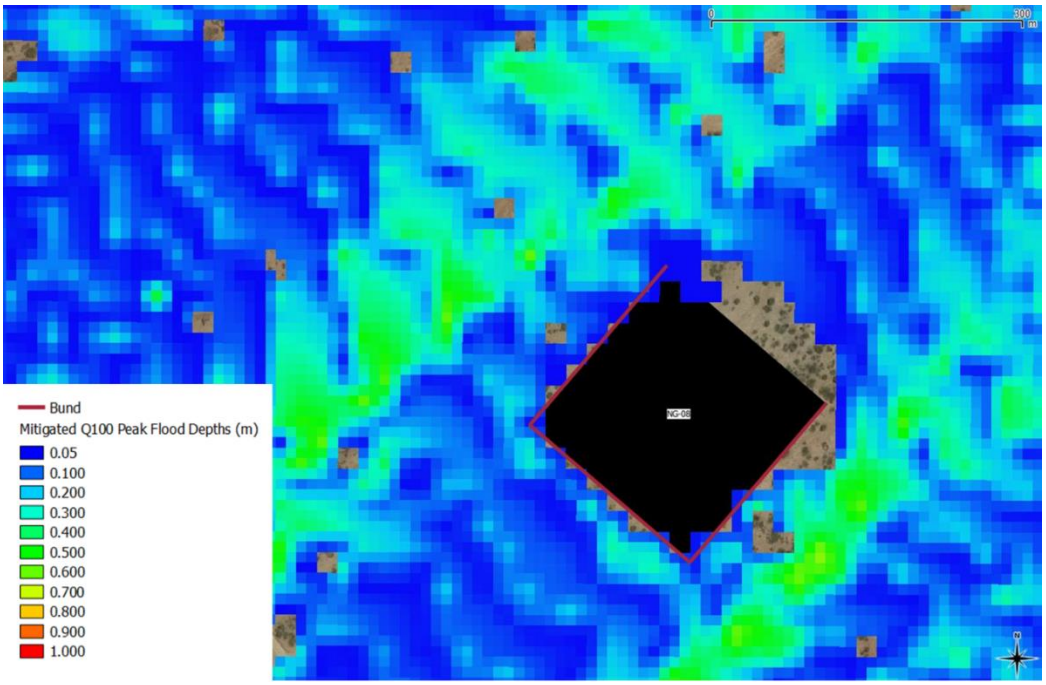


Figure 11 Mitigated Q100 flood depths for well pad NG-08

4.2.3 Contingent Well Pads

The proposed mitigation for the contingent well pads is described in Table 7. Some of the pads require a 0.5 m channel with a 0.5 m bund. For the remaining pads, a 0.5 m bund will be sufficient.

Table 7 Contingent well pads proposed mitigation

Well Pad	Proposed mitigation
NG-10	0.5 m flood protection bund
NG-23	0.5 m flood protection bund
NG-24	0.5 m flood protection bund
NG-25	0.5 m flood protection bund
NG-26	0.5 m flood protection bund
NG-27	None required
NG-28	None required
NG-29	None required
NG-30	None required
NG-31	0.5 m flood protection bund
NG-32	0.5 m flood protection bund
NG-33	0.5 m flood protection bund
NG-34	0.5 m flood protection bund
NG-35	0.5 m flood protection bund
NG-36	0.5 m flood protection bund
NG-37	0.5 m channel with 0.5 m bund
NG-38	0.5 m channel with 0.5 m bund
NG-39	0.5 m flood protection bund
NG-40	0.5 m channel with 0.5 m bund
NG-41	0.5 m flood protection bund
NG-42	0.5 m channel with 0.5 m bund

Well Pad	Proposed mitigation
NG-43	0.5 m flood protection bund
NG-44	None required
NG-45	None required
NG-46	0.5 m channel with 0.5 m bund
AM-05	0.5 m flood protection bund
AM-06	0.5 m flood protection bund
AM-12	0.5 m flood protection bund
AM-13	0.5 m flood protection bund
AM-14	0.5 m flood protection bund
AM-15	0.5 m flood protection bund
AM-16	0.5 m channel with 0.5 m bund
AM-17	0.5 m channel with 0.5 m bund
AM-18	0.5 m channel with 0.5 m bund
TW-01	0.5 m channel with 0.5 m bund
TW-02	0.5 m channel with 0.5 m bund
TW-03	None required

4.2.4 Kapese Airstrip

It is proposed that 1 m channels along the long sides of the airstrip with flood bunds at the upstream end of the strip will provide sufficient flood protection.

5. Mitigation

The new LiDAR data has shown to have an increase resolution in the modelling of the lugga channels. However, the processing to derive the DTM has resulted in a stepped profile. It is recommended that the DTM is reprocessed to provide a higher accuracy akin to the DSM.

The Baseline Scenario flood behaviour within the study area was shown to be variable due to the topographic variation of the luggas. Areas of both shallow expansive flooding, as well as discrete regions of deeper flow depths and higher velocities are evident within the study area.

The modelling results suggest that the flood risk to the CFA, well pads and Kapese airstrip can be mitigated using flood diversion channels and flood protection.

Appendix A. Well Pad Flood Mitigation Calculations

Wellpad	Catchment	Upstream catchment (km^2)	Peak upstream $m^3.s^{-1}$	Height	Base	Slope 1 in	A	P	R	Q	Comments
NG-01	c	0.95	1.42	0.6	0.8	2	1.20	3.48	0.34	1.7	Existing wellpad with channel
NG-02	c	1.67	0.60	0.5	0.3	2	0.65	2.54	0.26	0.7	Existing wellpad with channel
NG-03	c	0.11	0.16	0.5	0.3	2	0.65	2.54	0.26	0.7	Existing wellpad with channel
NG-04	c	0.17	0.21	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve / minor lugga
NG-07	c	0.14	0.21	0.5	0.3	2	0.65	2.54	0.26	0.7	Between luggas
NG-08	c	0.21	0.31	0.5	0.5	2	0.75	2.74	0.27	0.9	Between luggas
NG-09	c	0.4	0.60	0.5	0.5	2	0.75	2.74	0.27	0.9	Interfluve / minor lugga
NG-11	c	0.35	0.33	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve<0.1 m depth
NG-12	c	1.3	1.50	0.6	0.8	2	1.20	3.48	0.34	1.7	Interfluve<0.1 m depth
NG-13	c	n/a	0.00								
NG-14	c	0.18	0.24	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve / minor lugga
NG-15	c	0.18	0.22	0.5	0.8	2	0.90	3.04	0.30	1.1	Interfluve / minor lugga
NG-16	c	0.77	1.05	0.6	0.8	2	1.20	3.48	0.34	1.7	Interfluve / minor lugga
NG-17	c	0.16	0.22	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve<0.1 m depth
NG-18	c	0.14	0.21	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve<0.1 m depth
NG-19	c	n/a	0.00								
NG-20	c	n/a	0.00								
NG-21	c	n/a	0.00								
NG-22	c	n/a	0.00								

Wellpad	Catchment	Upstream catchment (km^2)	Peak upstream $m^3.s^{-1}$	Height	Base	Slope 1 in	A	P	R	Q	Comments
AM-01	d	n/a	0.00								
AM-03	d	0.65	2.01	0.75	0.8	2	1.73	4.15	0.42	2.7	edge of lugga
AM-04	d	2.8	3.35	0.5	0.3	2	0.65	2.54	0.26	0.7	Interfluve<0.1 m depth
AM-07	d	n/a	0.00								
AM-08	d	n/a	0.00								
AM-09	d	0.8	0.89	0.5	0.5	2	0.75	2.74	0.27	0.9	edge of lugga
AM-10	d	0.1	0.45	0.5	0.5	2	0.75	2.74	0.27	0.9	Edge of lugga Channel diversion
AM-11	d	0.99	3.12								Interfluve<0.1 m depth
TW-04	a	0.56	1.12	0.5	0.8	2	0.9	3.04	0.3	1.1	minor lugga

Wellpad	Catchment	Upstream catchment (km^2)	Peak upstream $m^3.s^{-1}$	Height	Base	Slope 1 in	A	P	R	Q
NG-10	c	n/a	0.00							
NG-23	c	0.18	0.27	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-24	c	0.19	0.28	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-25	c	0.23	0.07	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-26	c	0.23	0.34	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-27	c	0.6	0.30	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-28	c	n/a	0.00							
NG-29	c	n/a	0.00							
NG-30	c	n/a	0.00							
NG-31	c	0.4	0.22	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-32	c	0.16	0.15	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-33	c	0.35	0.52	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-34	c	0.04	0.06	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-35	c	0.11	0.16	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-36	c	0.18	0.27	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-37	c	0.42	0.63	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-38	c	0.69	1.03	0.6	0.3	2	0.90	2.98	0.30	1.1
NG-39	c	0.96	1.44	0.7	0.3	2	1.19	3.43	0.35	1.7
NG-40	c	0.2	0.30	0.5	0.3	2	0.65	2.54	0.26	0.7

Wellpad	Catchment	Upstream catchment (km^2)	Peak upstream $m^3.s^{-1}$	Height	Base	Slope 1 in	A	P	R	Q
NG-41	c	0.98	1.47	0.7	0.5	2	1.33	3.63	0.37	1.9
NG-42	c	0.2	0.30	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-43	c	0.88	1.32	0.6	0.8	2	1.20	3.48	0.34	1.7
NG-44	c	0.08	0.03	0.5	0.3	2	0.65	2.54	0.26	0.7
NG-45	c	n/a	0.00							
NG-46	c	n/a	0.00							
AM-05	d	0.25	1.12	0.5	0.8	2	0.90	3.04	0.30	1.1
AM-06	d	0.49	0.04	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-12	d	0.12	0.54	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-13	c	0.12	0.18	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-14	d	0.41	0.04	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-15	d	0.11	0.49	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-16	d	0.14	0.62	0.5	0.3	2	0.65	2.54	0.26	0.7
AM-17	d	0.34	1.52	0.6	0.8	2	1.20	3.48	0.34	1.7
AM-18	d	0.56	2.50	0.8	0.5	2	1.68	4.08	0.41	2.6
TW-01	a	0.46	0.92	0.6	0.5	2	1.02	3.18	0.32	1.4
TW-02	a	0.46	0.92	0.6	0.5	2	1.02	3.18	0.32	1.4
TW-03	a	0.49	0.98	0.6	0.5	2	1.02	3.18	0.32	1.4

Water

D3

2 Strategic Water Supply for Development - Intake location at Turkwel Dam

10 OPTIMUM INTAKE LOCATION AT TURKWEL DAM

INTRODUCTION

This paper discusses the main options for a water intake location at Turkwel Dam, which has been selected as the preferred option for strategic water supply. An initial assessment of the intake options was reported in August 2015 (see Technical Report 1), with three main options presented: a) the reservoir above the dam; b) an underground surge chamber; and c) the tailrace discharge canal. The surge chamber was ruled out, so the main options remain the reservoir or the tailrace. Since that report was written, the historical record of water levels in the reservoir and the way in which the dam is operated have been analysed in detail and the findings to date are summarised in this paper.

MAIN INTAKE OPTIONS

First, a reminder of the basic layout of the dam and associated facilities (Figure 1):

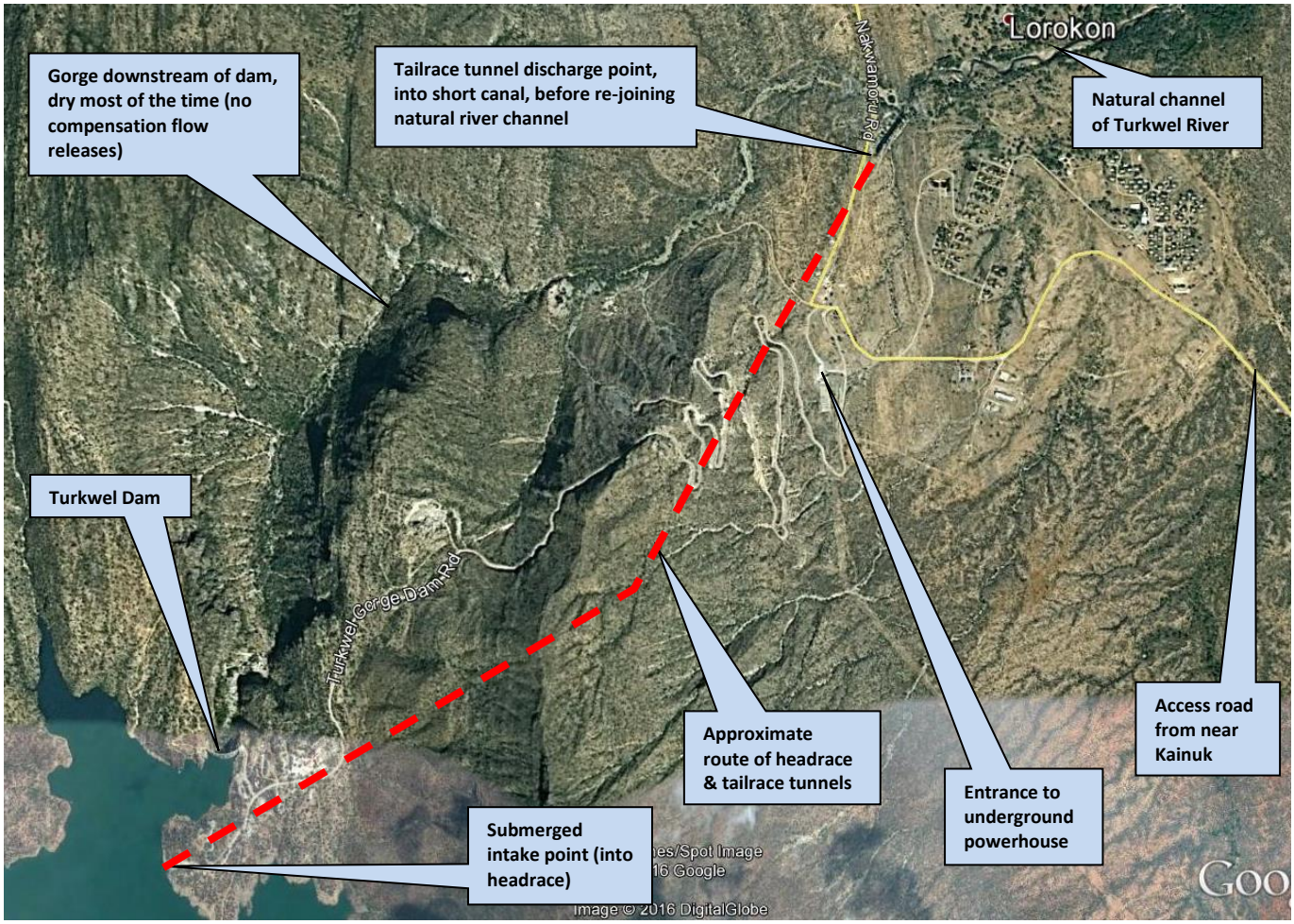


Figure 1: Layout of Turkwel Dam, associated facilities and the Turkwel River channel

Tailrace intake option

The tailrace tunnel discharges into a short canal (about 200 m long), which leads the flow back into the natural river channel (Figure 1). There is plenty of space on either side of the canal, so constructing a sump for the pump intakes, connected to the canal, would be relatively straightforward and inexpensive. These are the main reasons why Xodus recommended this as their preferred location for the make-up water station ("Turkwel Dam Make-up Water Study", Report L-100282-S00-Y-REPT-002, Xodus Group, December 2015).

Reservoir intake option

One of the other options considered by Xodus in the same report was an intake location at the upstream end of the reservoir (Figure 2). However, the most practicable location for an intake in the reservoir would be a floating pontoon somewhere near the dam, able to rise and fall with the fluctuating water levels. The pipeline would follow the dam access road (visible on Figure 1) and then drop down the escarpment, passing close to the tailrace discharge. The reasons why a location near the dam is preferable are summarised in Figure 2.

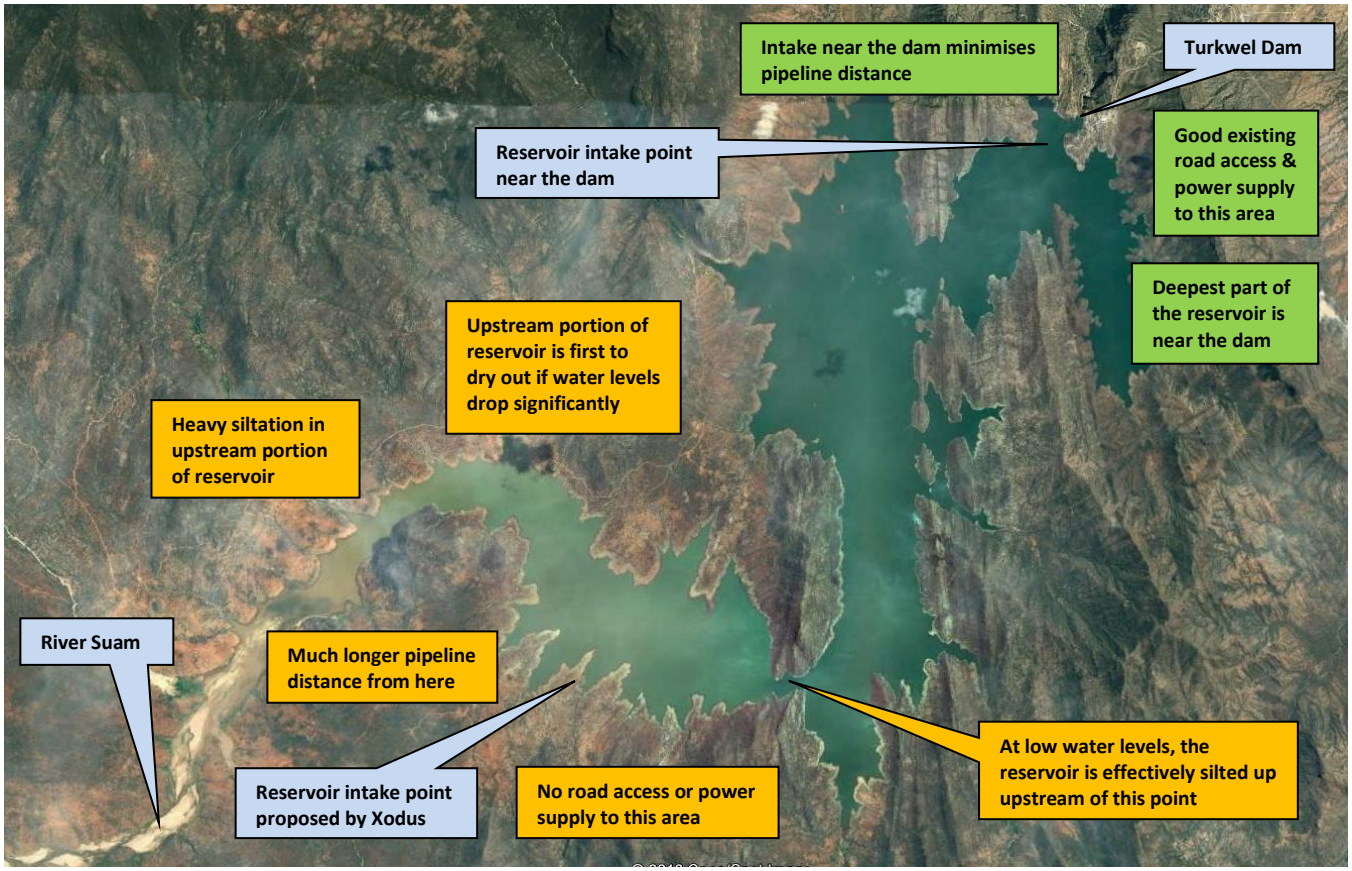


Figure 2: Alternative intake locations in the reservoir

RESERVOIR WATER LEVELS & STORAGE

Turkwel Dam is a concrete-arch dam built in a narrow gorge, commissioned in 1991, with a maximum generating capacity of 106 MW and a quoted total reservoir volume of 1.6 billion m^3. The photograph in Figure 3 shows the face of the dam, and it can be seen that there are four un-gated spillway openings and below the water line there is a low-level sluice for compensation flow and reservoir scouring. The low-level sluice would normally be used to release compensation flows downstream, but this is rarely done. In practice therefore, all water passing downstream does so through the turbines, so the natural channel between the dam and the tailrace discharge point is dry the vast majority of the time. Also, the low-level sluice would normally be fully opened periodically to make sure the mechanism is still working and to scour sediment accumulating behind the dam, but again, this is rarely, if ever, done. Some key elevations are as follows (all in metres above sea level, masl):

Maximum water level in reservoir:	1,154.5
Full supply level (spillway crest):	1,150
Highest ever water level to date in reservoir (in late 2012):	1,139
Average water level in reservoir (1991-2016):	1,119
Minimum operational level of water (for power generation):	1,105
Level of top of submerged intake to headrace tunnel:	1,098
Level of invert of submerged intake to headrace tunnel	1,094
Low-level sluice in face of dam (drain-down level):	1,070
Typical downstream pool water level:	1,036

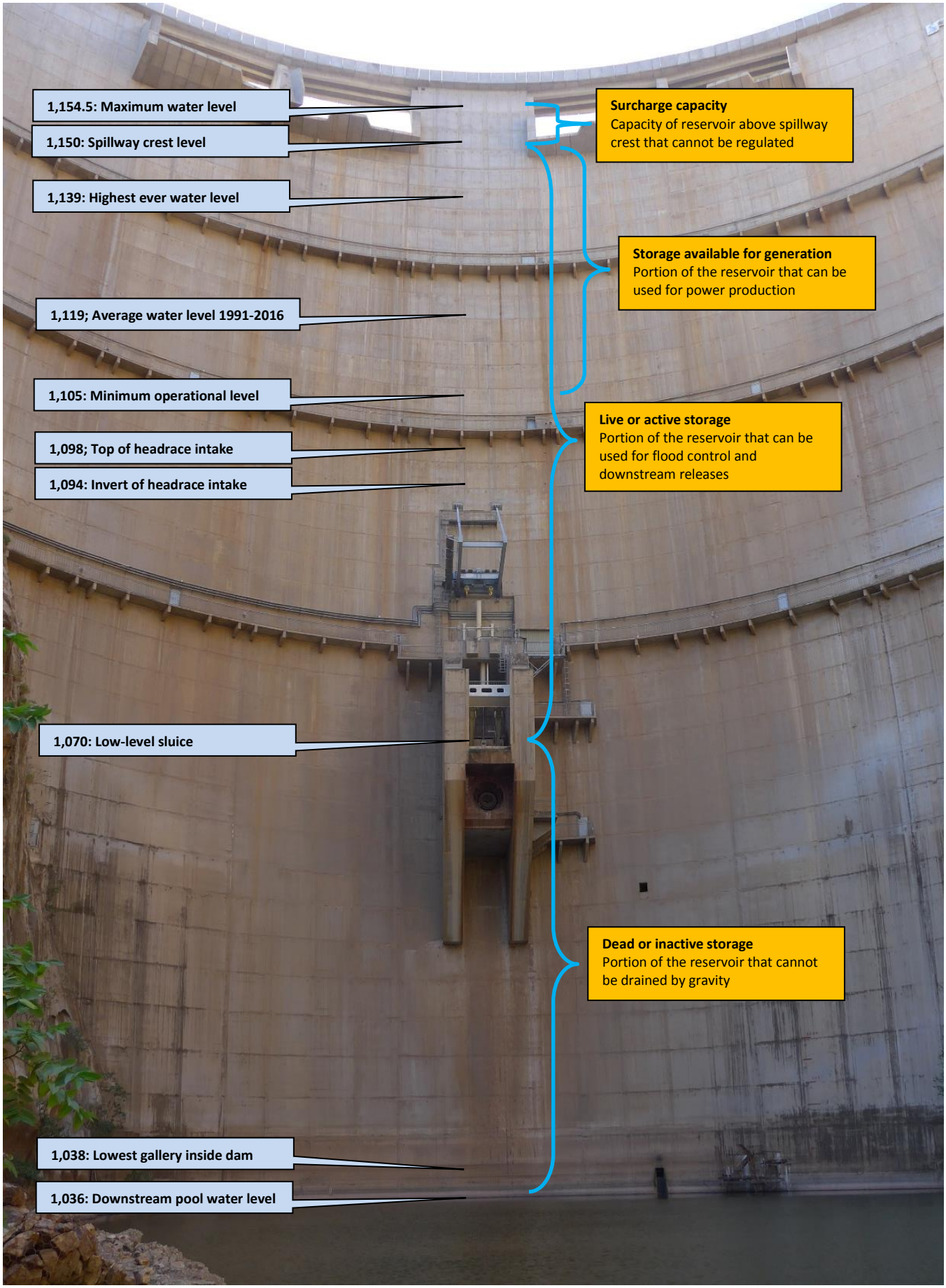


Figure 3: Summary diagram of elevations of key features at Turkwel Dam *(all figures metres above sea level)*

Historical records of water levels in the reservoir since it was constructed have been obtained and quality controlled and are shown in Figure 4, about which the following key points can be noted:

- The dam has never spilled since it was constructed; in fact, it took until September 2003 for the optimum generating water level to be reached, and the highest water level ever recorded, in October 2012, was still 11 m below the spillway crest level.
- Ignoring the initial period of filling immediately after construction, the water level has dropped below the minimum operational water level on eight separate occasions, sometimes for several months, the longest period being over six months in the first half of 2000 (the minimum operational water level is the level below which the dam can no longer generate electricity).

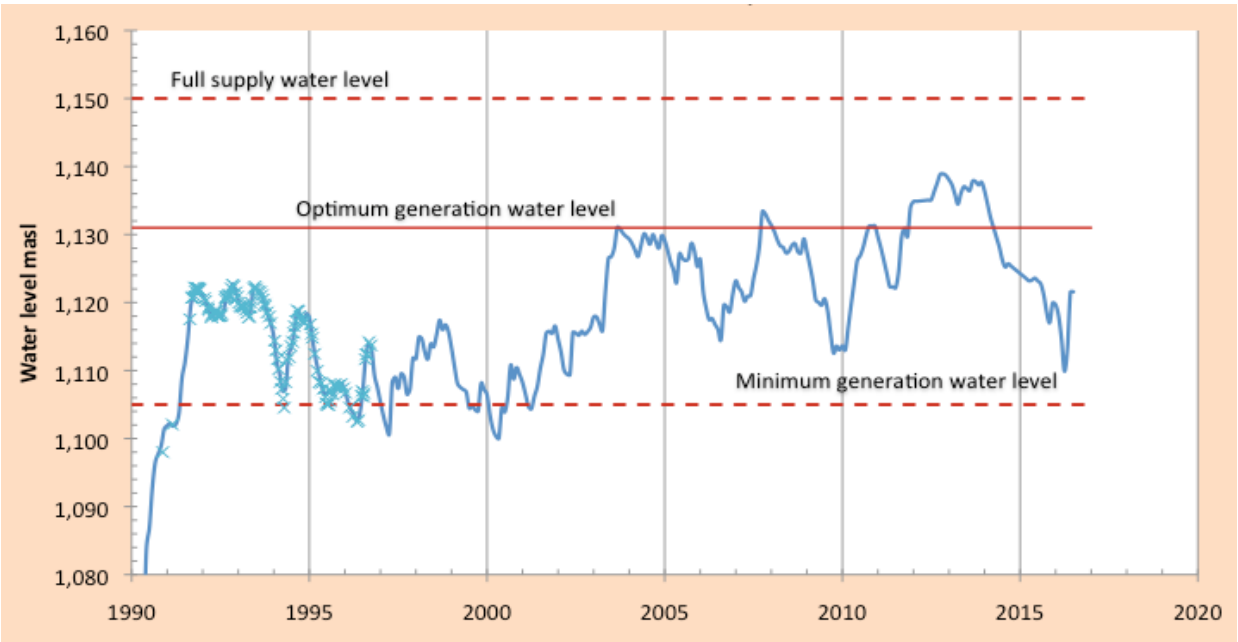


Figure 4: Historical water levels for Turkwel reservoir, 1990 to 2016

An alternative way of presenting the water level data is shown in Figure 5 - a water-level duration curve, derived by ranking the daily water level readings from highest to lowest, ignoring the actual dates, and plotting them.

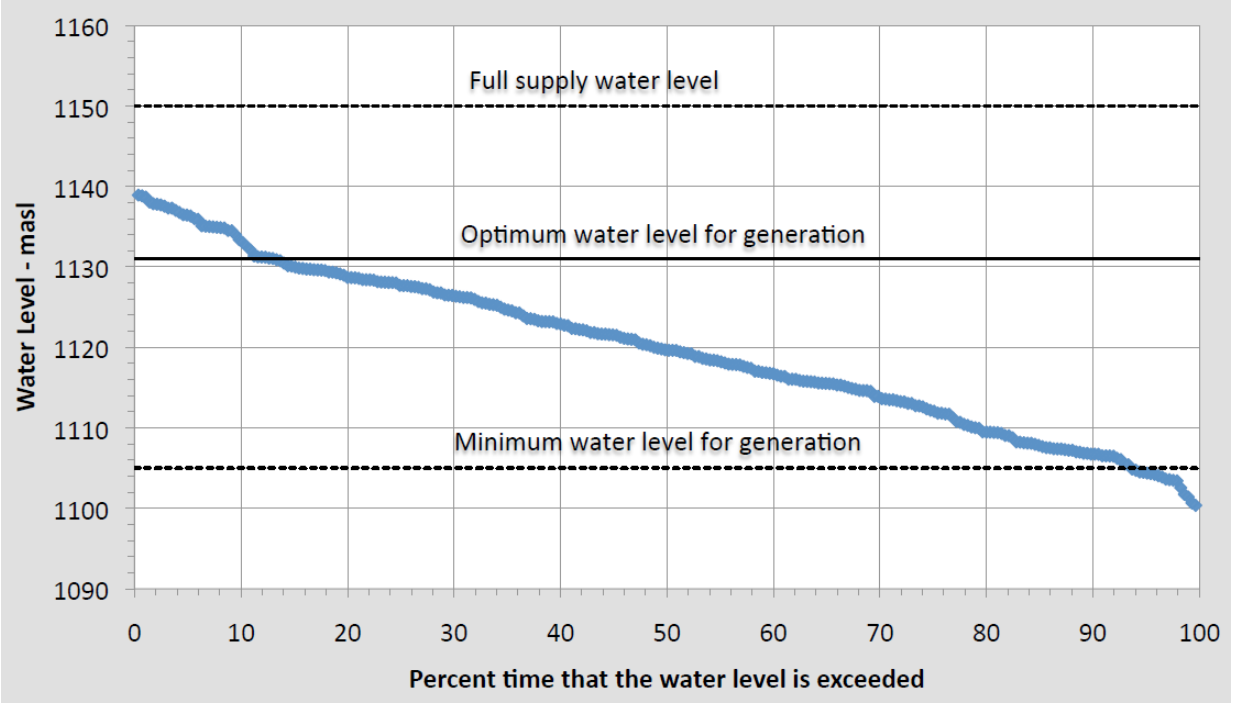


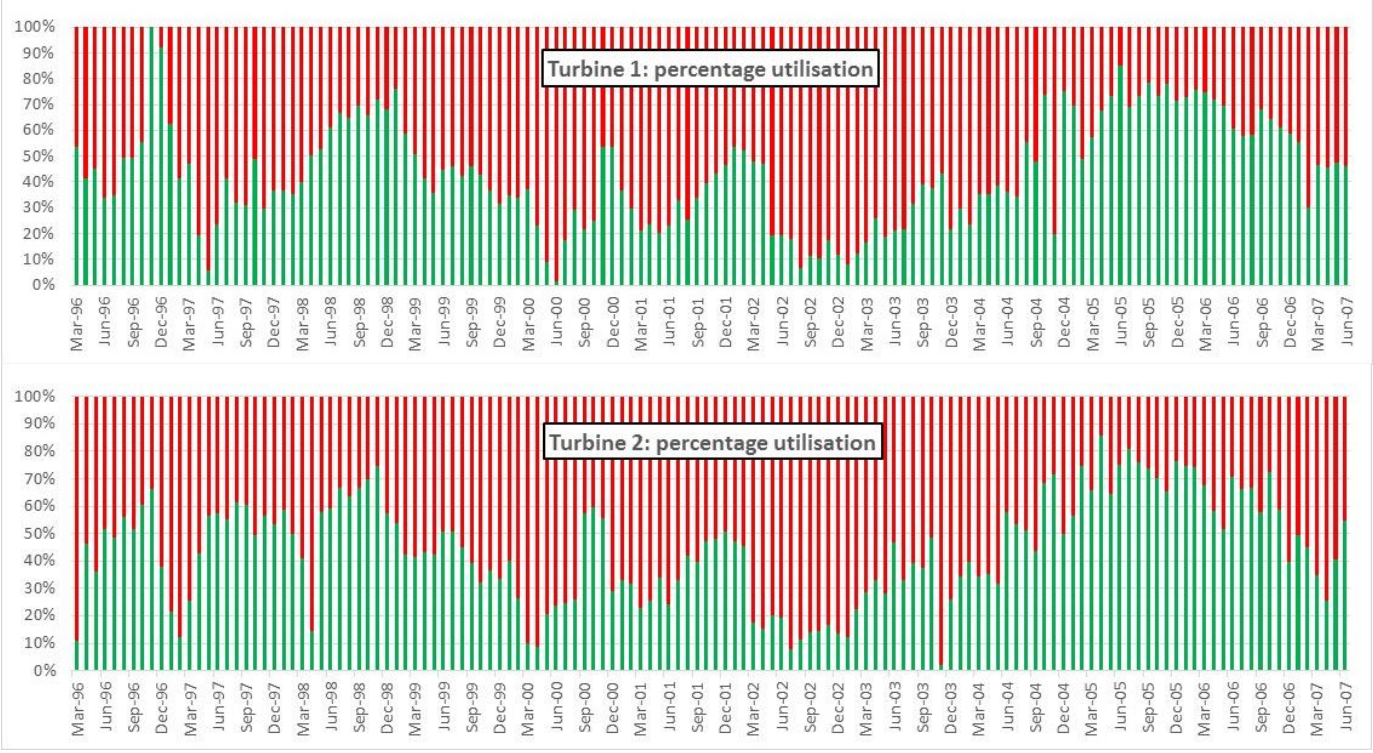
Figure 5: Water level duration curve for Turkwel reservoir, 1992 to 2016

Figure 5 shows the percentage of time, for the period 1992 to 2016, that a certain water level is exceeded. It can be seen that the minimum operational water level (1,105 masl) was exceeded about 94% of the time, or in other words, since 1992, the water level has been below the minimum operational water level for about 6% of the time. Ignoring the electricity generation regime, this represents the magnitude of the historical risk of water not being available at the tailrace discharge canal. Work will continue in 2017 on estimating the future risk over the lifetime of the South Lokichar oilfield, taking into account factors such as climate change, reservoir sedimentation and water resources development plans for the hydrological catchment above and below the dam.

ELECTRICITY GENERATION REGIME

Although Turkwel Dam was originally intended to be a multi-purpose project for hydro-power, irrigation, fisheries, river regulation and leisure activities, in practice it has only been used for electricity generation. As mentioned above, all water passing downstream does so through the turbines (because the low-level sluice in the face of the dam is rarely used), so downstream flows are entirely governed by the electricity generation regime. In other words, any benefits in terms of river regulation are incidental and if the turbines are shut down for any reason, no flow passes downstream.

Turkwel Dam is owned by the Kerio Valley Development Authority (KVDA), but the electricity generation is undertaken by the Kenya Electricity Generating Company Ltd (KenGen). There are two turbines at Turkwel Dam, with a combined capacity of 106 MW. The power is transmitted along a 220-kV transmission line, feeding directly into the national grid. The average monthly operating hours for the turbines vary throughout the year, depending on seasonal demand for electricity. In the event of power shortfall from other generating stations, Turkwel can be called upon to boost output to make up the deficit, but these calls are unpredictable. Figure 6 shows KenGen data on hours of operation for the period March 1996 to June 2007, in the form of percentage utilisation. Over that period, Turbines 1 and 2 were on average operating for 44% and 45% of the time (just over 10 hours per day), respectively. For example, a recent operating sequence was as follows (observed during a site visit in July 2016): during daylight hours on a weekday, a single turbine was running, generating about 40 MW; there was total turbine shutdown with zero water discharge all day Sunday until nightfall; during the evening hours on all days including Sunday, two turbines were operating from 19:00 until 22:30; on all days, there was no power generation overnight between 22:30 and 06:30, so water discharge was zero over that period.



(Green bars = average monthly percentage of time that turbine is operating)

Figure 6: Percentage utilisation of the turbines at Turkwel Dam, March 1996 to June 2007

It was mentioned earlier that when the water level in the reservoir drops below the minimum operational water level, generation of electricity ceases. However, comparison of Figures 4 and 6 reveals that in early 2000, when the water level was below the minimum operational level for several months, generation of electricity still continued, albeit at a reduced rate. This suggests that the minimum operational level is not used as a strict cut-off point. Interestingly, the fact that the dam has never spilled, even though the turbines are only operating less than half the time, could imply that either the dam was overdesigned or the turbines are being operated more than was originally intended. Work is continuing to collect and analyse more data on the electricity generation regime and its inter-relationship with reservoir water levels.

The main implication of the electricity generation regime just described for the choice of water intake location at Turkwel Dam is that an intake abstracting from the tailrace discharge canal would on average only be able to pump for about 45% of the time, and there may be occasions when the tailrace canal is dry for extended periods. Having said that, an advantage of the tailrace canal as an intake location is that the generation of electricity would not be affected by the water abstraction. With an intake in the reservoir behind the dam, any water abstraction would lower the water level, which would theoretically reduce the amount of electricity able to be generated. However, for the quantity of water required by Tullow, this effect is likely to be insignificant. For example, at a typical reservoir water level of 1,120 masl, the surface area of the reservoir is about 22 x 10^6 m^2. An abstraction rate of 7,000 m^3/day (the projected average water demand over a 25-year lifetime of oil production) would lower this water level by about 0.3 mm per day. Compare this to the average loss of water by evaporation from Turkwel reservoir, which is about 4.9 mm per day. Further analysis will be done on quantifying this effect.

TAILRACE CONFIGURATION

It has been suggested that there is sufficient water storage in the tailrace tunnel and discharge canal to cover interruptions in water flow through the turbines, so the tailrace canal cross-sections and longitudinal profile have been investigated. The tailrace canal is an excavated trench about 200 m long and 20 m wide. The tailrace tunnel discharges into the canal underwater and the tunnel exit is not normally visible. At the downstream end of the canal is a hydraulic control structure that doubles as a footbridge (see photo below left, looking upstream). Just downstream of the control structure, the channel constricts before tumbling down some small rapids (see photo below right, looking upstream) to re-join the original river channel.

Concrete stoplogs are stored nearby (see photo below left), which can be slotted into grooves on the control structure (see photo below right), forming a dam to raise the water level in the tailrace canal. The structure is designed to impound water up to near the deck level of the footbridge, a clear height of about 6 m. The original purpose of the impoundment structure was to raise the water up to the command water level to gravity-feed an irrigation offtake canal on the north bank. The irrigation scheme was never implemented, so the stoplogs have never been deployed. Plans for such an irrigation scheme have recently been revived by KVDA and a feasibility study has been undertaken.

When the turbines are running, the channel is full of fairly fast-flowing water (see photo below left, looking downstream), but when both turbines are shut down, the water level in the tailrace canal drops dramatically (see photo below right, taken from a similar vantage point). The constriction and its associated shingle bed, visible in the photo below right, are the hydraulic control governing the water levels in the tailrace canal.

The cross-sectional depth profiles of the tailrace canal were measured in July 2016, at a time when both turbines were shut down and there was only a trickle of water passing downstream, which meant that the water level was constant throughout the depth-measurement exercise. Water depths were measured using a 'Qliner 2' acoustic doppler current profiler, manufactured by OTT Hydromet (see photos below). Measurements of cross-sectional depth profiles were taken at seven locations, evenly spread along the length of the tailrace canal, starting at the footbridge and working upstream; the results are shown in Figure 7.

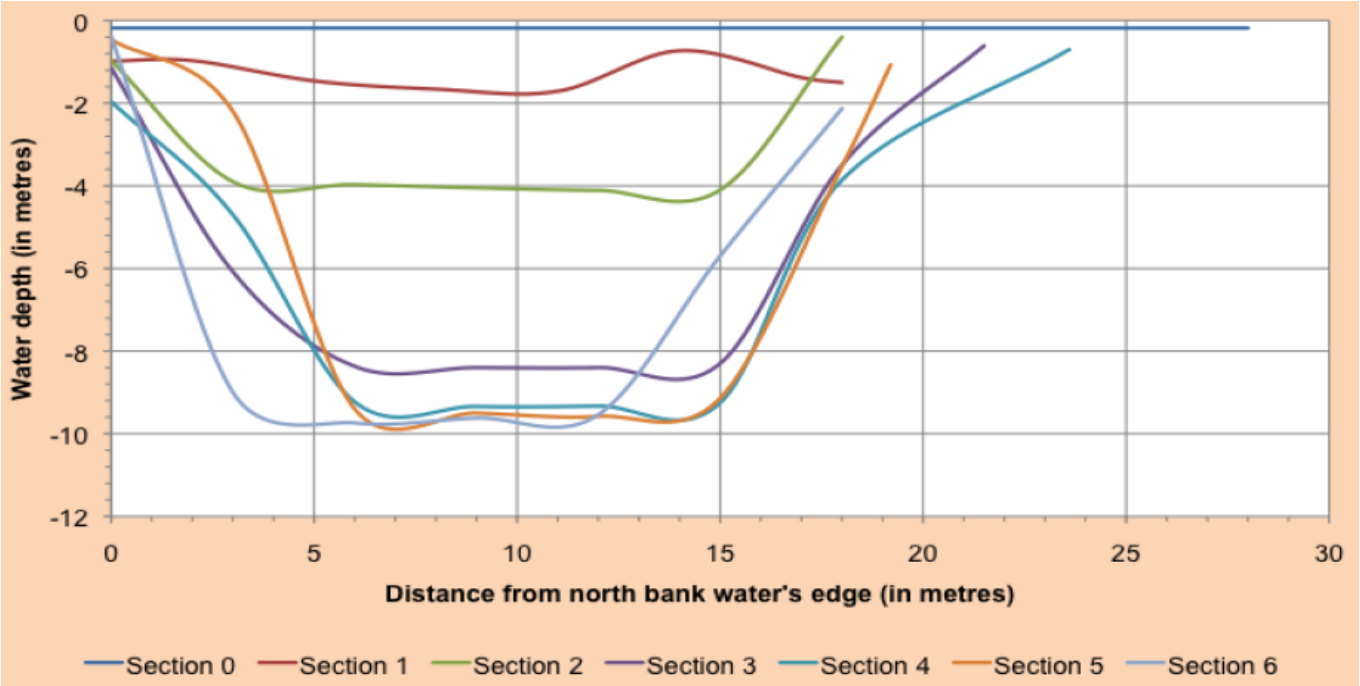


Figure 7: Tailrace canal cross-sections, measured at zero flow (with footbridge at Section 0)

Figure 7 shows that the ponded water (at zero flow) in the upstream half of the tailrace canal is between 9 and 10 m deep, reaching that depth at a distance of about 5 m from each bank. The pond depth reduces progressively downstream as the footbridge is approached. Under zero-flow conditions, the water depth under the footbridge itself is less than 20 cm. Integrating these results, the volume of ponded water in the tailrace canal at zero flow is about 14,200 m^3. The potential extra storage between the zero-flow pond level and the underside of the footbridge is about 20,740 m^3 (an added height of approaching 6 m); thus the theoretical maximum storage with stoplogs in place would be about 35,000 m^3. Taking into account the need to maintain adequate submergence for the pump intakes, this equates to about a day's worth of water supply at an abstraction of rate of 24,000 m^3/day (the design peak rate currently being used). Allowing for additional storage in the tailrace tunnel itself (the dimensions and gradient of which have not yet been ascertained), this might be sufficient to cover the overnight turbine shutdowns, but is certainly not enough storage in the event that the turbines shut down for long periods.

VARIATIONS ON THE TAILRACE OPTION

There are several variations on the tailrace option, including the following:

Further downstream

An intake could be constructed just below the point where the tailrace discharge re-joins the natural river channel. In principle, compensation flow releases could then be made through the low-level sluice in the face of Turkwel Dam to cover the periods when the turbines are shut down. However, the following issues should be noted:

- As mentioned earlier, the low-level sluice is rarely, if ever, used and its functionality is now doubtful. In fact, data from a preliminary depth-sounding exercise in the reservoir behind the dam suggest that the inlet to the sluice may now be buried under accumulated silt. Even if the sluice could be made to work again, water from this level in the reservoir is likely to be very dirty, and extensive desilting and clarification treatment would be required.
- Water released through the low-level sluice has not passed through the turbines, so the same discussion applies about depriving the turbines of water.
- If the irrigation plans are implemented, it is likely that the offtake for the irrigation command canal would be where it was originally intended to be – at the tailrace canal – and a downstream Tullow intake would therefore be vulnerable.

Additional storage

Another variation would be to construct bank-side water storage near the tailrace, fill it up whenever the turbines are running, then pump continuously from the bank-side storage along the delivery pipeline. The volume of the storage pond would be a simple factor of the design turbine shut-down period, but there may still be occasions when the storage is insufficient to cover long shut-down periods. In a sense, bank-side storage is just duplicating the function of Turkwel reservoir itself, so this is only really a sensible option if designed to cover relatively short shut-down periods. Detailed analysis of the frequency and length of shut-down periods will continue.

Turbine bypass

A variation has been suggested whereby water passes down the headrace and out of the tailrace even when the turbines are shut down. The concept is as follows: generation of electricity is supposed to stop when the reservoir water level reaches 1,105 masl, the minimum operational water level; however, this is still 11 m above the invert of the opening to the headrace tunnel (at 1,094 masl). Using the relationship between reservoir water level and reservoir volume derived by the original designers, it can be estimated that there is storage of about 108,000,000 m^3 between the water levels of 1,105 and 1,094 masl. Even allowing for evaporation losses, this represents plenty of storage to maintain the design peak abstraction of 24,000 m^3/d for extended periods (months if not years). Unfortunately, it has now been established that there is no bypass around the turbines in the underground powerhouse, so when both turbines are shut down, there is no way to continue releasing water via the headrace and tailrace. This option is therefore not viable.

CONCLUSIONS

There remain two main options for water intake location at Turkwel: an intake at the tailrace discharge canal; and a floating intake in the reservoir itself, near the dam, able to rise and fall with fluctuating water levels. The pros and cons of these two main options can be summarised as follows:

OPTION: TAILRACE	
PROS	**CONS**
Water has already been used for electricity generation, so Tullow abstraction does not deprive the turbines	Poor security of supply – water supply dries up whenever the turbines are shut down for more than a few hours
Simple engineering; quick to construct	Intermittent supply implies oversized pipeline and pumping systems to achieve design quantity delivered to CPF
Stable water level at intake and therefore pumping head	Vulnerable to future changes in electricity generating regime and potential irrigation schemes

OPTION: RESERVOIR (NEAR DAM)	
PROS	**CONS**
100% security of supply – abstraction can continue even when water level drops below minimum operational level	Abstraction from reservoir deprives the turbines of water, so strong justification will be required
Potential for gravity flow to CPF, once water has been pumped over high point in dam access road	Challenging engineering, especially coping with fluctuating water levels and pipeline descent of steep escarpment
Insulated from any future changes in electricity generating regime & water releases for irrigation or compensation flow	Wide range of variation in pumping head as reservoir water level fluctuates

From the point of view of security of supply and insulation from future changes to the way the dam is operated, it is clear that the reservoir intake option is the best. However, the final decision depends on the trade-off between various factors: security of supply; capital cost; operating cost; and continuity of water injection at the oilfields. These trade-offs need to be looked at in more detail during FEED.

Water

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3 Strategic Water Supply for Development – Turkwel Dam Option

STRATEGIC WATER SUPPLY FOR DEVELOPMENT - TURKWEL DAM OPTION
THE SOUTH LOKICHAR DEVELOPMENT AND OTHER WATER DEMANDS
AN OBJECTIVE PERSPECTIVE AND WAY FORWARD BY SEAN AVERY
OCTOBER 2018

INTRODUCTION

The first 5 years of oil production (Years 0 to 5) in the South Lokichar Development will on average require 13,600 m^3/d (0.157 m^3/s) of water, with a peak daily demand 13,700 m^3/d. [1] The following 20 years of oil production (Years 6 to 25) will on average require 5,000 m^3/d (0.058 m^3/s) of water. This is less than half the amount required during the first 5 years, albeit with a peak daily demand 11,500 m^3/d.[1] The estimates include a community water requirement assessed by Tullow amounting to 636 m^3/d (ibid.). [1]

This report compares the South Lokichar water requirement with other water demands that are dependant on the Turkwel water resource. The impact of the South Lokichar abstraction on Turkwel's water levels is presented again from the previous detailed work reported by the Consultant in 2015.

[1] Tullow Document No. T-KE-DEV-STG-0003 dated 26 February 2018.

TURKWEL DAM FLOW RELEASE AND MALMALTE COMBINED FLOW (TULLOW CONSULTANT'S WORK IN PROGRESS)

The average annual Turkwel dam flow release + River Malmalte combined flow = 21 m^3/s (estimate).[2] [3]

In addition, there are flood influxes from all catchments between Turkwel dam and the lake (not quantified in this short report). On the other hand, the Malmalte future flows will be reduced by upstream irrigation developments.

Figure 1: Turkwel and Malmalte confluence

[2] Strategic Water Supply for Development, Turkwel Dam Option, Field Reconnaissance Report 2, Turkwel Reservoir & Hydrology – Sept/Oct 2013, by Dr. Sean Avery, Tullow Consultant.
[3] Strategic Water Supply for Development, Turkwel Dam Option, Preliminary Hydrological Review, by Dr. Sean Avery, Tullow Consultant, September 2015.

RIPARIAN WATER NEEDS DOWNSTREAM FROM TURKWEL DAM TO LAKE TURKANA

The River Turkwel flows 260 km from the dam tailrace to the lake. In contrast to the semi-arid plains, the riparian aquifers sustain a "green belt" along both banks (delineated in Figure 2). This vegetated riparian zone is an attractive resource that has long been heavily impacted by agricultural activities. The main areas are upstream of Lodwar, the largest being at Katilu, but also downstream in the vicinity of the Turkwel delta. And with Turkana County's population growing at over 6% per annum, the pressure on these zones and the associated water resources is increasing.

The river channel is wide and sandy and there are appreciable "bed losses". These "losses" occur via surface evaporation and through recharge into the riverine aquifer. The channel is often dry in the lower reaches nearing the lake. Thus, the combined Turkwel and Malmalte average annual river discharge of 21 m^3/s is a reasonable indicator of the annual riparian water needs.

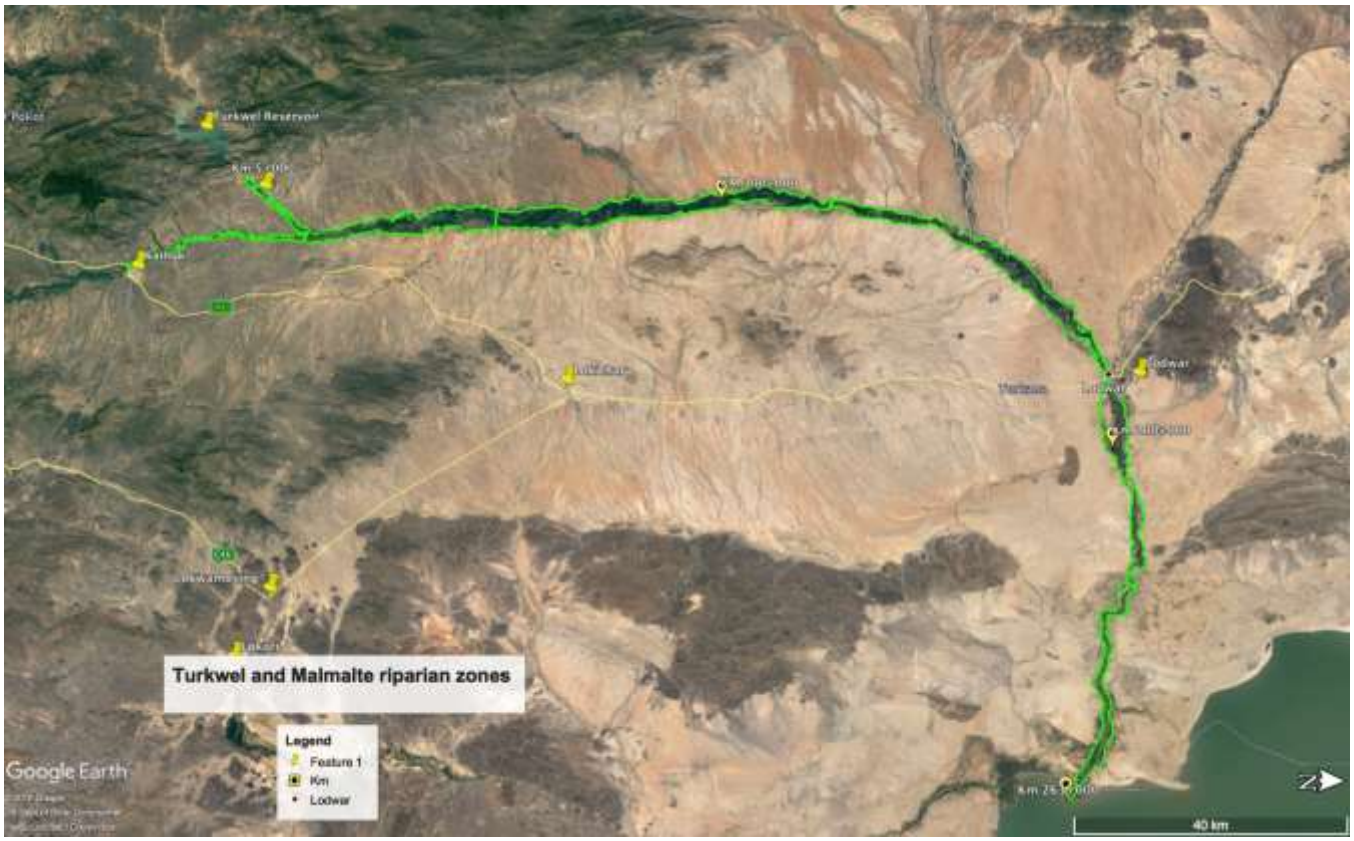

Figure 2: River Turkwel's "green belt"

WATER DEMAND ALONG LOWER TURKWEL (TULLOW CONSULTANT'S WORK IN PROGRESS)

An FAO sponsored study in 2013 has reported 1,753 ha existing under irrigation along the Turkwel river, with potential to increase this to 10,000 ha.[4] The estimated associated river water abstractions now and in future are as follows:

- Current irrigation area of 1,753 ha requiring 1.22 m^3/s.
- "Potential" irrigation area >= 10,000 ha requiring 6.95 m^3/s.

Also, in 2013, KVDA consultants studied the proposed Lower Turkwel Irrigation Project.[5] This envisaged a sugar plantation of cultivable area 22,100 ha, on the left bank not far from the tailrace. This project was not reported by FAO's team, and its potential irrigation area is thus additional to FAO's estimates. The KVDA scheme proposes to utilise the entire Turkwel dam flow release and in addition proposes to take supplementary water direct from the Turkwel reservoir (since it was believed there is spare capacity within the reservoir). The scheme's water requirement was computed to be:

- Lower Turkwel Irrigation Scheme area 22,100 ha requiring 18 m^3/s.

There is insufficient water for the above projects, and major abstractions would have serious consequences downstream. The scheme proposals are indicative of very ambitious government expectations from the River Turkwel.

The existing irrigation schemes are developed on areas cleared from within the riparian vegetation belt bordering the river. The crops thus replace existing vegetation. Irrigation waters are abstracted through gravity intakes on the riverbank and are conveyed to the schemes through open canals. With irrigated crop development, the vegetation water demand will adjust according to the difference in transpiration between natural vegetation and introduced crops. Shallow-rooted crops will transpire less water than deep-rooted trees. But on the other hand, the open irrigation canals and furrows increase evaporation losses, and the clearance of trees exposes the soils to solar radiation. This results in higher evaporation losses. The water efficiency of furrow irrigation schemes can be as low as 20%, and hence such schemes can be very water-wasteful.[6]

The government's recent Napuu drip irrigation project near Lodwar has developed 160 ha of land. KVDA's recent pilot centre pivot irrigation project has developed 370 ha, with 2,470 ha planned if successful. These schemes are assumed to embraced within the 10,000-ha potential proposed by the FAO study.

Compared to the above irrigation areas, the Tullow-estimated "following 20 years" long-term water requirements for the South Lokichar Development are equivalent to the water requirement of an irrigated area of only 83 ha.

[4] FAO / Ocra Consultants, Opportunities and Threats of irrigation development in Kenya's Drylands, Vol.VI Turkana County, 2013.
[5] Kerio Valley Development Authority (KVDA), Lower Turkwel Sugar Irrigation Project, WAPCOS, 2013.
[6] Lake Turkana and Lower Omo: Hydrological Impacts of major dam and irrigation developments, University of Oxford, Vol. I, by Dr. Sean Avery, October 2012 http://www.africanstudies.ox.ac.uk/lake-turkana-and-lower-omo-hydrological-impacts-major-dam-and-irrigation-developments

Figure 3: Irrigation intake from the River Turkwel (north bank of Turkwel)

Figure 4: Nakwamoru Irrigation Scheme

Figure 5: Napuu Drip Irrigation Scheme

TURKWEL RIVER DOMESTIC & LIVESTOCK WATER NEEDS (TULLOW CONSULTANT'S WORK IN PROGRESS)

A preliminary estimate of human population along the river in 2017 = 172,000 people (without Lodwar Town).[7]

Water demand inclusive of livestock in 2017 = 0.099 m^3/s (a rough estimate).

Domestic and livestock water demands along the Turkwel are insignificant compared to irrigation requirements.

Figure 6: Artesian borehole water source

[7] The Consultant has based the population estimate on the 2009 national census for sub-locations adjoining the river without attempting at this point to exactly delineate the population reliant on the river zone.

LODWAR TOWNSHIP WATER SUPPLY REQUIREMENTS

Lodwar Town draws its water supply entirely from boreholes near the banks of River Turkwel. These boreholes will benefit from recharge by water infiltrating underground from the riverbed. With flow regulation provided by the Turkwel dam releases, the river at Lodwar is effectively perennial these days, unless flows are interrupted by shutdown of the dam's turbines for operational reasons.

The Lodwar water supply requirements are estimated below, and are greater than the South Lokichar development's water requirements.

Lodwar's Year 2017 water supply demand = 0.116 m^3/s (measurements published in REACH project documents).[8]

Lodwar's Year 2030 water supply demand = 0.247 m^3/s (estimated at 6% per annum demand growth).

Figure 7: Lodwar Water Supply borehole

[8] Haynes et al., REACH Working Paper, Weather and climate knowledge for water security: Institutional roles and relationships in Turkana, September 2017.

TURKWEL RESERVOIR WATER LEVEL SIMULATION – IMPACT OF ABSTRACTION [3]

The evaporation loss from Turkwel reservoir at optimum operating level amounts to 4% of inflow, and this loss increases as water level rises (Table 1). In contrast, the South Lokichar development's water requirement in the "First 5 years" is equivalent to 1.02% inflow, dropping to 0.38% in the "following 20 years" (Table 2).

Table 1: Evaporation loss as % Turkwel inflow

Turkwel reservoir operating levels	Evap Loss m^3/s	Evap Loss as % Turkwel Inflow
Minimum operating level 1105 masl	0.629	4.1%
Optimum operating level 1131 masl	1.929	12.5%
Full supply level 1150 masl	3.723	24.2%

Table 2: South Lokichar water requirement as % Turkwel inflow

South Lokichar water requirements	Water Requirement m^3/s	Water Requirement as % Turkwel Inflow
First 5 Years	0.157	1.02%
Following 20 Years	0.058	0.38%

If water is abstracted direct from the Turkwel reservoir, the water level will be lowered slightly, and there will be an associated small reduction in generating output (Figure 8). The graph is a simulation of the reservoir operation using actual machine discharges that were derived from power generation records. [3] These records were availed by KVDA from 1993-2016. An update is within the Tullow Consultant's work in progress along with calibration of those machine discharges.

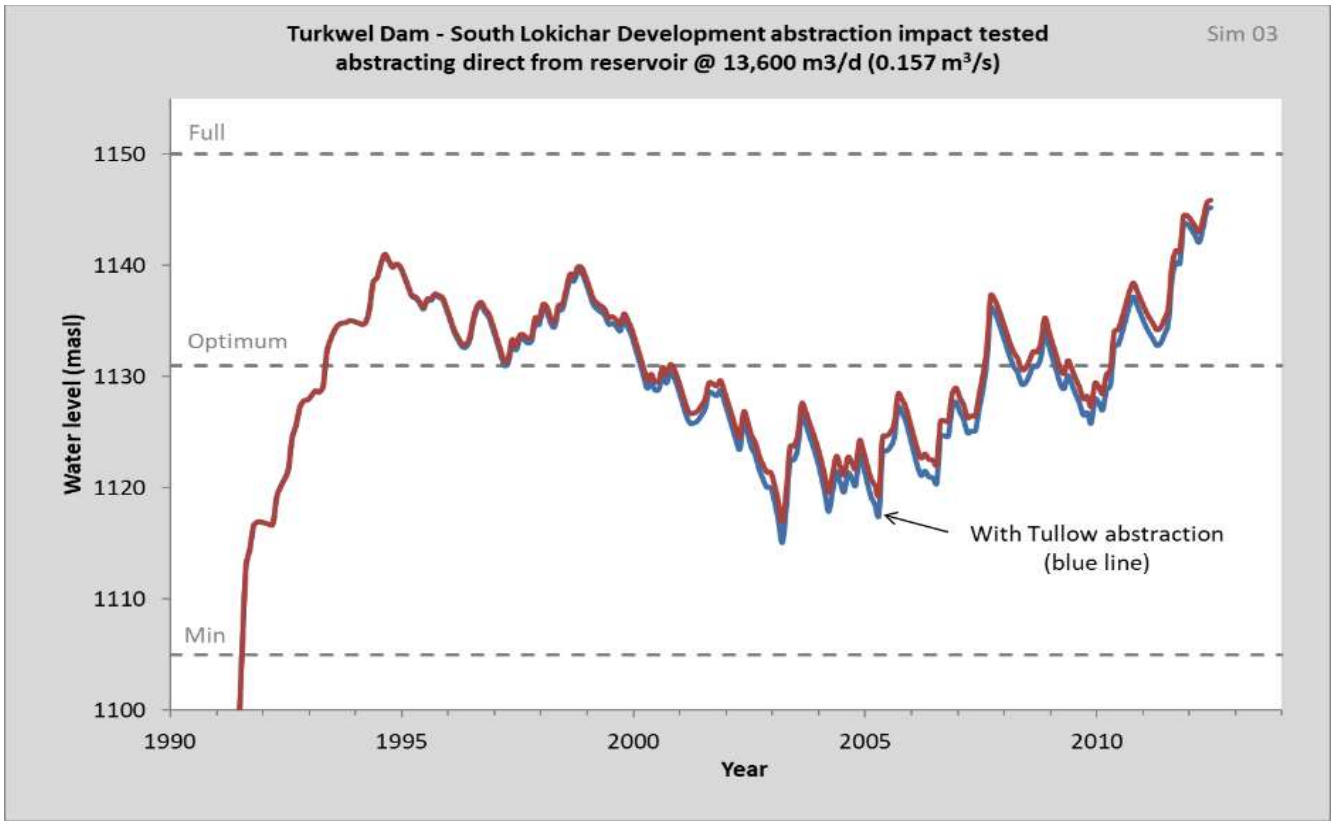

Figure 8: Turkwel reservoir water level simulation

LOWAAT DAM PROJECT NEAR LOKORI

Although not within the Turkwel Basin, the proposed Lowaat Dam project on the Kerio River is an interesting development to the south of the South Lokichar development area. The selected project dam site is located a short distance upstream from Lokori. The scheme aims to supply 0.2 m^3/s for water supply and 17.4 m^3/s for irrigation purposes. This yield was determined based modelling as recent actual data does not exist. The modelled mean annual discharge at the site is 50% higher than Turkwel dam produces. This may be optimistic, as the Lowaat dam catchment area is only slightly larger. There are also irrigation projects existing and planned in the upper basin, all of which will utilise water.

A large dam project like this would obviously take years to implement. The economic feasibility will first need to be verified through a period of baseline data collection, which will take time. But if this project was implemented in some form, it would provide a supplementary water harvesting source within a marginalised dry area, and it would be a possible backup to South Lokichar in the future.

The important but defunct river gauging station at Lokori was amongst the sites recommended by the Consultant for rehabilitation. Operationalising that gauging station should be a national and county priority, and is an objective that Tullow can support.

SUMMARY OF WATER DEMANDS

The biggest water demand in Turkana County will potentially be from irrigation schemes. Nationally, irrigation schemes are expected to account for 81% of Kenya's water demand by the year 2030.[9] The projected national water deficit in 2030 is expected to be 74% of total water demand.

The irrigation schemes along the River Turkwel will utilise a significant proportion of that river's water balance, and would potentially empty the river. And the river flows in Turkwel's main downstream confluence, the River Malmalte, will in turn be affected by irrigation developments, in this case largely upstream from Kainuk.

Notwithstanding the preliminary nature of water demand figures in this report, in comparison with the other huge water demands, the South Lokichar oilfield development water requirement amounts to a negligible proportion of the Turkwel water balance. It equates to a fraction of the water already evaporated constantly from the Turkwel reservoir surface.

Table 3: Summary of preliminary individual lower Turkwel water demand points

Water Demand Item	Amount of water required (m^3/s)	Expressed as a multiple of Year 6-25 South Lokichar water demand
South Lokichar Development's 20-yr production demand [a]	0.058	-
Turkwel reservoir's average evaporation loss @ Opt. Op. WL	1.929	33.3
Turkwel dam's average flow release + Malmalte flows	23	371
Lodwar Water Supply in Year 2017	0.116	2.0
Lodwar Water Supply forecast for Year 2030	0.247	4.3
Turkwel baseline riparian / irrigation water needs	23	371
Turkwel riparian population water needs	0.099	1.7
Turkwel potential irrigation abstractions [b]	6.950	120
Lower Turkwel Irrigation scheme	14.9 (18.0) [c]	Near 100%

Notes:
[a] Includes community water supply needs.
[b] KVDA Lower Turkwel sugar irrigation project not included.
[c] 14.9 = WAPCOS estimate of Turkwel turbine throughput. 18.0= WAPCOS total yield estimate.

[9] Irrigating Kenya's drylands – food for thought, by Sean Avery, Nov. 2013. A crop agriculture "Discussion Brief" prepared for the Regional Learning and Capacity Building Initiative for Vulnerable Dryland communities (REGLAP now DLCI), funded by ECHO, http://www.dlci-hoa.org/?s=avery

DISCUSSION AND RECOMMENDATIONS

This report demonstrates the many factors contributing to the lower Turkwel water balance, all of which were anticipated by the Consultant, and embraced within the intention of the Consultant's contract with Tullow. This work was foreseen as a long-term ambitious but necessary plan of work, and it was accepted by Tullow as such. Working papers are being produced, but the only "deliverable" is to establish final confidence in the water resource in order justify investment in the necessary infrastructure. The importance of that foundation work plan to the South Lokichar development is inescapable, and significant progress has been achieved in spite of frustrations.

Although the South Lokichar water demand is small, the development is increasingly prominent in the county's public eye. With the regional challenges of food security, and with the water demands arising, all water resources are under pressure. There will inevitably be increasing pressure on groundwater resources too. As noted in Kenya's national water masterplan, there is a major water deficit already arising in Kenya.

Lake Turkana is the ultimate "health indicator" of the basin's entire water resource exploitation. As recommended long ago and accepted by Tullow, the lake monitoring initiated by the Consultant is in Tullow's interests. The Consultant's expertise in this area was the reason Tullow invited the Consultant's engagement in the first place. It is strongly recommended that Tullow readily supports the Consultant's ongoing efforts to validate the baseline database. The request is to access data that Tullow staff have confirmed can be processed at very little cost from within. It is strongly recommended that this work be authorised.

Surface water runoff in Kenya's Rift Valley catchments is forecast to increase 50% over the coming decades. This is a mixed blessing as it is invariably an indicator of catchment degradation, which is a national concern. The direct impact of faster runoff response to storm rainfall includes increased erosion, deterioration in water quality, and reduction in the economic life of costly reservoirs through sedimentation. The bathymetry work on Turkwel has been an important step towards quantifying those impacts, as were the Consultant's intentions to broaden the perspective through encompassing data from similarly affected regional lakes including nearby Lake Baringo. That work is ongoing, but is being delayed by belated internal bureaucracy concerning equipment procured solely for this task. The Consultant's recommendations on this work front are strongly reiterated here.

The importance of efforts to restore the river gauging network is strongly re-iterated. That data is vital to firmly establish the feasibility of the water resource to supply the South Lokichar development. The planned data collection is required for the climate change modelling that has also been programmed. There have been delays beyond the Consultant's control, but the need for that work is not diminished in any way.

THE WAY FORWARD

The work is being undertaken by a locally-based consultant with international accreditations, including membership of an international network whose expertise in water resources and hydrology is exceptional.[10] The Consultant has almost four decades of personal hands-on experience in Turkana, and he is fully licensed and gazetted by the Kenya government to undertake the services required. However, this year Tullow commitment to the work plan has wavered, for whatever internal reasons, and a decision needs to be made before all momentum is lost. And if Tullow considers that the Consultant's judgement needs to be questioned at every step, that service provision needs to be reconsidered.

[10] See website: www.watres.com

Water

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4 Strategic Water Supply for Development – Preliminary hydrological review of Turkwel Dam

1.1 PRELIMINARY HYDROLOGICAL REVIEW OF TURKWEL DAM

INTRODUCTION

As part of the series of technical studies being undertaken on options for strategic water supply, the hydrology of Turkwel Dam and its catchment were reviewed. This technical report presents the results of the study. The report number (1.1) corresponds to the number allocated to this piece of work in the list of technical studies. The results of study 1.2 (on the reliable yield of the dam)are also reported here. Turkwel Dam is one of the options for strategic water supply currently being investigated. The design figure being used for Tullow's total water requirement for the Lokichar Basin Phase 1 Development, leading into Production, is 24,000 m^3/day (0.278 m^3/s), and this is the water demand figure used throughout this report.

TURKWEL DAM CATCHMENT AREA

Turkwel Dam, owned and managed by the Kerio Valley Development Authority (KVDA) is located on the western margin of the Rift Valley, just before the river drops into the Rift Valley below. A few kilometres downstream of the dam, the river is joined by the Malmalte River (also known as the Weiwei), which drains the adjacent catchment to the south and provides significant additional flow. The river then flows north and eastwards through semi-arid lands to Lake Turkana. The combined Turkwel and Malmalte flows sustain a riparian forest totalling 40,000 ha fringing the Turkwel River along its route to the lake. This forest is utilised by local people, with some cultivation, including some irrigation from the river. Figure 1 shows the general layout.

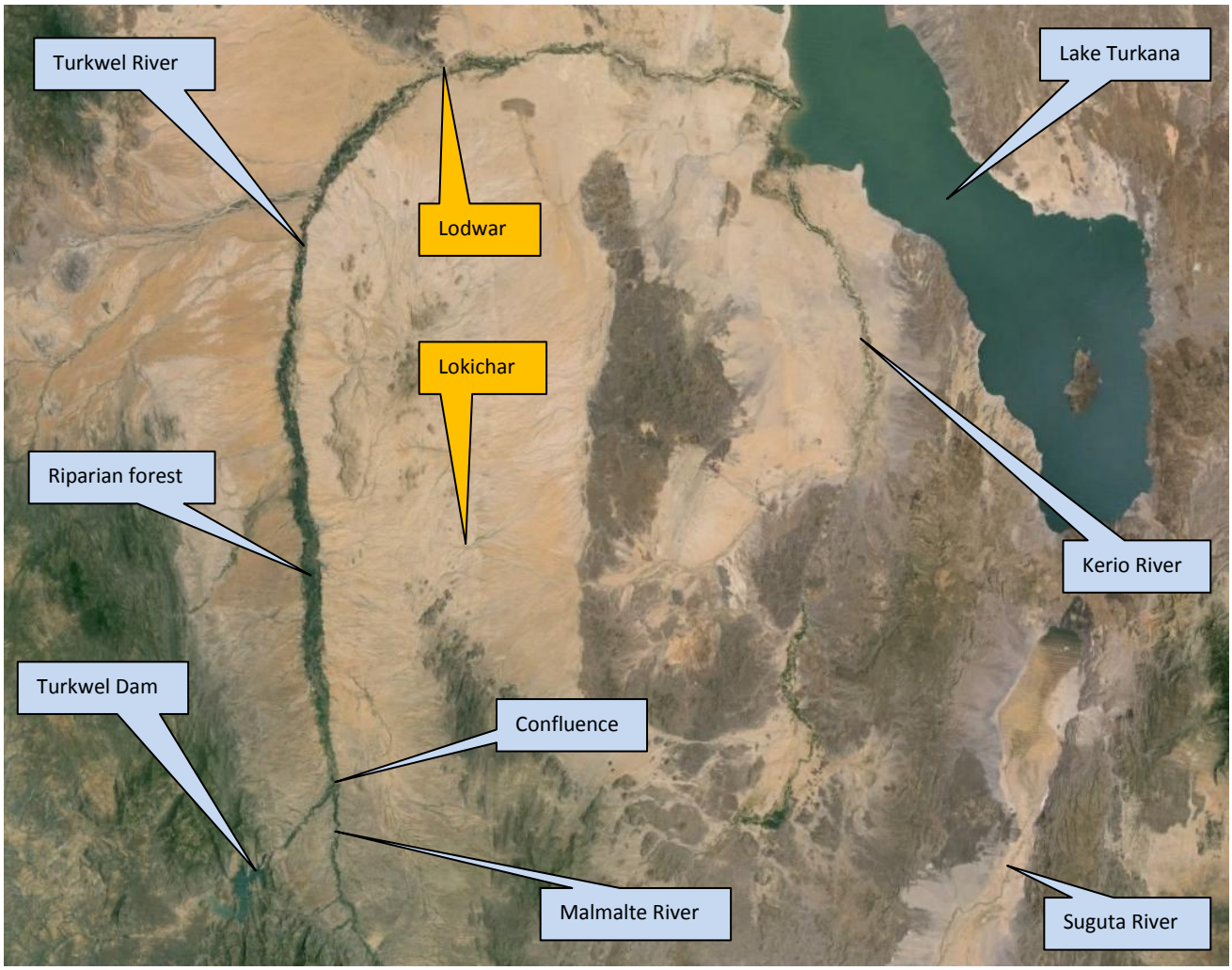


Figure 1: General layout of hydrological features
Basemap from Google Earth

The dam's total catchment area is about 5,900 km^2, broken down as shown in Table 1 and Figure 2.

Table 1: Turkwel Dam sub-catchment flow contributions

Sub-catchment	Area (km^2)	Mean annual rainfall (mm)	Flow contribution (% at dam)
Upper Suam to Kongelai	1,350	1,125	70.0
Kanyang'areng to Kanyao	1,900	680	22.5
Kanyao to Kanyao	700	925	7.5
Suam below Kongelai & Kanyao	1,950	720	Near zero
Totals (or overall average)	5,900	825	100

Source: Turkwel Dam preliminary design document extracts provided by KVDA; also for Figure 2.

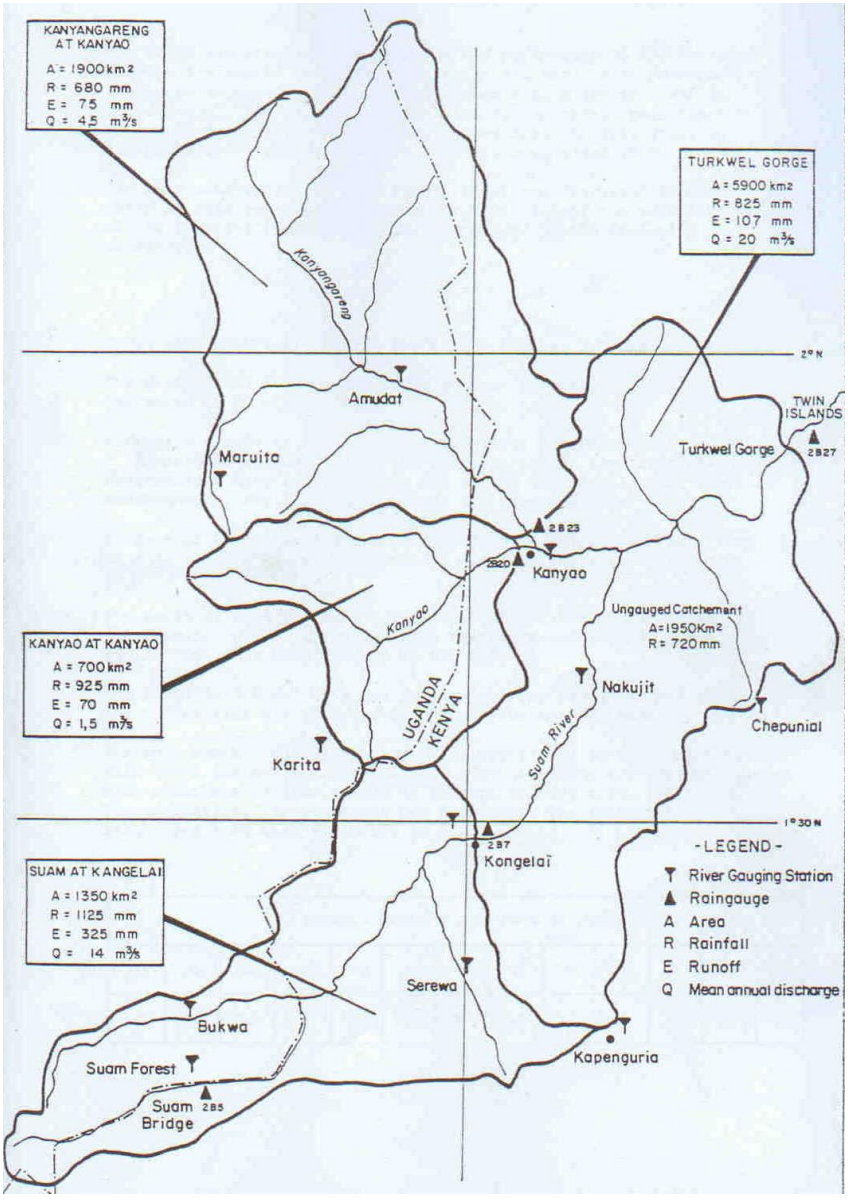


Figure 2: Turkwel Dam catchment & sub-catchments
Note that symbols for RGS and raingauge are reversed in the legend

The river's highest point is on Mt Elgon, in the far south-west of the catchment, which receives over 1,200 mm rainfall per year. At the dam, rainfall is less than half that, and by the time the river reaches Lodwar, the annual rainfall is less than 200 mm. Referring to Figure 2:

South-western sub-catchment
This is the main tributary (in terms of flow), with headwaters comprising three streams from Mt Elgon, two of which rise within Uganda. The Suam River drains 1,350 km^2 to River Gauging Station (RGS) 2B07 at Kongelai. Annual average rainfall is 1,125 mm. This sub-catchment comprises only 25% of the total catchment area at the dam, but contributes 70% of the flow at the dam.

North-western sub-catchment
This sub-catchment drains 2,600 km^2 from Karamoja in Uganda. There are two seasonal tributaries, proportioned as follows: Kanyang'areng River, 1,900 km^2 at RGS 2B23 at Kanyao, annual rainfall 680 mm, and contributing 22.5% of total flow at the dam; Kanyao River, 700 km^2 at RGS 2B20 at Kanyao, annual rainfall 925 mm, and contributing 7.5% of total flow at the dam.

Lower Suam sub-catchment: This is the catchment area from Kongelai and Kanyao down to Turkwel Gorge, with annual rainfall averaging 720 mm, but reported to contribute very little river flow to the total. Thus, whilst the majority of the dam's water inflow is generated within Kenya's boundaries, a major portion of the catchment area is in Uganda, and the Karamoja portion is a dry area characterised by large seasonal flows that can convey high sediment loads.

INFLOW ASSESSMENTS AT THE TURKWEL DAM SITE

The main hydrological reports for the Turkwel Dam date from over 30 years ago and were not available from KVDA. However, sufficient information has been gleaned from various supporting documents that were available. When Turkwel Dam was designed, considerable data manipulation was undertaken as there was very limited site-specific data available. Flow estimates varied, and the dam's final design adopted a mean annual discharge of 18 m^3/s; earlier estimates were as high as 24 m^3/s.

In 1992, the Japan International Cooperation Agency (JICA) team of Nippon Koei presented a national water master plan for Kenya, in which flow simulations were undertaken for all major river basins including the Turkwel and Kerio basins. Unfortunately, the data published for Turkwel Dam were inconsistent - the average flow in the flow duration analysis was 24.6 m^3/s, whereas the tabulated rainfall-runoff model simulation computed the naturalised mean monthly discharge to be 14.3 m^3/s. The same JICA team has updated the country's national water master plan 20 years later, in 2012, but the individual river sequences have unfortunately not been presented in their report.

The three main inflowing river gauging stations at Kongelai and Kanyao have been visited. They have not been operational for some years. Hence, there is no recent river gauging station data with which to update the dam inflow hydrology. However, reservoir operational data for Turkwel dam can be used to derive flow sequences. The Turkwel Dam flow database that has been utilised consists of the following:

1939 to 1978: Flows "infilled" by WLPU Consultants;
1978 to 1985: Measured river discharges;
1985 to 1991: Missing data;
1991 to 2012: Flows simulated from KVDA/KenGen from Turkwel reservoir operational records.

DAM OPERATION WATER LEVELS AND FLOWS

KVDA kindly provided monthly water levels for the period of dam operation from 1990 to 2014. These are plotted in Figure 3. Also plotted are the following three key reservoir operating levels, namely: the full supply level (the spillway level), at 1,150 m above sea level (masl); the optimum operating level (1,131 masl); and the minimum operating level (1,105 masl, set a few metres higher than the headrace intake). Since it was commissioned, the Turkwel Reservoir has never spilled and the full design flow expectation of 18 m^3/s has never been realised; instead, a lower throughput of 15.4 m^3/s has been recorded since 1990. The dam has however been able to generate power, albeit operating at below optimum operating level until recently.

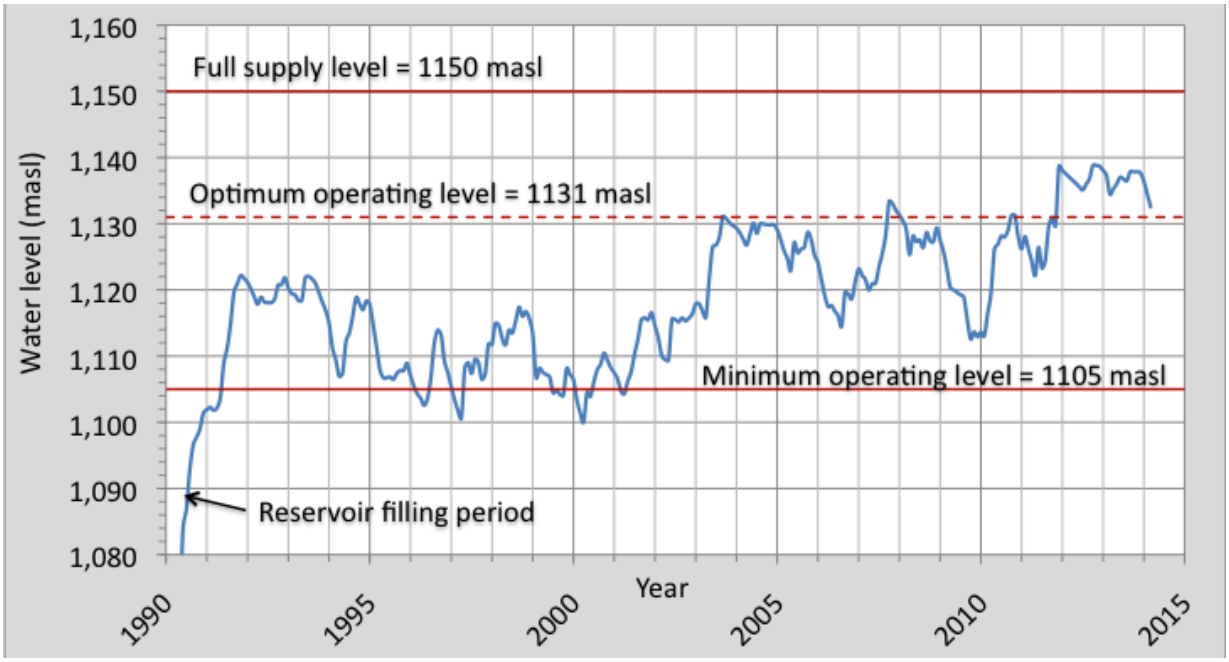


Figure 3: Turkana Dam water Levels since 1990

Two sets of discharge measurements are compiled at the dam:

1) Machine Discharge: This is the quantity of water passing through the turbines. The discharge computation methodology has not yet been provided by KVDA, but is understood to comprise an algorithm relating discharge to the average reservoir head and overall machine efficiency.
2) Test Flow: This is the reservoir inflow calculated by KVDA, and presumed to be from the spreadsheet-based reservoir water balance model incorporated within the dam monitoring procedures; the model uses a monthly time step. The net evaporation loss in each month is calculated, based on the average daily effective rainfall on the reservoir and the average daily surface water evaporation. The evaporation loss is the product of the reservoir surface area and the standard net evaporation loss value for the month in question. The daily reservoir water level is measured at the dam, and the change in reservoir storage is calculated from the day-to-day water level changes. The dam monitoring procedures include algorithms relating surface area and storage to water level. Thus the inflow is calculated from the following simple water balance equation:

TEST FLOW = INFLOW = MACHINE.Q + EVAP - RAIN + VOL.FROM.STORAGE

The KVDA Machine Discharges and Test Flows are plotted for the period 2003-2013 in Figure 4. The 'natural' reservoir inflow is flashy (blue line), whereas turbine discharge is controlled (red line). The reservoir water level change is plotted along the top of the graph (green line), and water level high points do coincide with inflow highs, as they should.

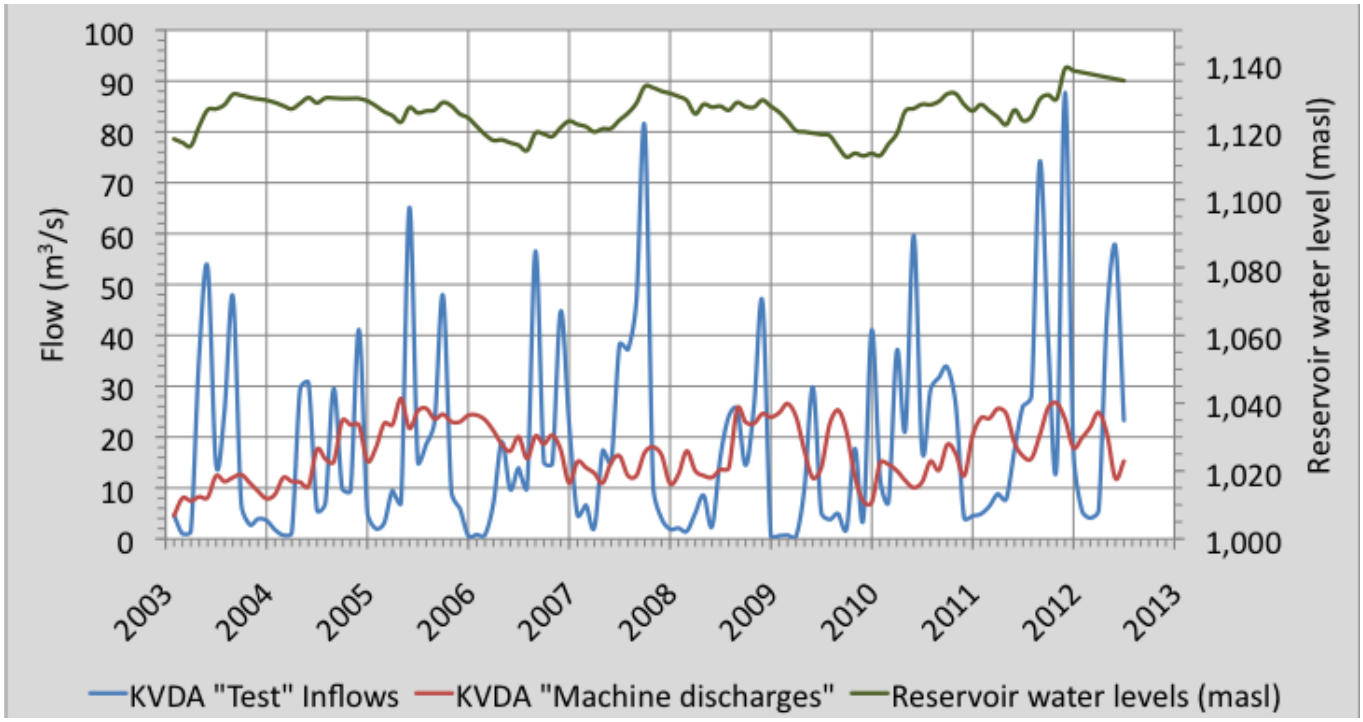


Figure 4: Turkana Dam inflows and water levels compared, 2003-2013

The cumulative 'machine' and 'test' flows are compared in Figure 5, and the cumulative flows nearly balance (within 10%). However, no machine discharge data was provided from 1991-2003, and typographic anomalies have been noted in the monthly record provided from 2003-2013, and there are also data gaps. The full daily dataset has been requested from KVDA, but a visit to the dam may be necessary to obtain this.

ANALYSIS OF MONTHLY FLOWS AT TURKWEL DAM

Turkwel's cumulative monthly runoff data series has been plotted against Lodwar cumulative rainfall in Figure 6. Although Lodwar is downstream, the two series correlate remarkably well. No major data inconsistencies are apparent.

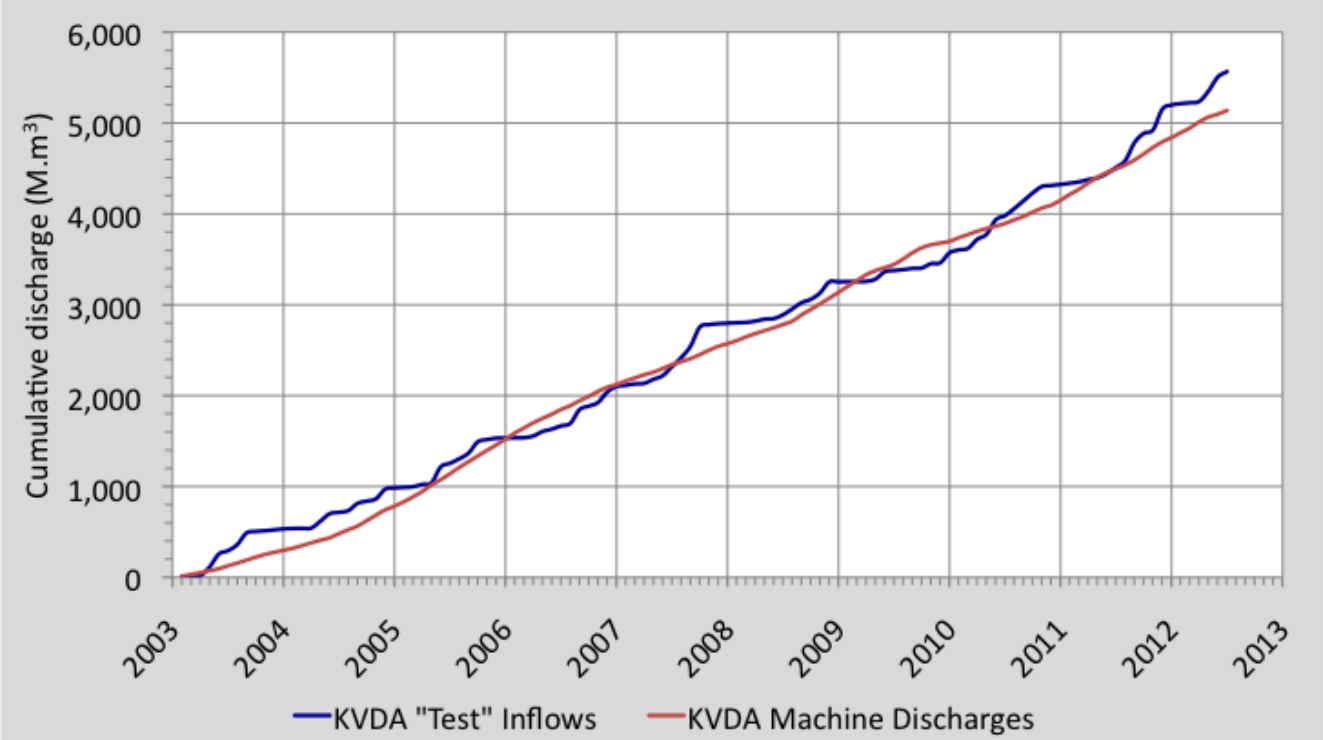


Figure 5: Turkwel Dam cumulative flow estimates compared, 2003-2013

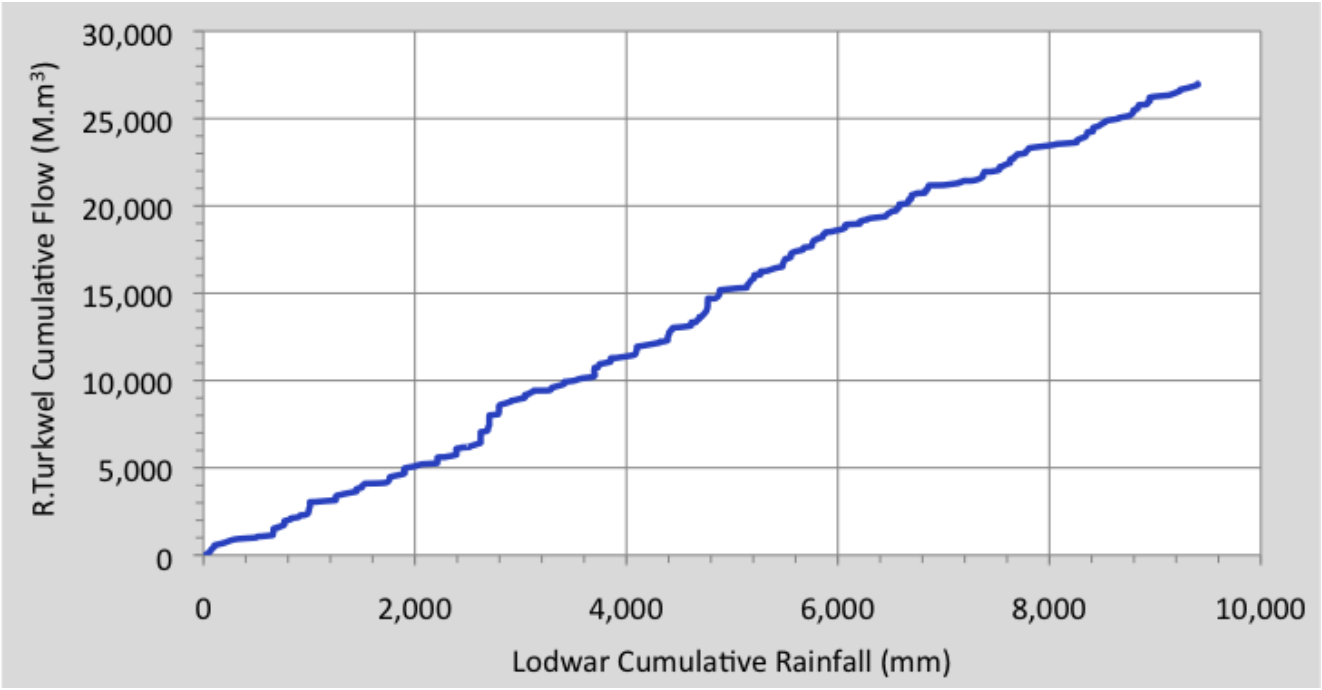


Figure 6: Cumulative Turkwel flow (at Twin Islands) and Lodwar rainfall compared, 1961-2012

Flow duration curves for the Turkwel Dam are plotted in Figure 7. The river's mean discharge of 15.4 m^3/s over the period of dam operation is also indicated (based on data for the 1991-2012 record). Note that in Figure 7, the y-axis is plotted on a logarithmic scale in order to exaggerate the critical low-flow range. The flow duration curve for the period 1939-1985 is from an infilled dataset that recorded the river to be totally dry 12% of the time (blue curve). The flow duration curve for the period 1991-2012 is similar, as would be expected, except that flows in the medium-to-high flow range are lower. In addition, this dataset does not capture the inflowing river's low flow characteristics (green curve), because this dataset has been generated from reservoir level changes that are insensitive to low flows. The full regulation effect of the dam on the river discharges is shown properly by the

flow duration curve for controlled downstream releases (red curve). The high flows are dampened and the low flows are enhanced. Nonetheless, this regulated flow dataset includes downstream releases as high as 34.2 m^3/s and as low as 4.2 m^3/s.

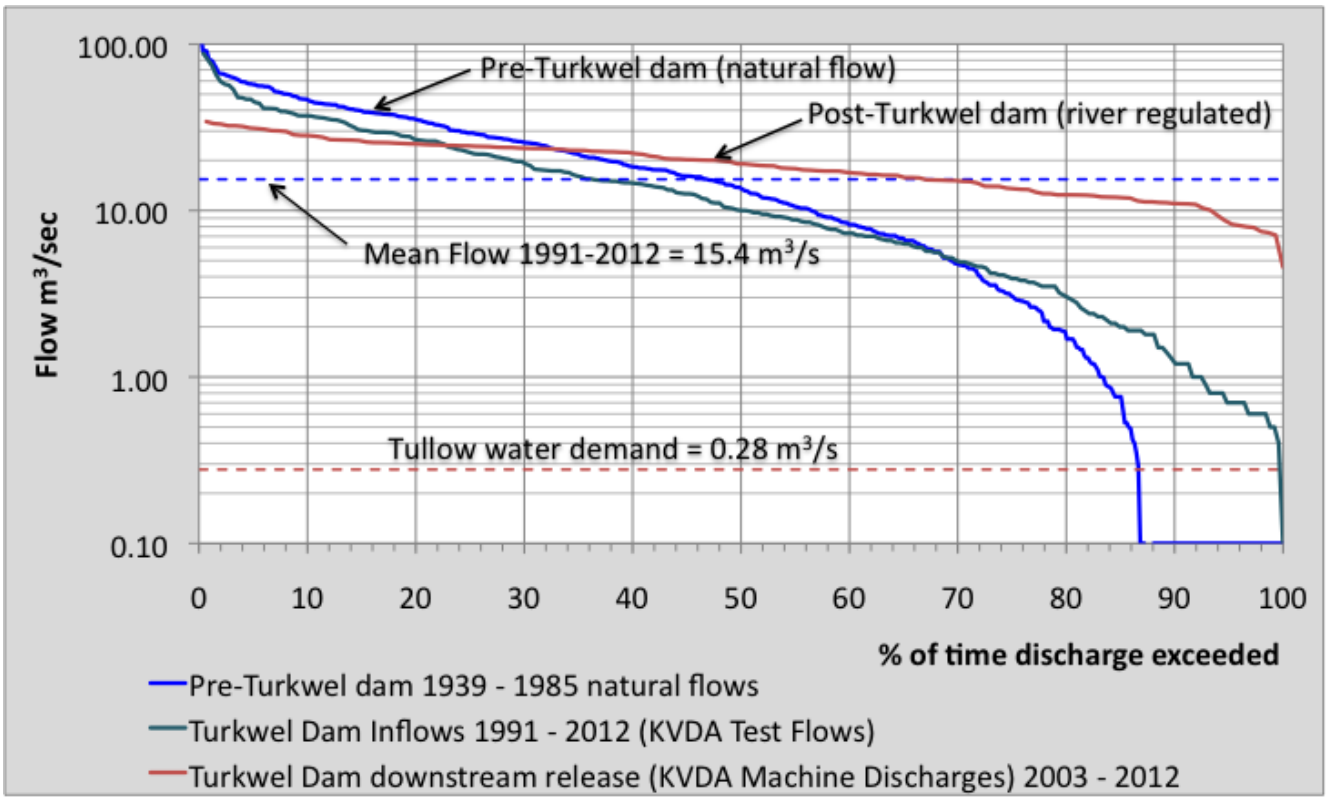


Figure 7: Flow duration curves at Turkwel Dam

The Tullow water demand line is also illustrated in Figure 7, amounting to 1.8% of the flow passing through the reservoir. This figure is not insignificant, but to put this amount into perspective, at optimum operating level, the reservoir loses 7% of river flow through evaporation alone. Expressed differently, the evaporation averages 4.9 mm/day, whereas Tullow's water demand of 0.278 m^3/s equates to 0.7 mm/day (at optimum operating level).

While the flow duration curve shows the proportion of time that a particular flow value is exceeded over the entire analysis period, flow frequency curves show the proportion of years, or equivalently the average interval between years (return period), in which the river falls below a given discharge. Flow frequency curves are preferred for assessing extreme events. The natural flow frequency curves for the Turkwel River are plotted in Figure 8. The minimum flow for various time durations was abstracted from the database by a process of moving averages. Note that the mean annual flow of 15.4 m^3/s has a return period of 2.33 years, and that annual flows ranged from a maximum 33.5 m^3/s to as little as 5.2 m^3/s. Summary results are tabulated in Table 2. Once in 25 years, the natural river can be dry for 6 consecutive months, and the lowest annual flow of 5.2 m^3/s has a return period of once in 100 years.

Table 2: Turkwel River low flow frequency analysis

Probability	Natural Flow - various durations and return periods			
	1-month (m^3/s)	3-months (m^3/s)	6-months (m^3/s)	12-months (m^3/s)
1 in 2 years	0.1	1.8	6.0	17.3
1 in 10 years	0	0	2.2	10.5
1 in 25 years	0	0	0	8.0
1 in 100 years	0	0	0	5.2

Notes: 1) Combined dataset 1940-85, and 1993-2012; 2) Data 1993-2012 missing.

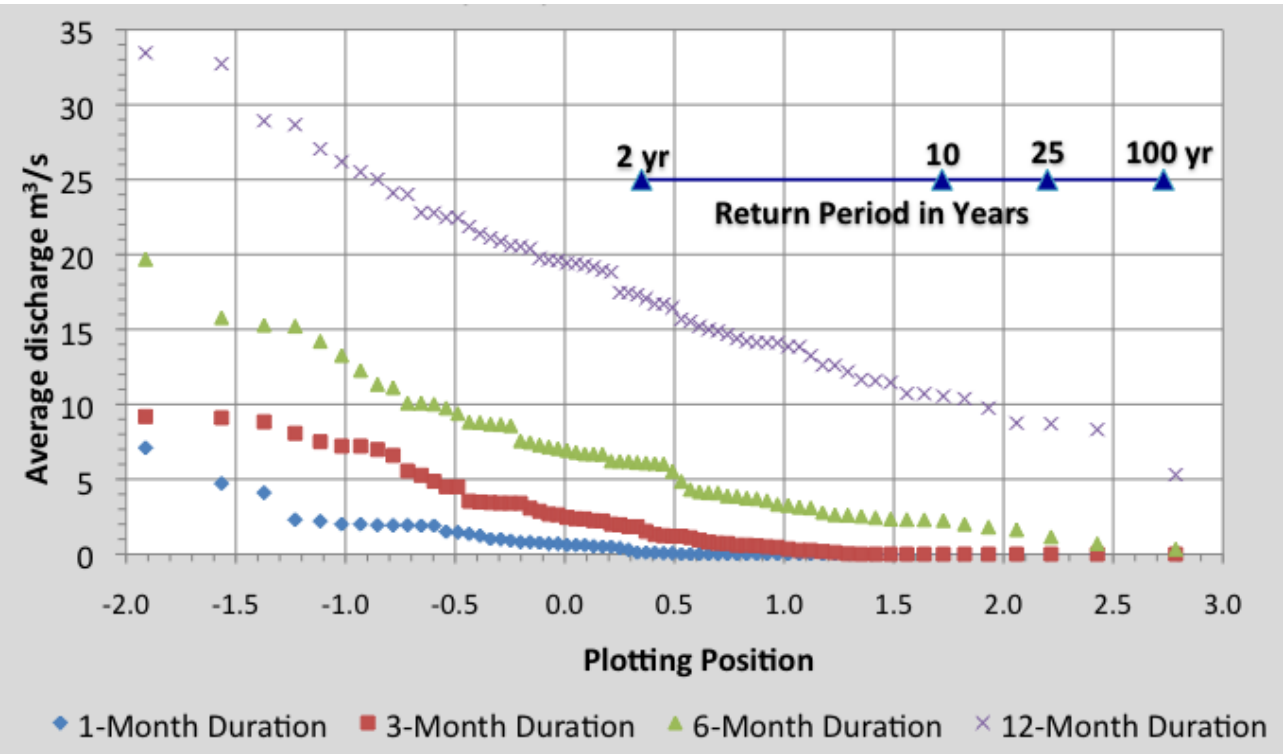


Figure 8: Turkwel River flow frequency curves for different durations (up to 12-months)

RAINFALL ON TURKWEL RESERVOIR

The Turkwel dam design assumed that an average of 650 mm would fall on the reservoir surface annually. Rainfall data is measured at the dam itself, and in the gorge below near Twin Islands where the turbine discharges are returned to the river – see Figure 9. Rainfall has in some years varied more than one might expect between two sites in close proximity. Annual rainfall has averaged 560 mm, hence less than was assumed at the time of the dam design.

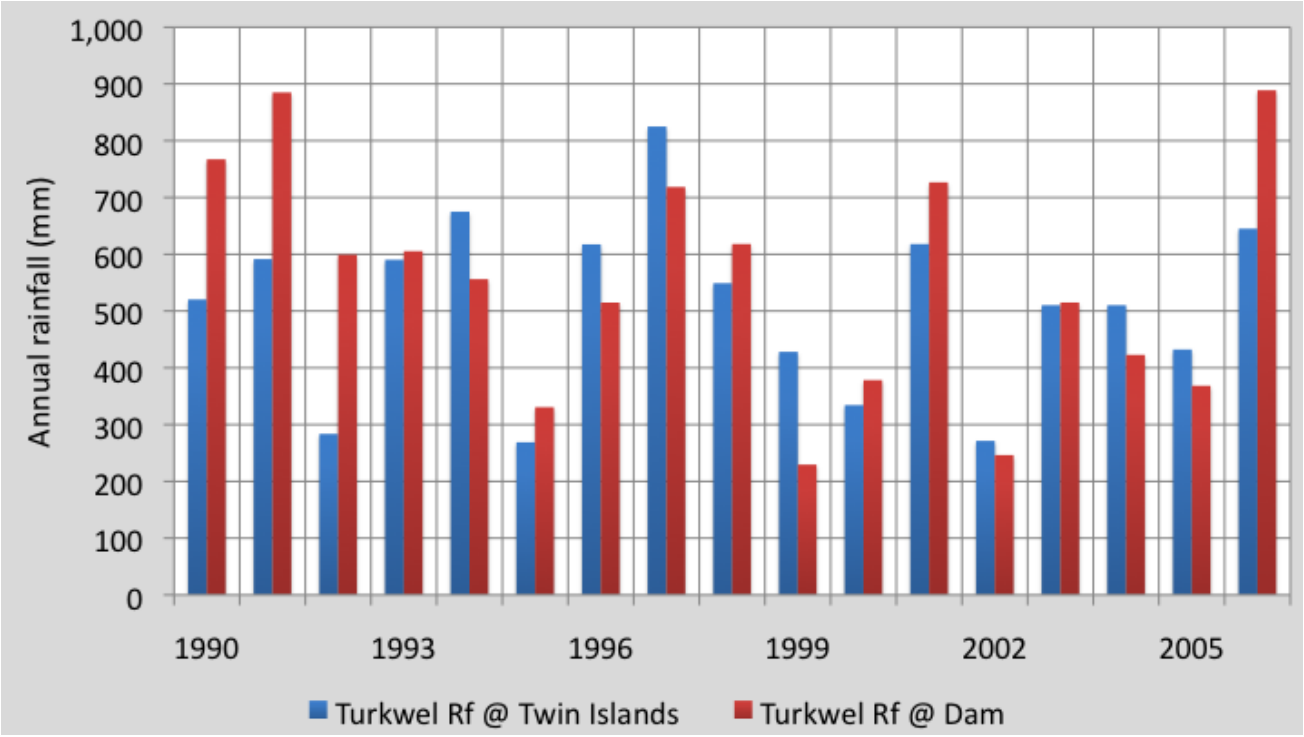


Figure 9: Annual rainfall at Turkwel Dam and Twin Islands

The Turkwel Dam rainfall data integrity has been tested with other rain gauges using double-mass curves and has been found to be compatible throughout the time period compared – see Figure 10. Recent data collection at the dam has however been fragmented with nothing up to date. The missing data is reported to be associated with periods of insecurity at the dam.

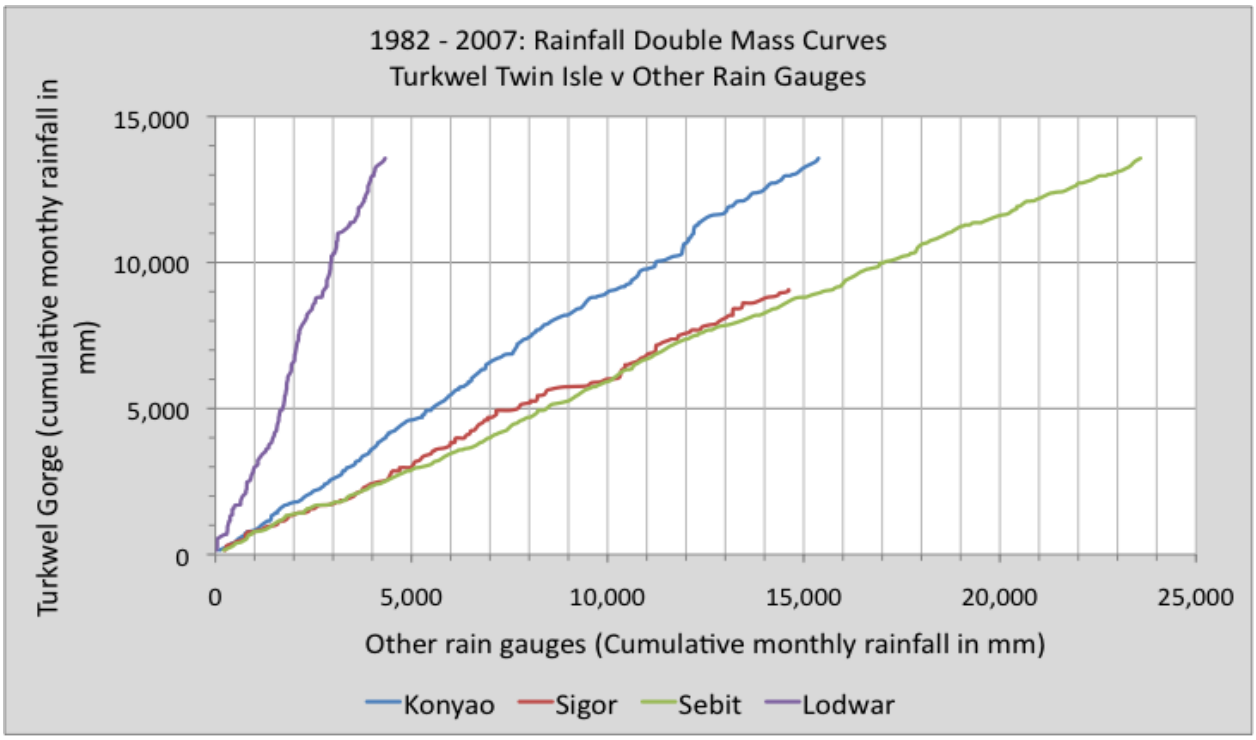


Figure 10: Cumulative rainfall at various rain gauges in the Turkwel catchment

Reasonable quality historic rainfall data series within the catchment are being sought to fully assess the trend to date. In addition, satellite-based rainfall is also being downloaded. A historic monthly data series for Sebit was the best provided, but this data is also fragmented (Sebit is north-east of Kapenguria). This data does however illustrate the high rainfall of recent years that is consistent with the rise in the dam's water level – see Figure 11.

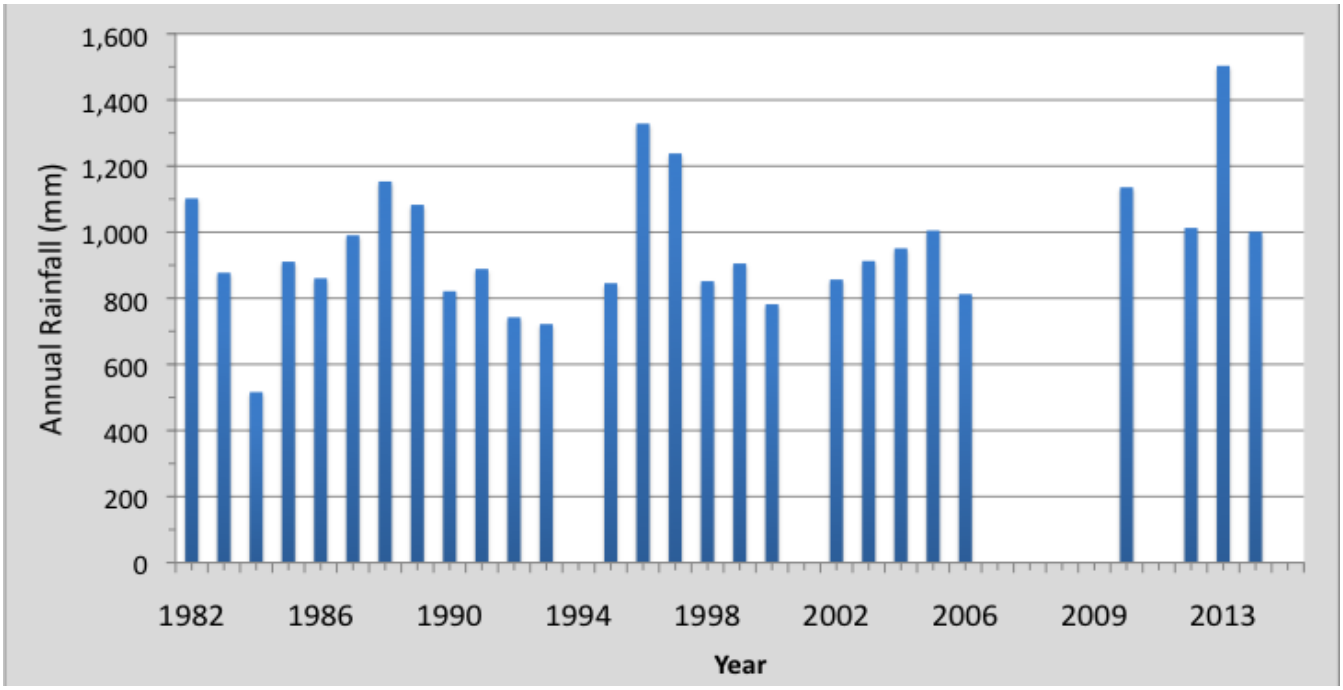


Figure 11: Annual rainfall at Sebit, north-east of Kapenguria, 1982-2015 (gaps signify missing data)

An increasing rainfall trend is apparent in the Lodwar annual rainfall downstream of the dam – see Figure 12. This graph was referenced from another study with annual data back to 1921.

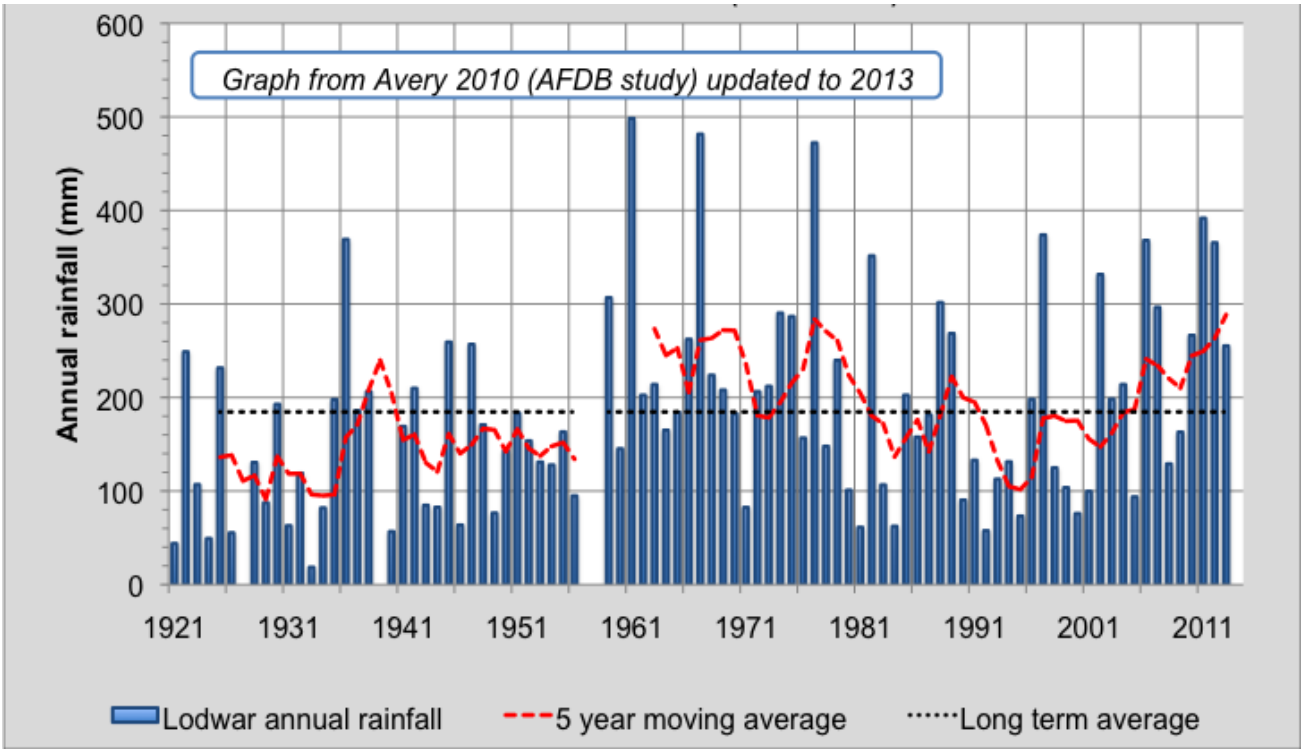


Figure 12: Lodwar annual rainfall, 1921-2013 (gaps signify missing data)

NET EVAPORATION LOSSES FROM TURKWEL RESERVOIR

Based on the assumptions built into the monthly reservoir model in the KVDA's dam monitoring procedures, the evaporation loss from the reservoir averaged about 1.13 m^3/s during the period since the dam was commissioned. During this time, the river flow has averaged 15.4 m^3/s, so the loss amounts to 7.4% of the river discharge. The dam's preliminary design utilised work done in 1968 in which the Penman formula was used to demonstrate a linear evaporation relationship with altitude. Based on this relationship, and adopting a mean altitude of 1,100 masl, the potential evaporation at Turkwel Dam was estimated to be 2,100 mm per year.

In 1988, the Ministry of Water (MoW) prepared a manual for irrigation projects for the whole of Kenya. Based on the MoW's work, Turkwel Dam falls within a zone of evapotranspiration of 2,300 mm/year. KVDA has provided some pan evaporation data for Turkwel Gorge dating from 1984 to 1998, but unfortunately there are major data gaps since 1990. The annual pan evaporation from this data averaged 2,727 mm, and ranged between 2,200 and over 3,000 mm. Assuming the evaporation pan factor to be 0.85, the potential evapotranspiration would be 2,300 mm/year, identical to the MoW figure above. Thus the potential evapotranspiration may have been higher than was assumed at the time of the design. There is of course the reality of global warming, which is affecting the entire region, and this in itself will cause evaporation losses to increase from the reservoir over time.

The preliminary dam design assumed the pre-dam baseline situation that 650 mm rainfall would fall on the reservoir area, and that 50 mm would run off. By creating the reservoir, the effective rainfall was increased by 600 mm, and the evaporation loss from the reservoir computed to be 2,100 - 600 = 1,500 mm/year. The rainfall data at the dam has been discussed earlier. Since the dam was commissioned, annual rainfall averaged 567 mm, and as mentioned, this is lower than the 650 mm that had been assumed during the design 30 years ago. Adopting the same approach as the design, the effective rainfall since the dam was commissioned was 567 – 44 = 523 mm., and the evaporation loss from the reservoir would have been 2,300 – 523 = 1,777 mm/year; see Table 3. This is higher than previously assumed.

Table 3: Evaporation from Turkwel Reservoir

Net evaporation loss from Turkwel Reservoir (mm)													
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Year*
1990	160	150	150	100	100	110	90	100	120	130	140	150	1,500
2015	190	178	178	118	118	130	107	118	142	154	166	178	1,777

Evaporation losses are a significant consequence of Turkwel Dam, especially with annual inflows being lower than had been expected. As shown in Table 4, evaporation losses would amount to 24% of the current average river inflow at full supply level, reducing to 12.5% at optimum operating level. From a water conservation perspective, it is thus advantageous to operate the reservoir at lower levels. In practice however, since commissioning over 20 years ago, the dam has only recently reached optimum operating level, although this may change in the future. Operating at lower water levels conflicts with the objective to generate hydropower, but this can be mitigated to some extent by the installation of turbines designed to operate efficiently at these lower levels. It is believed that KVDA is in the process of exploring possibilities. However, any turbine optimisations are not expected to affect the water release, as the entire river discharge passes through the turbines already.

Table 4: Turkwel dam evaporation losses

Operating level	Water level (masl)	Water surface area (hm^2)	Evaporation loss (mm/day)	Evaporation loss (m^3/s)	Evaporation loss as % MAI %
Full supply level	1,150	6,608.0	4.87	3.723	24.2
Optimum level	1,131	3,424.0	4.87	1.929	12.5
Minimum operating level	1,105	1,116.5	4.87	0.629	4.08

STORAGE WITHIN TURKWEL RESERVOIR AND SEDIMENT DEPOSITION EFFECTS

The final adopted design capacity of the Turkwel Reservoir was 1,641 Mm^3, zoned as shown in Table 5. This gross volume is equivalent to storing 3.8 years of current average flow from the Turkwel River.

Table 5: Turkwel Dam's storage zones

Storage Zone	Elevation range (masl)	Storage volume (Mm^3)
Active storage	1,105 to 1,150	1,478
Inactive storage	1,070 to 1,105	159
Dead storage	< 1,070	4
Gross storage		1,641

Based on actual sediment runoff measurements in the 1980s, the dam design assumed that catchment sediment yield into the Turkwel Reservoir would displace 10 Mm^3 per year (1,695 $m^3/km^2/yr$ or 2,373 $t/km^2/yr$). It would thus take 164 years for the catchment to deliver a volume of sediment equal to the entire Turkwel Reservoir volume of 1,641 Mm^3. The gross storage provision would enable regulation capacity in excess of the mean annual flow for nearly 100 years of operation, provided there was no increase in average sediment yield - see Figure 13.

The dam design was shown to be sensitive to the assumed sedimentation rate, with reservoir life diminishing if there is any ongoing annual increase in sedimentation rate. This is illustrated in Figure 13. According to the dam design team, an annual sediment increase of 3% per year was "not inconceivable". To put the assumed 10 Mm^3/year design sediment displacement rate into perspective, Kenya's Small Dams Manual defines a "heavy" erosion rate to be 1,500 $m^3/km^2/yr$, very similar to the figure adopted for Turkwel Dam. Global extremes have however included sediment runoff far in excess of these figures.

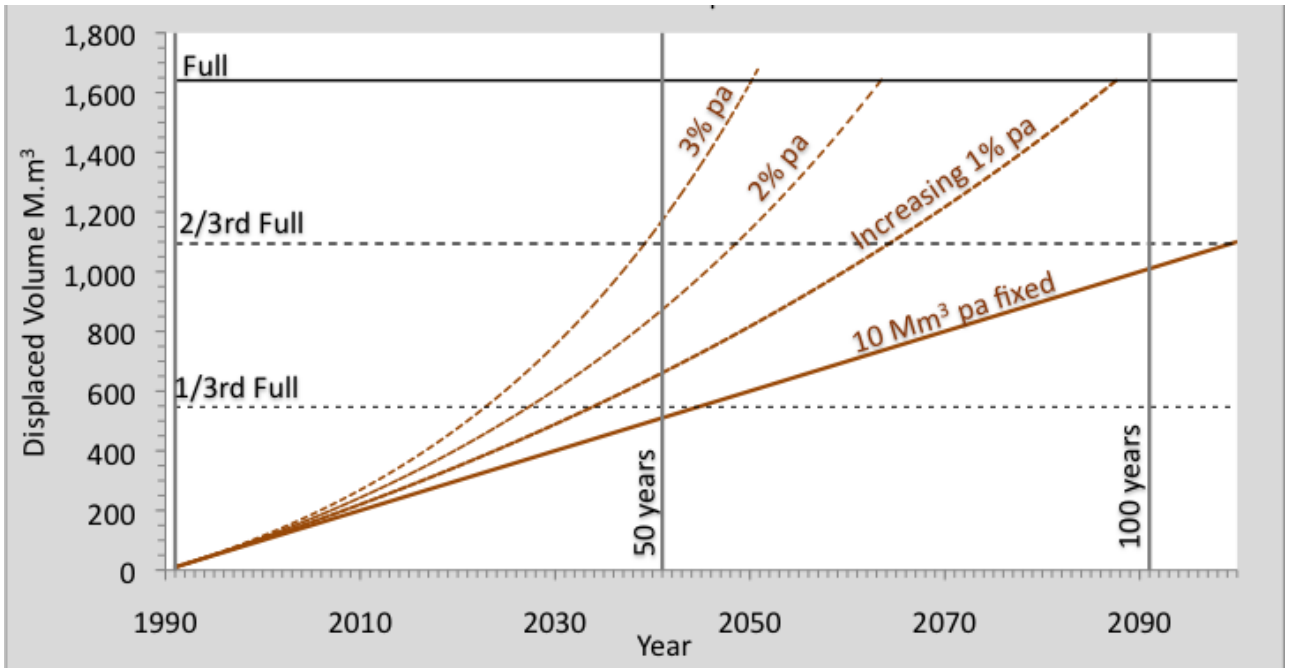


Figure 13: Sediment displacement volumes over time in Turkwel Reservoir

Figure 14: Google Earth image of Turkwel Dam delta

Google imagery in Figure 14 clearly illustrates the sandy luggas discharging into the top of the reservoir, and the slight discolouration of the water in this area is evident. Much of the sediment deposition will be occurring here, and progressing from here. The imagery also suggests degradation of the riparian zones adjoining the reservoir and inflowing rivers, probably due to livestock accessing water. Possible improved catchment protection measures can be looked into.

There is no recent sediment sampling data available for the catchment. However, as the dam has been operational for over twenty years, a bathymetric survey of the reservoir today would provide an accurate update of the design assumptions. Sediment monitoring within the reservoir was recommended as part of ongoing dam monitoring procedures. KVDA procured depth-sounding equipment, but no work has yet been done. Tullow has offered to assist KVDA undertake this necessary survey, and has requested the original baseline topographical survey for the reservoir.

RESERVOIR YIELD

The reservoir performance at various draft scenarios is illustrated in Figure 15. Drafts in this reservoir model are proportioned relative to the mean annual inflow (MAI) of 15.4 m^3/s. This reservoir model assumes no power generation until the reservoir reached 1,120 masl (as per what actually happened – see Figure 3). 87% draft represents the theoretical net maximum yield, which is the mean annual inflow less an average reservoir loss. At 87% draft, the reservoir model breached the minimum operating level more than once, which mirrors what happened in practice (see Figure 3).

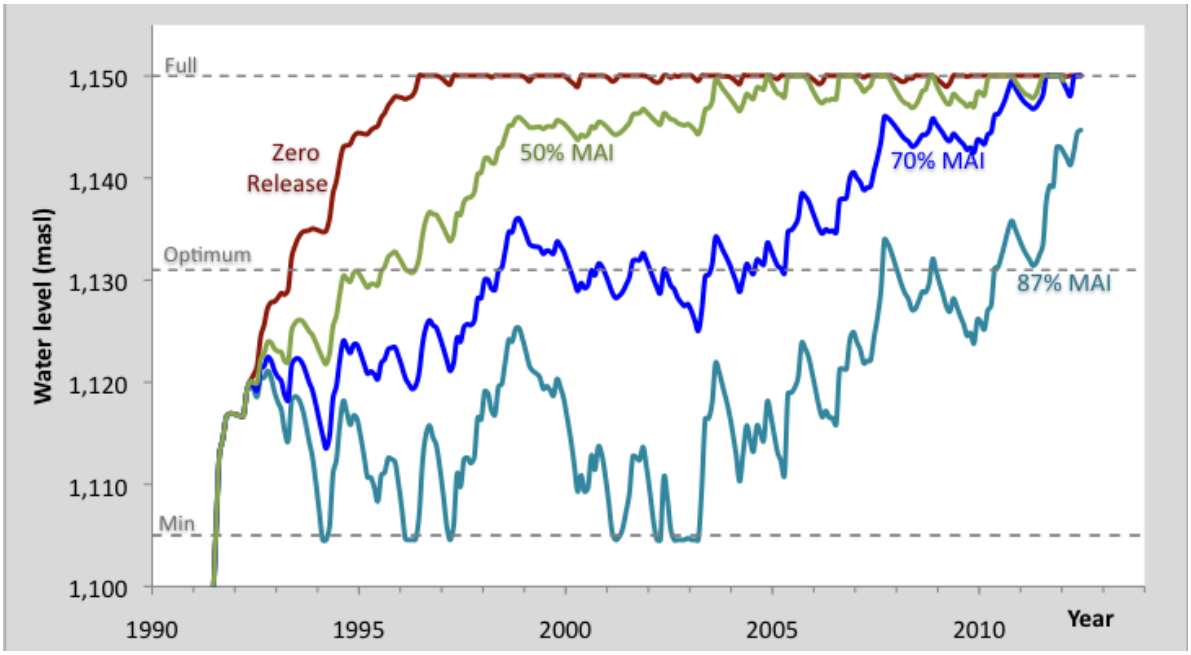


Figure 15: Turkwel Reservoir - tested with different yield (release) scenarios

Figure 16 presents a different set of scenarios whereby the reservoir was allowed to fill further before generating power. This is hypothetical. An uninterrupted fill period should never happen, as flow for downstream water users and the ecology must be sustained, but it serves to illustrate the extent to which the storage is utilised in order to sustain the maximum yield. The effect of the option of the Tullow abstraction direct from the reservoir is illustrated in Figure 17. Whereas the daily evaporation from the reservoir is 4.9 mm, irrespective of water level, the direct abstraction of 0.278 m^3/s has an effect that varies with water level, as shown in Table 6.

Table 6: Tullow water demand expressed as reservoir depth

Reservoir operating level	Depth equivalent of Tullow 0.278 m^3/s water demand (mm/day)
Full supply level	0.4
Optimum operating level	0.7
Minimum operating level	2.2

The Tullow water demand equates to 2.2-mm depth daily on the reservoir at minimum operating level. This depth is cumulative, with daily amount diminishing as reservoir surface area increases, being 0.7 and 0.4 mm per day respectively at optimum and full supply levels. The cost in terms of head loss for power generation would need to be considered for comparison with the option of taking water after it has passed through the turbines, in

which case there is no impact on reservoir level. In the scenario depicted in Figure 17, the water level is up to 3.4 m lower at times.

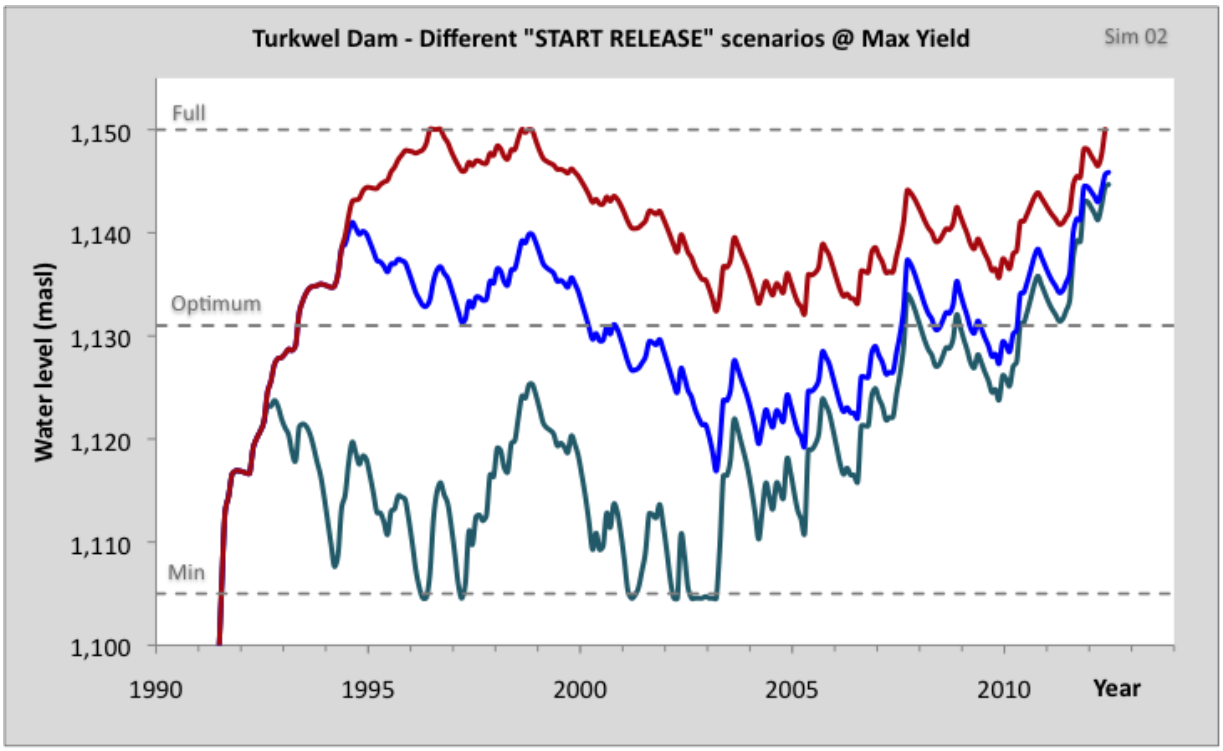


Figure 16: Turkwel Reservoir - operating at the maximum yield scenario

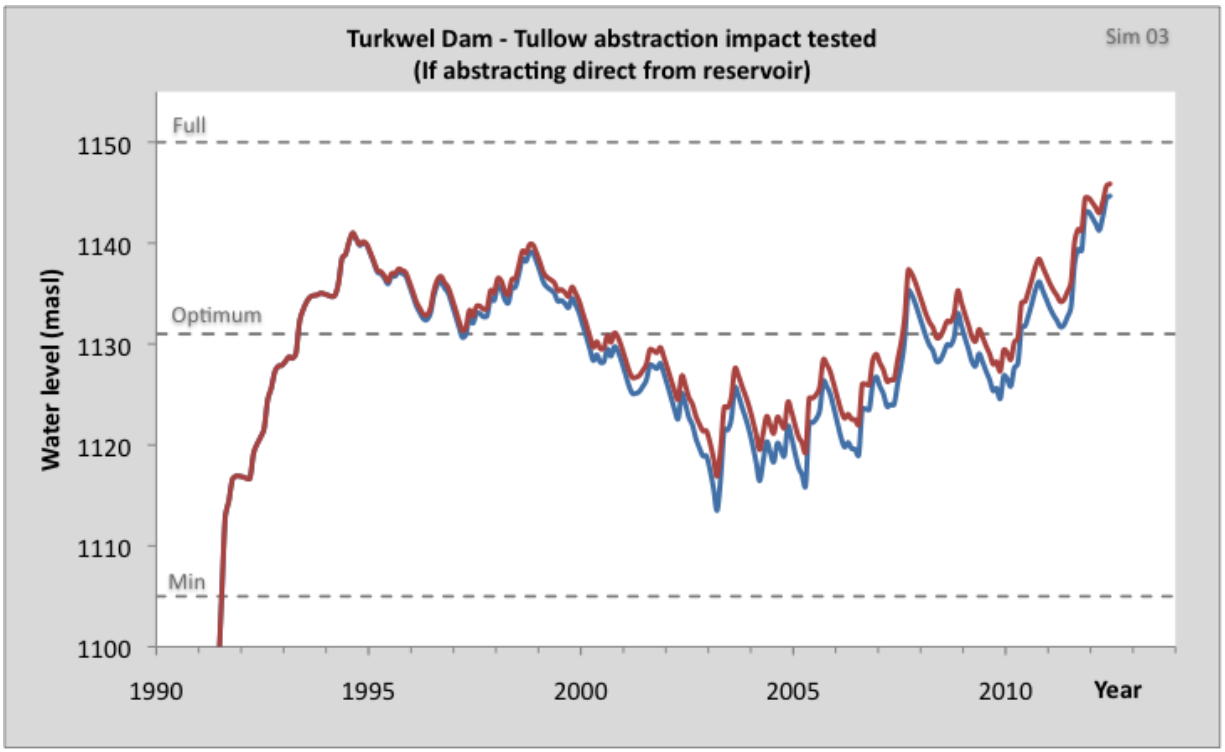


Figure 17: Turkwel Reservoir with Tullow abstraction imposed

COMPENSATION FLOW AND DOWNSTREAM WATER RELEASE

There is no compensation flow release from the dam, and the river between the dam and the turbine tailrace is dry. However, this river stretch is short, and is confined within the gorge. Some leakage does occur through the dam, and a small permanent pool exists immediately downstream (see Photo 1 on next page). The leakage from

the diversion tunnel plug was measured as part of the dam's monitoring procedures. Records have been seen only between 1985-1994, and no increase in leakage was indicated, and the discharge averaged 9.65 litre/s (0.009647 m^3/s, or 834 m^3/day).

Photo 1: Plunge pool immediately below dam

The principal function of the dam is to generate power. Based on the Turkwel's average daily design flow of 18 m^3/s, the turbine water release was designed to be 36 m^3/s over 12 hours. From an ecological and downstream water-use perspective, this 12-hour release pattern is not ideal.

Some degradation of the riverbed was expected as a consequence of the dam. This is because the dam has totally arrested sediment movement down the river at this point. Any river will naturally compensate this loss through scouring of the bed and banks. The Turkwel Dam designs considered the main degradation impact zone to be up to the Malmalte River confluence not far downstream (about 18 km in a straight line). The degradation beyond the confluence would be slight, as the Malmalte would continue to provide a large proportion of the modified sediment load capacity of the lower reach (Turkwel Dam has not altered the Malmalte inflows). The dam has of course altered the natural downstream river hydrology. Flows will be regulated, and two main impacts were considered in the dam's design:

1) The behaviour of the Turkwel river aquifer would be altered, and this in turn would result in possible vegetation changes. This would primarily affect the river stretch between the dam and the Malmalte confluence, where the water table naturally fluctuated within a 1-m range. With riverbed degradation, there was potential to drop the groundwater table, which might adversely affect some of the vegetation, and lead to changes.
2) The regulated discharge in the river would lead to increases in irrigation areas and human pressure on the natural ecology.

Protection works and weirs to mitigate river degradation were recommended as part of the dam design. The implementation and effect of these measures (if any) has not yet been explored, but will be included in future fieldwork. Any new abstraction from the river would of course compound the impact of the irrigation abstractions. This aspect has been briefly addressed in this report, and will be investigated more fully. The impact of irrigation abstractions is potentially so large that any other abstractions are insignificant.

DOWNSTREAM WATER NEEDS

The Kenya Government has plans to increase irrigated areas in Turkana in order to meet food-security needs. Kenya's Vision 2030 planned a 600% increase in irrigated lands, with most of this development within the arid and semi-arid lands. Following water balance studies that revealed severe water stress arising, the planned areas have been reduced and water conservation measures recommended. The recent National Water Master Plan update lists two planned irrigation projects in Turkana, these being two proposed KVDA irrigation projects totalling 7,000 ha, as follows:

- Turkwel Dam Irrigation Project - 5,000 ha net irrigated area (currently out to tender);
- Namerit Dam Irrigation Project - 2,000 ha, said to be "100 km south of Lodwar" and "to be developed in the Turkwel River".

A recent FAO study, funded by the EU and undertaken by Ocra Consultants, investigated the irrigation potential along the Kerio and Turkwel Rivers in Turkana. Ocra determined the Turkwel River to be discharging on average 12.8 m^3/s, and with the Malmalte River (Photo 2) contributing on average 7.8 m^3/s, Ocra concluded that there is a total of 19.8 m^3/s "to be shared amongst users". Later in their report, Ocra adopted a Turkwel flow of 15 m^3/s. The Ocra study has assumed that 50% of the Turkwel flow (7.5 m^3/s) would suffice to meet "domestic, livestock and ecological maintenance" water needs, and that the balance of 7.5 m^3/s "is available for irrigation". Based on this figure, it was concluded that there is potential to increase the present irrigated area along the Turkwel River from the present 1,753 ha to 10,000 ha. The figures presented by Ocra are "net" requirements. It is presumed that the KVDA irrigation development plans are in general encompassed within the 10,000 ha mooted by the FAO study. It is worth noting that the economic viability of these irrigation projects was not clearly established by the Ocra study.

Photo 2: Malmalte River at Kainuk Bridge

There are also irrigation schemes in progress in the lower Turkwel area from highly-productive boreholes drilled into the Napuu aquifer near Lodwar (presumably being recharged indirectly by the Turkwel River). The FAO study mentions, but did not investigate, the irrigation development potential of the much-hyped UNESCO/RTI Turkana aquifers. The National Water Master Plan update also mentions the UNESCO/RTI Turkana aquifer finds, and observes as others have done, that clarifications are needed on the various assumptions leading to the potential aquifer water yields that have been claimed. Ocra/FAO recommend that the Water Resources Management Authority (WRMA) fulfils its obligation to prepare a Water Allocation Plan, and in view of the ambitious irrigation development plans mooted for the Kerio and Turkwel Rivers, this is clearly urgent.

By constructing irrigation schemes, one form of vegetation is replaced with another. The net water "loss" will depend on the nature of the vegetation change, and will principally comprise the irrigation application losses. These losses can be appreciable, being typically 50% in furrow irrigation systems, perhaps more. Assuming the potential 10,000 ha falls entirely within the existing vegetated riparian zones, the associated water loss equates to 3.75 m^3/s. In comparison, the Tullow water demand is a fraction of this amount. Thus in terms of downstream water demands:

- The riparian vegetation/forest zones down to Lake Turkana were estimated during the dam design as totalling 39,390 ha, and to sustain these areas was estimated to require 25 m^3/s of water. This data will need to be updated, but is indicative of the environmental flow requirements of the river.
- The Ocra/FAO studies assumed that only 50% of the river is required to meet domestic, livestock and ecological maintenance requirements. For the entire river to the lake, this would amount to 9.9 m^3/s, almost one-third the figure estimated by the dam design team for ecology alone.
- The Ocra/FAO irrigation expansion would result in losses of 3.5 m^3/s.

- The Ocra study does not consider the irrigated areas potentially arising from the UNESCO/RTI Turkana aquifer pronouncements. If any of these potential areas tap the Turkwel river water, even if indirectly, they would be additional to the Ocra 10,000 ha.

The potential Tullow abstraction amount of 0.278 m^3/s is equivalent to the water required by a riparian or vegetated area totalling about 415 ha. The abstraction's immediate impact zone would be from the dam to the Turkwel/Malmalte confluence. At the time of the dam design, the riparian forest within this section totalled 1,370 ha, and there was another 2,006 ha along the Malmalte to the confluence. The combined area extending down to Katilu totalled 6,748 ha. It is intended to inspect these areas in the field.

DEMOGRAPHIC & CLIMATE CHANGE

It is beyond the scope of this report to quantify the climate and long-term changes that will affect the dam, but it is worth mentioning the emerging scenarios. The entire Rift Valley Catchment Area population is forecast to increase 53% between 2010 and 2030 – see Table 7. Water demand, with irrigation included, will increase 318%, and the Water deficit/Water demand ratio will exceed 40% in 2030, which will put the Rift Valley Catchment Area into the "under severe water stress category".

Table7: Rift Valley statistics

Rift Valley Catchment Area statistics[1]			
	2010	2030	Increase
Population (millions)	4.86	7.45	53%
Water demand (irrigation excluded)	214	419	96%
Water demand (irrigation included)	357	1,494	318%
Available water resources[4]	2,559	3,147	23%
Water deficit[2]	92	867	842%
Ratio: Water demand / Water resource[3]	14%	47%	
Ratio: Water deficit / Water demand	26%	58%	

Footnotes:
(1) National Water Master Plan, JICA, 2013;
(2) Annual Water Deficit for probability 1 in 10 yrs for domestic and industrial uses, and 1 in 5 yrs for irrigation;
(3) If ratio Water demand / Water resource > 40% = "under severe water stress" (OECD [1]);
(4) Groundwater component fixed at 102 Mm^3/yr throughout (UNESCO/RTI Turkana aquifer announcement seen too late and assumptions deemed by JICA to require "clarification").

If it is decided that Turkwel Dam will be pursued as the principal water source for the Tullow oilfields, the long-term hydrological prospects of Turkwel Dam should be assessed by means of a hydrological model that offers climate change modules (for example HYSIM developed by Water Resource Associates). This possibility has been broached in discussions, and data collection is currently being approached keeping in mind this next stage of consolidating the water supply options.

As mentioned above, rainfall patterns are changing, and temperature is increasing. Rainfall increases are to an extent offset by the increased evaporation that results from increasing temperature. The main likely eventuality is increasing runoff with increasing rainfall compounded by the ongoing catchment degradation. Warnings of degradation were made in the 1980s whilst the dam was under design, and the ongoing catchment degradation is very evident at the key gauging station for the project, RGS 2B07 at Kongelai, whose river gauging cableway infrastructure has largely collapsed into the river due to erosion by floodwaters increasing the waterway area and down-cutting the channel (see Photos 3 and 4).

Catchment degradation is a consequence of land pressure, and the associated poor land-use practices are often attributable to constraints arising from extreme poverty. Increased runoff results in increased erosion, and hence sediment runoff, as mentioned earlier in this report. As part of ongoing work on this assignment, Tullow's GIS department is assisting by investigating imagery from which past land-use changes and degradation trends can be mapped.

The National Water Master Plan has forecast the available water resource in the Rift Valley Catchment Area increasing 23% by 2030 (in Table 7). Hence a long-term increase in annual runoff into Turkwel Dam seems likely. At the same time, an increase in sediment runoff is also likely, and this does need to be investigated. However, the dam design did intentionally include very large allowances for sediment accumulation to ensure that it is a long time before the reservoir's active storage zone is compromised.

Photo 3: River Turkwel River gauging station RGS 2B07 at Kongelai

Note river down-cutting with stilling-well pipe now stranded. Lowest staff gauge at left missing altogether.

Photo 4: River Turkwel RGS 2B07 at Kongelai

Note widening of the river, and the cableway foundation slab on far bank now collapsed into the river.

CONCLUSIONS

Turkwel Dam was originally designed as a multi-purpose scheme, and hydrologically, its storage reservoir is indeed a viable water source for the strategic water supply that Tullow Kenya requires. KVDA, the dam owner and operator, has reacted positively to this suggestion and has fully cooperated with this study.

The Tullow water demand is a very small proportion of the Turkwel river flow, and amounts to a fraction of the evaporation loss from Turkwel Reservoir. There will be a small reduction in river flow, estimated to equate roughly to the water used by 415 ha of riparian forest, or a similar-sized irrigation scheme. However, with climate changes forecast in the National Water Master Plan, the river flows will increase by 2030 and more than offset the small reduction arising from the potential project abstraction.

If the water is abstracted below the dam, there would be no impact on the reservoir operation for power generation. If the water is abstracted directly from the reservoir (Photo 5), the reservoir water level would be reduced, thus reducing the power generated. However, by optimising reservoir water levels at a lower level, water losses to evaporation would be reduced.

Photo 5: Reservoir behind Turkwel Dam

The potential impact zone downstream of the dam encompasses the Turkwel River and its important riparian zone, and Lake Turkana (Photo 6), an endorheic lake that is the terminus for the Turkwel and other rivers. This will be the subject of further study and will be covered in a future technical report.

Photo 6: Lake Turkana from Eliye Springs

ACKNOWLEDGEMENTS
The Kerio Valley Development Authority's cooperation is gratefully acknowledged and thanks are due to the Managing Director, Mr David Kimosop and his team of technical officers. The Consulting Engineer engaged by Tullow for this assignment is registered with the Engineers Board of Kenya, and is licensed by the Ministry of Water & Irrigation in various categories including water supply and hydrology, and in addition is licensed by NEMA.

Water

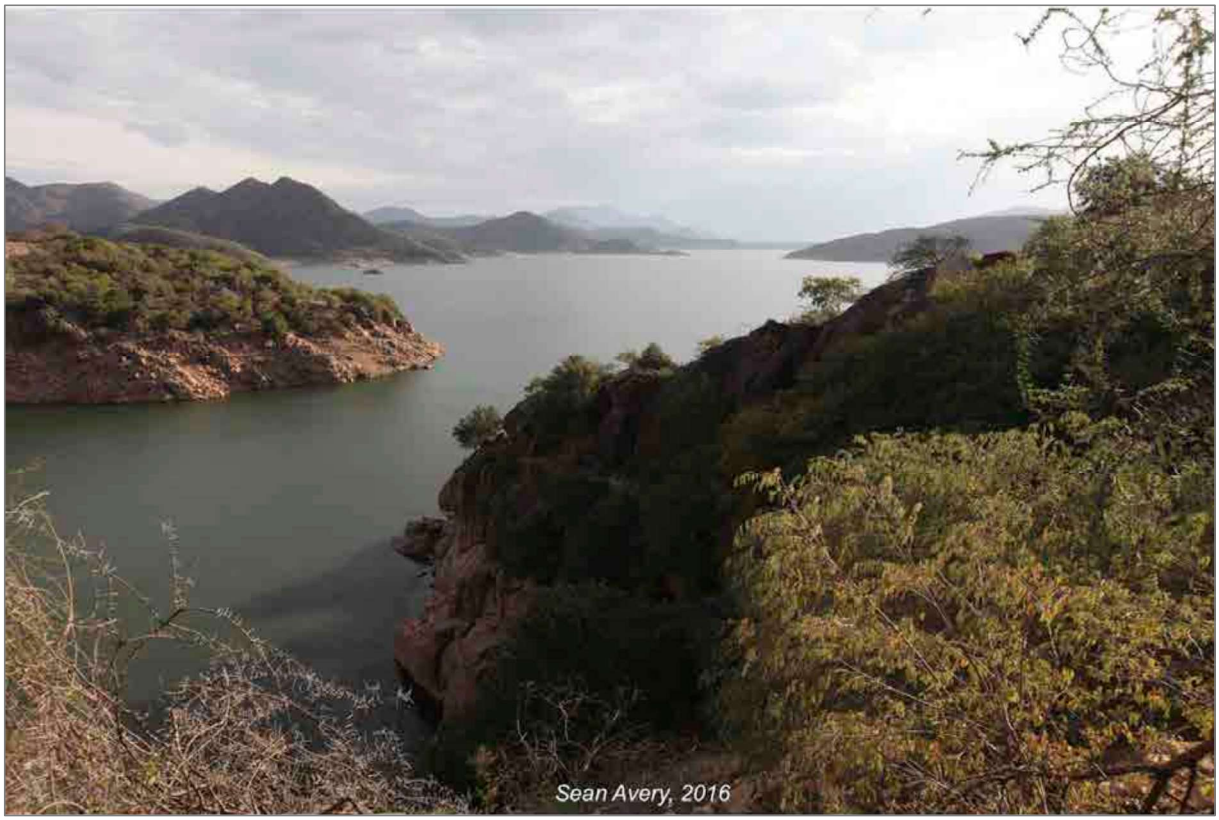
D3

5 Strategic Water Supply for Development - Turkwel Reservoir Hydrology

TULLOW OIL KENYA BV
SOUTH LOKICHAR DEVELOPMENT

STRATEGIC WATER SUPPLY FOR DEVELOPMENT
TURKWEL DAM OPTION

TURKWEL RESERVOIR HYDROLOGY



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August 2020

DOCUMENT CONTROL

No of Copies	Version	Date	Location / Comment
PDF	V1_Draft	11 June 2020	Hydrology Report
PDF	V2_Final	10 August 2020	Hydrology Report

This is version V2_Final_100820 in PDF format.

Signed by:

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ACKNOWLEDGEMENTS

The Consultant is grateful to Tullow Oil Kenya BV for the opportunity to review and update the hydrology of Turkwel Basin, in particular Richard Boak for initiating the assignment in 2015 and for supporting the various specialist field studies and associated equipment procurements necessary for the work, including encouraging wider knowledge sharing through publication of findings. And the Consultant is grateful to Johana Ekwam for commissioning the current report.

Thanks are due to the management and staff from KVDA and Kengen. The knowledge of Daniel Kimetto from his past role as a KVDA hydrologist working with the Turkwel design team was invaluable. And Messrs Shikuku and Adeya of Kengen kindly dealt with periodic requests for vital hydrological data during field visits to the dam and during the subsequent analysis.

All KVDA reports cited in this report on Turkwel dam were physically viewed in their library archive in Eldoret. KVDA historic flow data records were viewed in KVDA's Kapenguria office, and dam monitoring data were viewed at the KVDA Turkwel dam office.

The Water Resources Authority offices in Kapenguria and Lodwar were visited, and the status of recent river flow data collection was shared by their staff.

All water quality laboratory testing was arranged by Tullow at accredited laboratories in Kenya.

Data and reports were accessed from within the Consultant's archive, and all photos were by the Consultant. All field equipment was provided by the Consultant except the final phase bathymetry equipment sourced by the Consultant and procured by Tullow.

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LIST OF UNITS AND ABBREVIATIONS

µS/cm	electrical conductivity in micro Siemen per centimetre
S	Siemen (unit of electrical conductivity of a liquid)
°C	temperature (degree Celsius)
m	metre
mm	millimetre (10^{-3} m)
cm	centimetre (10^{-2} m)
hm	hectometre (10^{2} m)
km	kilometre (10^{3} m)
m^2	square metre
mm^2	square millimetre (10^{-6} m^2)
cm^2	square centimetre (10^{-4} m^2)
hm^2	square hectometre (10^{4} m^2)
km^2	square kilometre (10^{6} m^2)
	1 hm^2 = I ha (hectare) = 10,000 m^2
m^3	cubic metre
mm^3	cubic millimetre (10^{-9} m^3)
cm^3	cubic centimetre (10^{-6} m^3)
L	Litre (10^{-3} m^3)
hm^3 or MCM	cubic hectometre or million cubic metres (10^{6} m^3)
km^3	cubic kilometre (10^{9} m^3)
L/s	Litre per second (rate of discharge)
m^3/s	cubic metres per second (rate of discharge)
m^3/d	cubic metres per day (daily discharge)
kg	kilogram
µg	microgram (10^{-9} kg)
mg	milligrams (10^{-6} kg)
g	grams (10^{-3} kg)
t	metric tonne (10^{3} kg)
mg/L or ppm	milligrams per litre (dissolved salt concentration)
	I mL = 1 cm^3
W	watt (unit of power)
Wh	watt-hour
kW	kilowatt (10^{3} W)
kWh	kilowatt-hour (10^{3} Wh)
MW	megawatt (10^{6} W)
MWh	megawatt-hour (10^{6} Wh)
GW	gigawatt (10^{9} W)
GWh	gigawatt-hour (10^{9} Wh)
m ASL	metres Above Sea Level (elevation or altitude)
GPS	global positioning system
UTM	Universal Transverse Mercator co-ordinate system
WGS	World Geodetic System
y	year
d	day
h	hour
min	minute
s	second

BGA-PC	Blue green algae – phycocyanin
Chl	Chlorophyll
DO	Dissolved oxygen (measured in mg/L or percentage saturation)
EC	Electrical Conductivity (measured in µS/cm)
FDOM	Fluorescent dissolved organic matter
FSL	Full supply level (1150 m ASL at Turkwel dam)
pH	Hydrogen ion concentration
NTU	Nephelometric Turbidity Units
PET	Potential evapotranspiration
PMF	Probable maximum flood
RFU	Relative Fluorescence Units
SAR	Sodium Adsorption Ratio
SPC	Specific conductivity of water (standardised at 25°C)
TDS	Total dissolved solids
TSS	Total suspended solids
WL	Water elevation above mean sea level datum
ADCP	Acoustic Doppler current profiler
ASL	Above mean sea level
BGS	British Geological Survey
CHIRPS	Climate Hazards Group InfraRed Precipitation with Station rainfall data
CIDP	County Integrated Development Plan
GIZ	Deutsche Gesellschaft fur Internationale Zusammenarbeit GmbH (German Society for International Cooperation)
JICA	Japan International Cooperation Agency
KBS	Kenya Bureau of Standards
Kengen	Kenya Electricity Generating Company
KJV	Kenya Joint Venture (Tullow Kenya BV, Africa Oil, Total)
KS	Kenya Standard
KVDA	Kerio Valley Development Authority
KWS	Kenya Wildlife Service
KP	Knight Piesold Consulting (see also WLPU Consultants)
MoWD	Ministry of Water Development
NWMP	National Water Master Plan
RGS	River Gauging Station (where water level and discharge are monitored)
RVBP	Rift Valley Basin Plan
TRMM	Tropical Rainfall Monitoring Mission (now discontinued)
WLPU	UK partnership of Knight Piesold renamed WLPU Consultants in 1984 (formerly Watermeyer, Legge, Piesold and Uhlmann)
WSRP	Water Sector Reform Programme
USGS	United States Geological Survey
WRA	Water Resources Authority, Kenya
WRMA	Water Resources Management Authority, Kenya (now called WRA)
lugga	seasonal dryland river

TURKWEL RESERVOIR HYDROLOGY

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1 INTRODUCTION

1.1 Background Information

On 7th August 1989, the Water Apportionment Board issued the Managing Director of the Kerio Valley Development Authority (KVDA) with permit numbered P24406 approving the construction of a concrete arch dam 150 metres in height on the Turkwel River (Figure 1). The permit allowed the use of 1,468,000,000 Litres/day (17 m^3/s) "from flood flow for power purpose (100 per cent returnable)".

The design and construction supervision of Turkwel Dam were undertaken by Sogreah Ingenierie (Consulting Engineers), with WLPU Consultants performing an oversight role and directly advising KVDA. The dam was constructed by international construction company Spie Batignolles.

Construction commenced in 1986 and in January 1990 the diversion works were closed, and filling of the reservoir commenced. The hydropower station was planned to operate at 25% capacity from January 1991, at 50% capacity from July 1991, at 75% capacity from July 1992, and at 100% capacity from July 1993 onwards.[1]

The Turkwel hydropower station is operated by Kengen, and contributes electricity daily to Kenya's national grid.

Turkwel was planned as a multi-purpose project, principally for hydropower generation, but at a later date would include irrigation projects downstream. These irrigation abstractions were not included in the KVDA water permit, and have never been implemented.

The dam's 5,900 square kilometre catchment is predominantly within the West Pokot County of Kenya, but with its upper reaches within Uganda. Not far downstream from the dam, the river is joined by the Malmalte river, and then flows on through Turkana County to Lake Turkana (Figure 2). The lake is the terminus of the Omo Turkana Basin, a trans-boundary basin split almost equally in area between Kenya and Ethiopia, but also encroaching into Uganda and South Sudan (Figure 3). Since the Turkwel project was commissioned in Kenya, a number of hydropower projects and associated large scale irrigation projects have been implemented in the Omo Turkana Basin in Ethiopia (Figure 3).

The study of the hydrology of the Omo Turkana Basin by the Consultant was initiated by the African Development Bank in 2009,[2] and that work has continued since with the support of others. The key focus of studies was the assessment of the impact of hydropower and irrigation projects on Lake Turkana, an important consideration for any developer.[3]

The Government of Kenya contracted Tullow Kenya BV and its joint venture partners (currently Africa Oil and Total), together referred to as the Kenya Joint Venture (KJV), to explore oil and gas prospects in Kenya. Following the discovery of oil prospects in the Lokichar Basin within Turkana County, a suitable water source was sought to serve the injection water requirements of the planned oil abstraction methodology. Turkwel dam's impounded reservoir was considered the most viable of the many options to meet the oilfield's water supply requirements.[4] Communities along the pipeline route to Lokichar would also have access to the water.

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[1] KVDA letter Ref KVDA/MD/I.9/Vol.II, dated 16th November 1989, to Sogreah (KVDA-appointed Consulting Engineers for Turkwel dam).

[2] Hydrological Impacts of Ethiopia's Omo Basin on Kenya's Lake Turkana Water Levels and Fisheries, Final Report, African Development Bank, Tunisia, by Sean Avery, November 2010.

[3] What Future for Lake Turkana? The impact of hydropower and irrigation development on the world's largest lake, by Sean Avery (Ed. David Turton), African Studies Centre, University of Oxford.

[4] Strategic Water Supply for Development, Technical Report 5, Turkwel Dam versus Lake Turkana, by Richard Boak, Water Resources Manager, Tullow Kenya, 13 February 2015.

The Consultant was commissioned by Tullow in 2015 to undertake hydrological studies on Turkwel dam as well as an intake survey on Lake Turkana.[5] [6] Following the preliminary Turkwel hydrological assessment during which the baseline hydrological database collection was reviewed, further studies and data collection were initiated. These findings are summarised here in this report to Tullow, which seeks to provide sufficient data for assessing the hydrological sustainability of the Turkwel dam as the water source for the Lokichar oilfield's water injection needs.

1.2 Scope of the Hydrological Review

The hydrological review process for Turkwel dam has included the following tasks, some of which are still in progress:

- Review of historic hydrological data and reports
- Status review of the river gauging network and its rehabilitation
- Review of catchment climate data and climate trends
- Survey of actual sediment deposition within the reservoir since commissioning
- Water quality profiling of the Turkwel reservoir and its water chemistry
- Calibration of the Turkwel dam's turbine discharges and simulation of reservoir inflows
- Determination of the impact of an added abstraction from the dam's reservoir
- Assessment of upstream water abstractions and water demand
- Downstream release requirements
- Catchment land use practices

[5] Strategic Water Supply for Development, Technical Report 3, Preliminary Hydrological Review of Turkwel Dam, by Sean Avery, Consultant, Tullow Kenya, October 2015.
[6] Strategic Water Supply for Development, Lake Turkana Water Intake Option – Water quality and bathymetric verification, and long-term ecological monitoring, by Sean Avery, Consultant, Tullow Kenya, January 2016.

Figure 1: Turkwel dam (water level 28 metres below full supply spillway level)

Figure 2: The Turkwel river system from Mount Elgon to Lake Turkana

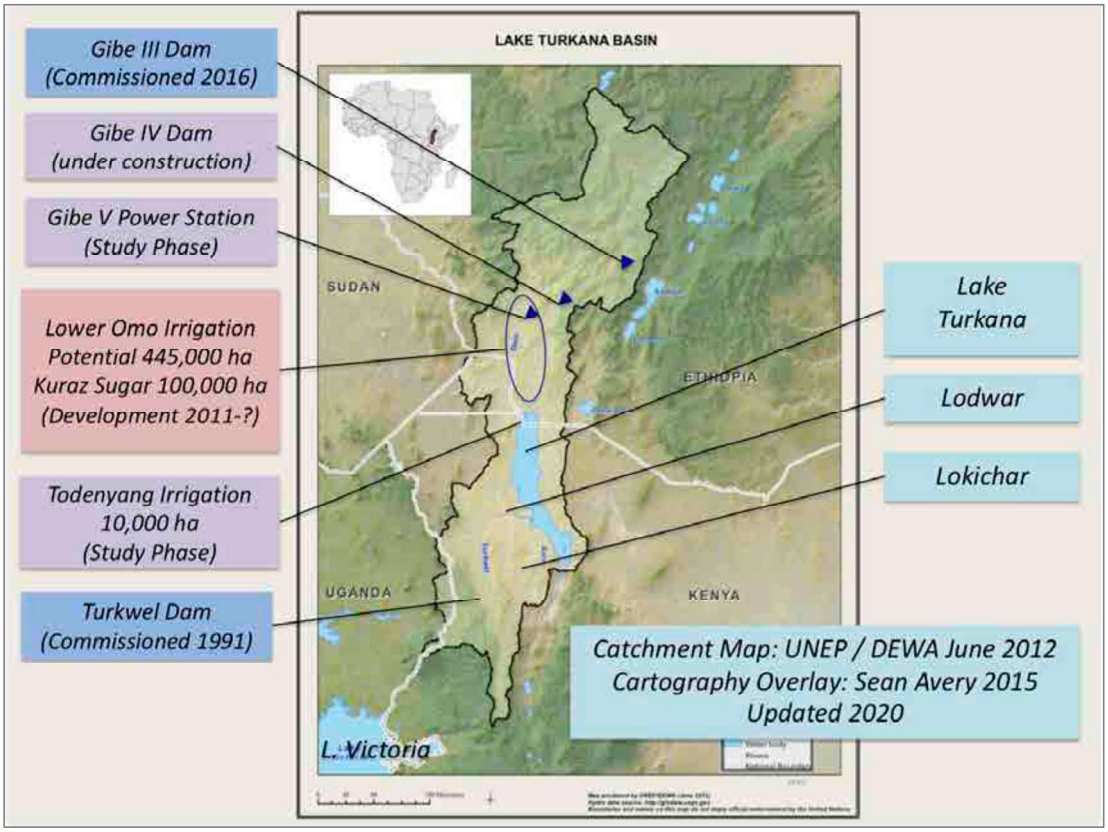

Figure 3: Turkwel dam within the Omo Turkana Basin [7]

[7] Strategic Water Supply for Development, Technical Report 4, Lake Turkana Hydrology & Water Quality Monitoring, by Sean Avery, Consultant, Tullow Kenya BV, January 2016.

2 UPPER TURKWEL BASIN

2.1 Turkwel dam's topography and catchment characteristics

Turkwel's 153 metre high concrete arch dam has a 150 metre long curved crest spanning Turkwel Gorge on the western margin of the Rift Valley (Figure 1). The dam and impounding reservoir are within very scenic mountainous terrain (Figure 7).

The catchment is within Kenya's Rift Valley Basin, and the river passes downstream and north-east to Lake Turkana through semi-arid and arid terrain, generally flat, but with hills (Figure 2 and Figure 3).

Upstream of the dam, the basin fans out into a plateau that rises gently from 1,100 m ASL to the surrounding chain of mountains 2,000 to 2,500 m ASL (Figure 4).

The dam's total 5,900 km^2 catchment area is broken down into the key sub-catchments as described below in the dam design documents (Table 1 and Figure 5).[43 9] The majority of the dam's river inflow is generated within Kenya's boundaries, but a large portion of the physical catchment area is in Uganda.

2.1.1 The south-western sub-catchment (Suam river)

The Suam is the main flow tributary, its headwaters comprising three streams on the north-eastern slopes of Mount Elgon, two of which rise within Uganda. The Suam River drains 1,350 km^2 to the dam's important river gauging station RGS 2B07 / RGS 2B33 at Kongelai [8] (Figure 5). The annual rainfall of this sub-catchment averages 1,125 mm. Whilst comprising only 25% of the Turkwel catchment, 70% of the Turkwel dam's river inflow is contributed by this tributary.

2.1.2 The north-western sub-catchment (Kanyangareng and Kanyao rivers)

This sub-catchment drains 2,600 km^2 rising from within Karamoja in Uganda (Figure 5). There are two seasonal sand rivers, both prone to floods with high sediment loads, and proportioned as follows:

- Kanyangareng River, 1,900 km^2 at RGS 2B23 at Kanyao, annual rainfall 680 mm, and contributing 22.5% of Turkwel's river inflow.
- Kanyao River, 700 km^2 at RGS 2B20 at Kanyao, annual rainfall averaging 925 mm, and contributing 7.5% of Turkwel's river inflow.

2.1.3 Lower sub-catchment (lower Kanyangareng, Kanyao and Suam rivers)

This is the "ungauged" catchment area contributing from Kongelai and Kanyao down to Turkwel Gorge, with annual rainfall averaging 720 mm (Figure 5), reported to be subject to significant river bed losses and contributing very little river inflow.

[8] RGS 2B07 was relocated in 1987 to a new location downstream referenced RGS 2B33.

Table 1: Turkwel dam sub-catchment flow contributions [43] [9]

Sub-catchment	Sub-catchment area (km^2)	Mean annual rainfall (mm)	Proportion of Turkwel flow contribution (%)
Suam	1,350	1,125	70.0
Kanyangareng	1,900	680	22.5
Kanyao	700	925	7.5
Lower portion to dam	1,950	720	
Total at Turkwel dam	5,900	825	

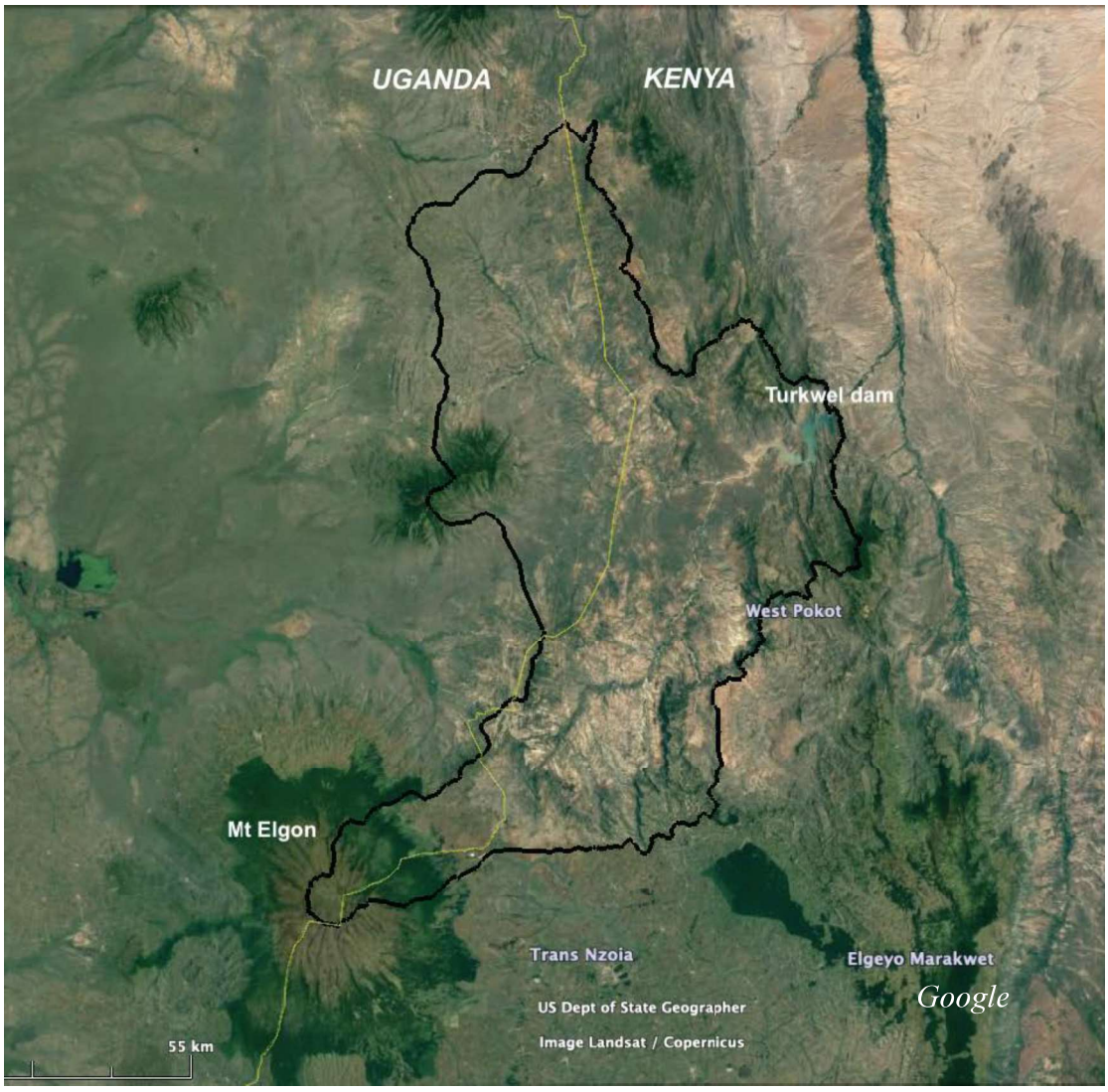

Figure 4: Turkwel dam's catchment [10]

[9] Extracts from "Turkwel Gorge Multipurpose Project, Dam-Hydropower Plant-Transmission Line, Preliminary Design Phase, Engineering Report, Vol III Detailed Studies, Part 2 Hydrology, presumed Sogreah Ingeniere, 1983. These hydrological extracts have directly cited the rainfall analysis from the Norconsult Feasibility Study dated 1979.[43] The Consultant has not seen the final design hydrology report by Sogreah.

[10] The yellow line on the image is the international border between Uganda and Kenya.

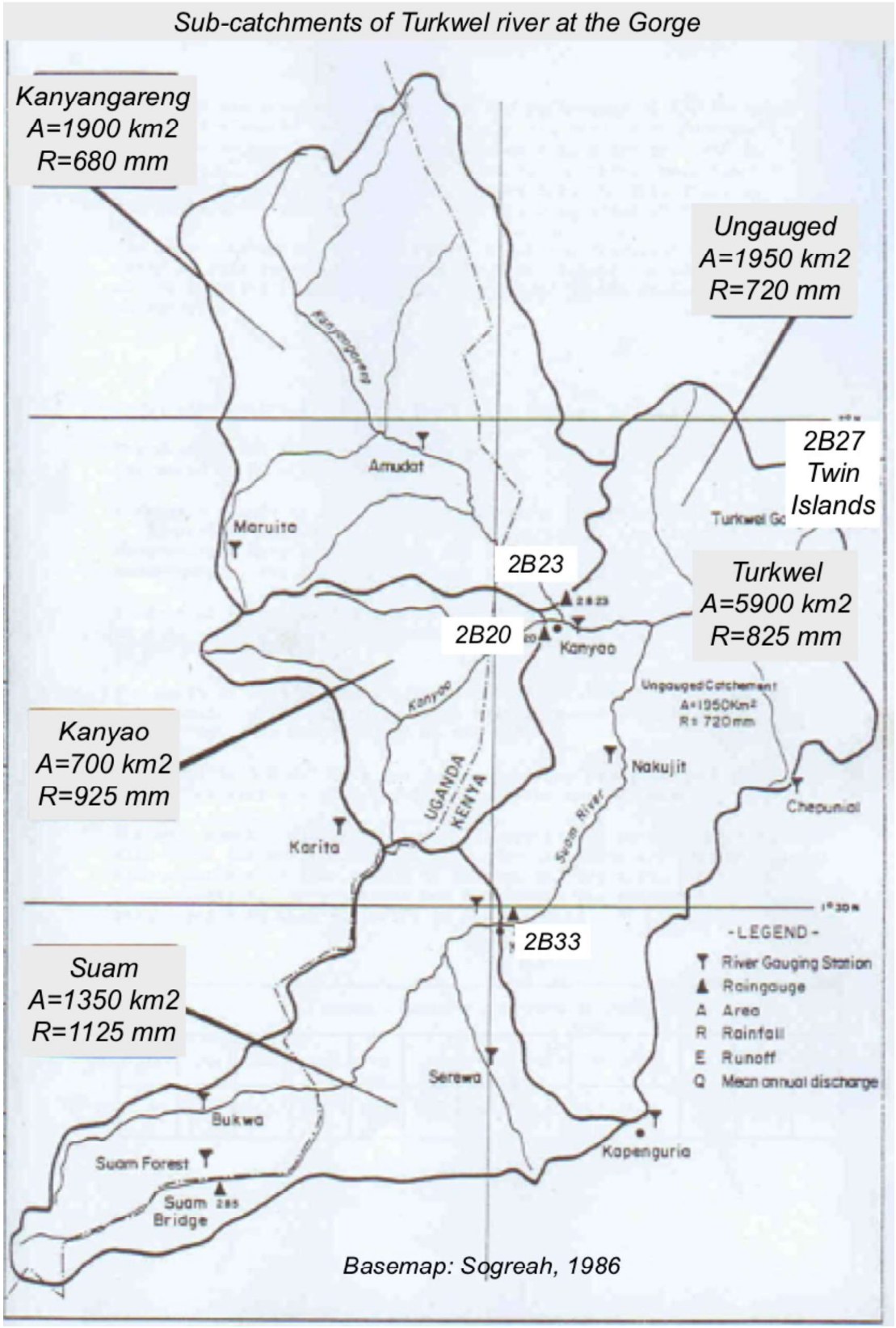

Figure 5: Turkwel dam sub-catchments and rainfall contributions [9 43]

2.2 Geological characteristics

2.2.1 Geology

Practically the whole of Africa is underlain by rocks of the Precambrian Basement Complex.[11] Much of East Africa's landscapes has been formed through faulting and volcanic activity, the most notable being the East African Rift system within which lies the Turkwel catchment draining to Lake Turkana.[12] The greater part of rocks exposed in the Turkwel catchment consist of gneisses and schists of the Basement Complex.[13]

The Suam river rises on the slopes of Mount Elgon, an area of tertiary volcanic deposits. The Elgon massif 80 kilometres in diameter is a very old volcano, extinct for about 12 million years, but still with hot spring activity.[14] Its crater is in places over eight kilometres across. Mount Kadam to the north is the same type of volcano, both being within an igneous centre in south-eastern Uganda that intruded the Precambrian Basement Complex.[15] Although over 100 kilometres west of the margins of Rift Valley itself, Elgon and Kadam are believed to have been formed by the same forces that created the Rift Valley.[12]

Downstream of the Elgon volcanics, the Suam river flows through formations of the Basement Complex. The southern tributaries of the Suam drain from the Kapenguria plateau, an area of gneiss and metamorphic rocks. The northern tributaries drain a plateau in Uganda, partly covered with the tertiary volcanic deposits from Mount Kadam.

Downstream of Turkwel dam, the river continues through the compartments of the Basement Complex to Lake Turkana.[16]

The metamorphic bedrocks underlying Turkwel reservoir are impermeable.[16] Rock exposures dramatically outcrop within the reservoir, and some of the reservoir flanks have a loose rocky mantle (Figure 7).

2.2.2 Soils

Apart from volcanic soils on Mount Elgon and Mount Kadam, all other soils are derived from rocks of the Basement Complex (Figure 8). These Basement Complex soils are very much more erodible than the volcanic soils, perhaps an order of magnitude higher due to the poor structural stability of these soils.[17] The black cotton soils tend to be less erodible than the Basement soils.

[11] Key, R.M., 1992. An introduction to the crystalline basement of Africa, from Wright, E.P. & Burgess, W.G. (eds), Hydrogeology of Crystalline Basement Aquifers in Africa, Geological Society Special Publication No. 66, pp. 29-57.
[12] Nyamweru, C., 1980. Rifts and Volcanoes, a study of the East African Rift system, published by Nelson Africa.
[13] McCall, G.J.H., Geology of the Sekerr Area, Report No. 65, Geological Survey of Kenya, 1964.
[14] Mount Elgon National Park, Kenya Wildlife Service, The Official, Guide, 2003.
[15] The Sukutu phosphate deposits, south-eastern Uganda, F.A. Kagambe-Kaliisa, in Phosphate Deposits of the World: Volume 2, Phosphate Rock Resources, Volume 2, Cambridge University Press.
[16] KVDA, Turkwel Environmental Impact Study, Final Report, Sogreah, May 1991.
[17] KVDA, Socio-Economic impact of Turkwel Gorge Multipurpose Project, African Development and Economic Consultants Ltd., December 1982.

Figure 6: Geological map of Uganda and NW Kenya [18]

Figure 7: Rock exposures and mountainous terrain background

[18] Geological map of East Africa compiled by Geological Survey Department, Tanganyika, 1954.
(Colour Legend: Light green zones – Volcanics (Elgon and Kadam); Orange zones - Basement Complex rocks).

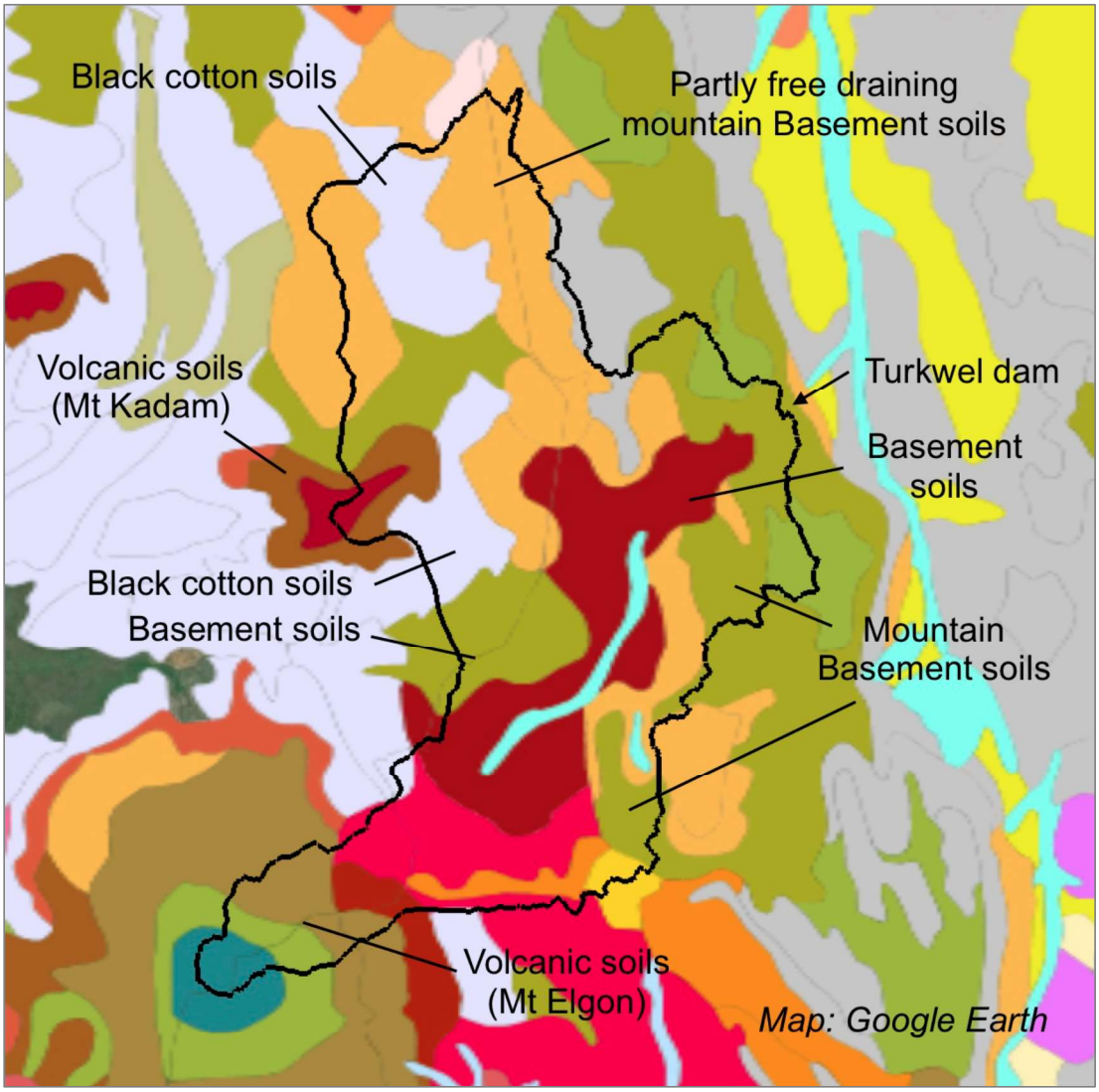

Figure 8: Soils within Turkwel dam's catchment [19]

2.3 Climate, land usage and vegetation cover

The Turkwel dam catchment rises in cool sub-humid highlands on Mount Elgon and the Kapenguria plateau (Figure 9, Table 2, Table 3). Parts of Mount Elgon including the peaks are national parks and forest reserves, the vegetation ranging from wet montane and bamboo forests to afro-alpine moorlands on the upper slopes.[14] The areas bordering the protected areas below and beyond are intensively cultivated (illustrated in Figure 68).

The lower catchment within Kenya is semi-humid to semi-arid, and is warm to hot. The mean daily temperature measured below the dam was 27.8 °C (1982 to 1985 data).[20] And downstream of the dam within Kenya there is increasing aridity towards Lodwar. The South Lokichar Development Zone falls within a very arid zone that is hot.

[19] The Digital Soil and Terrain Map of East Africa, FAO, 1998, viewed in Google Earth. Elgon and Kadam are of intrusive volcanic origin; all other soils are derived from Basement rocks.
[20] Turkwel Gorge Multipurpose Project, Dam-Hydropower Plant-Transmission Line, Part 1, Basic Data, Vol.1-2, Hydrology and Climatology, Section 1-2-5, Ambient Air and Reservoir Water Temperatures, Sogreah, Feb. 1987.

The northern Uganda catchment portion of Amudat (not covered by Figure 9) comprises semi-arid plains characterised by a long dry season and erratic rainfall (much the same characteristics as adjoining areas in Kenya).[21]

The traditional and main farming livelihood in most parts of West Pokot is pastoralism, and this has evolved to cope with the area's erratic rainfall and associated natural dryland vegetation cover. The higher altitude areas to the south support agro-pastoralism and mixed farming, and Kapenguria is a growing urban centre where the County Government offices are based.

The northern Uganda catchment in Amudat is a pastoral livelihood zone dominated by flat plains covered with thorn scrub, shrubs, *Balanites* trees, aloes and other hardy dryland plants.[21] The pastoral livelihood is supplemented by charcoal burning, wood collection, honey production, mining and opportunistic cropping. And relief food aid has been provided from time to time.[21]

This semi-arid international border area has a long history of insecurity that has undermined both crop and livestock production.[21] Turkwel dam's operation and hydrological monitoring have likewise been affected by insecurity.

With population increase and other factors within West Pokot, there has been a transition "from nomadic to sedentary, market-oriented, agro-pastoralist production systems", but with livestock remaining important.[22] Increases in vegetation cover between 2001 and 2014 in the Chepareria and Kongelai areas of West Pokot have been reported, but vegetation cover in mountainous areas has decreased.[22] The increases in vegetation cover have been linked to sedentarisation and adoption of farming enclosures.

There are no data for the vegetation cover changes within the all-important flood contributing areas of the principal river and its tributaries. The proportion of any catchment that contributes flood runoff varies with soil class, land slope and land use, with the standard contributing area for a grassed catchment varying from 9 to 50%.[23] Changes in land use to bare soil can increase this contributing area a further 50%. The Suam river is clearly a very scarce resource within a dry area, and as a result, attracts settlement and subsistence cultivation that favours areas adjacent to the river, with negative effects in terms of flood generation and soil erosion (illustrative images are included later in this report - Figure 65, Figure 66, Figure 67).

Turkwel dam's design documents in 1986 noted the "serious condition" of the Turkwel catchment. This concern was based on an earlier KVDA study that revealed 15% of the catchment subject to "very high erosion" and 68% subject to "moderate to high erosion", and only 17% subject to "very low to low erosion".[17]

The erosion hotspots have tended to be associated with livestock, and hence are within walking distance of permanent water, namely perennial rivers and ephemeral rivers whose sandy beds serve as aquifers (accessed through scrapes and shallow wells).[17] Today, sand mining is taking place direct from the Suam river and its tributaries. The removal of sand is damaging and results in compensatory sand scavenging by flood flows and consequent erosion of river channels. Charcoal is being brought out of this area to Kapenguria, so tree cover is being removed in places as well.

From a hydrological flow and sediment runoff perspective, the riparian portions are the critical zones within the catchment contributing areas whose protection needs to be enforced in accordance with national legislation.

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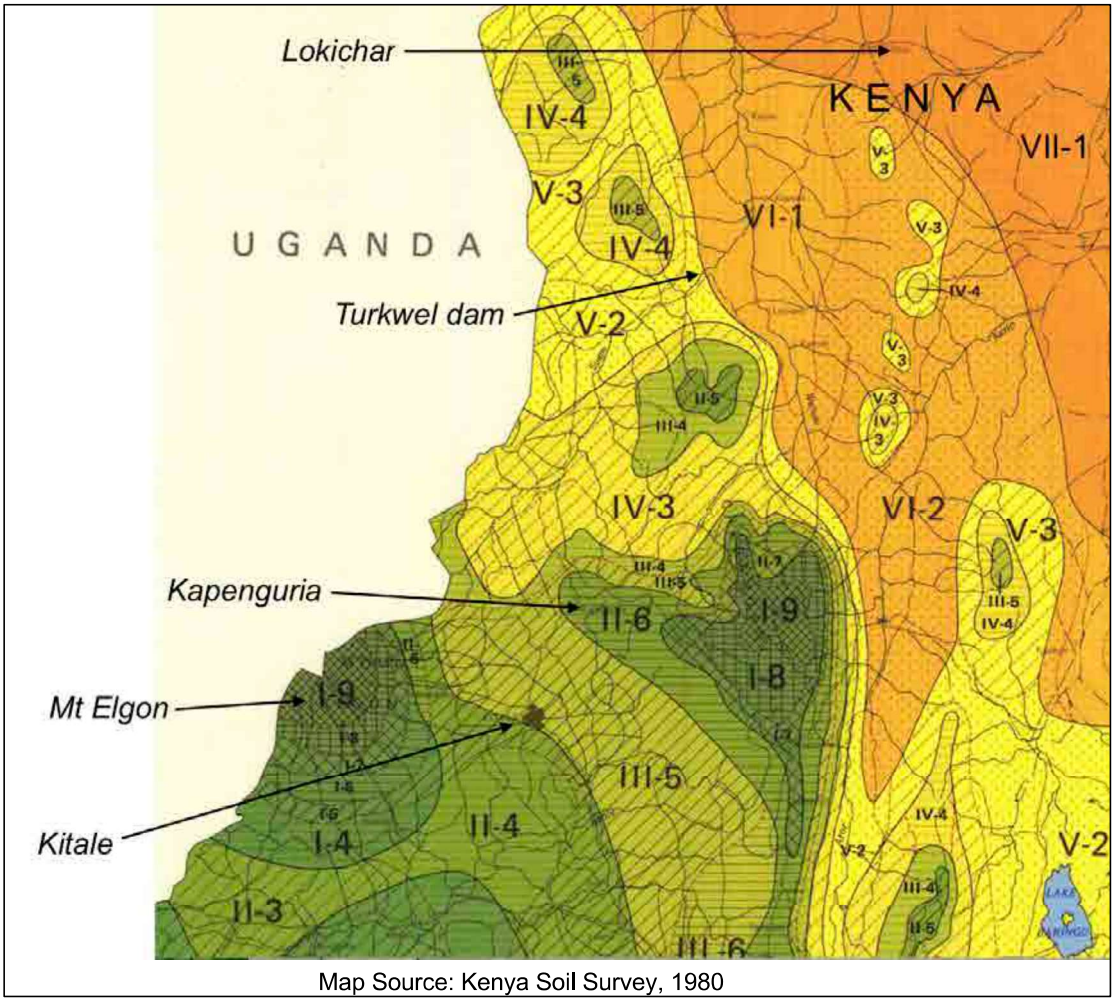
[21] FAO / ECHO, A food security analysis of Karamoja, by Simon Levine, September 2010.

[22] Nyberg, G., Knutsson, P., Ostwald, M. et al. Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. *Pastoralism 5*, 25 (2015). https://doi.org/10.1186/s13570-015-0044-7.

[23] Fiddes, D., The TRRL East African Flood Model, TRRL Laboratory Report 706, 1976.



Map Source: Kenya Soil Survey, 1980

Figure 9: Agro-climatic zone map of Kenya (the portion including Turkwel catchment)

Table 2: Moisture availability zones

Zone	Class	Average annual rainfall (mm)	Average annual potential evaporation (mm)	Vegetation	Potential for plant growth	Maize crop risk of failure (%)
I	humid	1100 - 2700	1200 - 2000	moist forest	very high	0-1%
II	sub-humid	1000 - 1600	1300 - 2100	moist & dry forest	high	1-5%
III	semi-humid	800 -1400	1450 - 2200	dry forest & moist woodland	high to medium	5-10%
IV	semi-humid to semi-arid	600 -1100	1550 - 2200	dry woodland & bushland	medium	10-25%
V	semi -arid	450 – 900 *	1650 - 2300	bushland	medium to low	25-75%
VI	arid	300 - 550	1900 - 2400	bushland & scrubland	low	75-95%
VII	very arid	150 - 350	2100 - 2500	desert scrub	very low	95-100%

Table Source: Kenya Soil Survey, 1980 [24] Notes: * Turkwel dam mean annual rainfall = 568 mm (at dam intake, altitude 1145 m ASL, KVDA data, 1990-2008), also Sogreah documents [9]

Table 3: Temperature zones

Zone	Mean annual temp. (°C)	Average annual rainfall (mm)	Mean maximum temp. (°C)	Mean minimum temp. (°C)	Altitude (m ASL)	General description
9	< 10	cold to very cold	<16	< 4	>3050	Afro-Alpine highlands
8	10 – 12	very cool	16 – 18	4 – 6	2750 - 3050	Upper highlands
7	12 – 14	cool	18 – 20	6 – 8	2450 - 2750	
6	14 – 16	fairly cool	20 – 22	8 – 10	2150 - 2450	Lower highlands
5	16 - 18	cool temperate	22 – 24	10 – 12	1850 - 2150	
4	18 - 20	warm temperate	24 – 26	12 – 14	1500 - 1850	Midlands
3	21 - 23	fairly warm	26 – 28	14 – 16	1200 - 1500	
2	23 - 25	warm	28 – 30	16 – 18	900 - 1200	
1	25 – 31 **	fairly hot to very hot	30 - 36	18 - 24	0 - 900	Lowlands

Table Source: Kenya Soil Survey, 1980 [24] Notes: ** Mean temp = 27.8 °C (at Twin Islands below dam site, altitude 770 m ASL, Sogreah data, 1982-85) [20]

[24] Agro-Climatic Zone Map 1980, Kenya Soil Survey.

3 WATER DEMAND AND ALLOCATION

3.1 General

The Turkwel dam catchment is predominantly within West Pokot County in north-western Kenya bordering Uganda. The main activities in this county are agriculture and livestock keeping, with 39% of employment being in these sectors.[25]

In terms of water security, intra-basin and trans-country disputes over water and land in Turkana and West Pokot Counties have been reported by the Rift Valley Basin Plan, these being attributed to "… limited availability of water to support domestic and livestock as well as unwillingness to share water resources…" [26]

3.2 Domestic, industrial, livestock, wildlife and fisheries water demand

The National Water Master Plan 2030 reports water demands for the entire Rift Valley Basin without showing the demand distribution through sub-basins. The Master Plan did however report that 91.3% of the West Pokot County population was living in the rural areas (in 2009), with 63.6% reliant on river or pond water.[27] The Suam river system is clearly vital to the county as well as to the sustainability of Turkwel dam's long-term multi-purpose functions.

The human population of West Pokot County is on a progressive increasing trajectory (Table 4). A county-specific master plan does not exist for water, but water demand from the Suam / Turkwel catchment will obviously follow the population growth trajectory. The Consultant has assumed the county population within the dam's catchment to be roughly that within North Pokot and West Pokot sub-counties, and this amounts to just over half the county totals given in Table 4.[30] It is interesting to note that the current CIDP forecasts were made before the latest national census in 2019, and that the 2019 census population in West Pokot was lower than the CIDP had forecast.

For the whole Rift Valley Province, the National Water Master Plan 2030 forecast a combined domestic, industrial, livestock, wildlife and fisheries water demand of 419 MCM/yr. Spread over a forecast 2030 population of 7.45 million, this equated to a unit water requirement of 154 L/cap/day. For the forecast 2030 North and West Pokot sub-county population, the water demand will thus be roughly 1.20 m^3/s (Table 5). For the same North and West Pokot sub-county population, the basic human need set by law at 25 L/cap/day amounts to 0.20 m^3/s (Table 5).[28]

The recent Rift Valley Basin Plan prepared by the Water Resources Authority has presented water demands on a sub-catchment basis, and in the case of Turkwel dam, data are presented for sub-catchment 2BC which comprises the dam's catchment plus the catchment below the dam to the confluence with the Malmalte river (Table 5).

The water demand estimates in Table 5 are a small proportion of the Suam river water resource draining to Turkwel dam.

[25] Rift Valley Basin Plan (RVBP), Kenya Water Security and Climate Resilience Project, Second Draft submitted by Aurecon Group, November 2019, p.36 and p.39.
[26] ibid, p.139.
[27] National Water Master Plan 2030 (NWMP), Vol. IV, Sectoral Report (A), Socio-economy, JICA / Nippon Koei, 2013.
[28] Basic human need = 25 L/cap/day (as stipulated in the Guidelines for Water Allocation issued under the Water Act).

Table 4: West Pokot County population growth

Year	Early and census population	CIDP population forecasts	Data source
1923	22,483		Nangulu, 2009 [29]
1943	23,089		Nangulu, 2009
1969	82,488		Nangulu, 2009
1979	158,652		Kenya National Bureau of Statistics
1989	225,449		Kenya National Bureau of Statistics
1999	308,086		Kenya National Bureau of Statistics
2009	512,690	512,690	Kenya National Bureau of Statistics
2018		777,180	West Pokot CIDP, 2018 – 2022 [30]
2019	621,241		Kenya National Bureau of Statistics
2022		991,949	West Pokot CIDP, 2018 – 2022
2030		1,344,357	West Pokot CIDP, 2018 – 2022

Table 5: Water demands in Turkwel dam's catchment

Domestic, industrial, livestock, wildlife and fisheries demand (m^3/s)			
	2018	2030	2040
Basic human needs	0.17	0.20	
JICA NWMP 2030	0.84	1.20	
RVBP 2020	0.33		0.76

3.3 Irrigation water demand in upper Turkwel

The National Water Master Plan 2030 listed only one potential major irrigation scheme in West Pokot, this being the 5,000 ha Turkwel Irrigation Project planned downstream of the existing Turkwel dam.[31] KVDA has since undertaken studies for an irrigated sugar cane plantation scheme downstream of the dam whose cultivable area is very much larger (22,100 ha requiring 18 m^3/s of water).[32] [38] All the other irrigation prospects in West Pokot focus on catchments to the south that drain into the Rift Valley from the Cherangani Hills. Hence none of the National Water Master Plan and KVDA proposals would affect the river inflow to Turkwel dam.

[29] Anne Kisaka Nangulu, Food Security and Coping Mechanisms in Marginal Areas. The case of West Pokot 1920-1995, African Studies Centre, The Netherlands, 2009.
[30] West Pokot County Integrated Development Plan (CIDP), 2018-2022, West Pokot County Government, Kenya, https://cog.go.ke/downloads/category/106-county-integrated-development-plans-2018-2022.
[31] National Water Master Plan 2030, Sectoral Report (E), Agriculture and Irrigation, Vol. IV, JICA / Nippon Koei, p.E-35.
[32] Lower Turkwel Sugar irrigation Project, Kerio Valley Development Authority, WAPCOS, 2013.

The West Pokot County Government has however warned of the following challenging irrigation water expectations faced by the Suam River: [33]

- River water levels are expected to "further decline with expansion of the irrigation sector"
- River water quality is expected to "decline due to increased farming activities"
- There will be rapidly growing competing demands for water

The anticipated irrigation water demands are not stated in the county integrated development plan, so the intentions and above warnings need elaboration.

The recent Rift Valley Basin Plan does however include irrigation forecasts, the irrigation demand in sub-catchment 2BC[34] being 0.40 m^3/s in 2018 and increasing to 6.28 m^3/s in 2040.[35] This irrigation demand is presumed immediately downstream of the dam tailrace, and hence not affecting inflows to the dam. It does however have a bearing on the water release obligations from Turkwel dam, discussed later in this report.

3.4 Existing river water abstraction permits issued in upper Turkwel

A tabulation of existing water permits for the Suam catchment was provided to Tullow by the Water Resources Authority (Annex 1). The total licensed abstraction is 0.47 m^3/s (Annex 1).

KVDA holds a permit for Turkwel dam (17.0 m^3/s, Row No.9 in Annex 1).

Kengen holds a permit to use water at Turkwel dam for power generation (19.2 m^3/s, Row No.16 in Annex 1). This water is taken from the storage reservoir created by the dam. After passing through the turbines the water discharges into the tailrace channel and onwards to join the original Turkwel river channel. It is thus 100% returnable to the river.

There is a small water supply component abstracted by Kengen to supply treated water to the staff camp at Turkwel. The camp's piped sewerage system collects and conveys sewage to the treatment plant prior to its return to the environment.

3.5 Water abstraction permit sought for South Lokichar Development

On behalf of Project Oil Kenya and the Tullow Joint Venture contractor, the Ministry of Petroleum and Mining is seeking approval to abstract up to 40,000 m^3/day from KVDA's Turkwel reservoir (0.46 m^3/s).[36] This abstraction would double the permitted abstraction from the river up to this location. This water would be conveyed by pipeline to Lokichar and beyond to the South Lokichar Development area. The pipeline will provide water for communities along the pipeline route, for Lokichar township, and for the oil injection and other oilfield development and operation requirements.

[33] "County Vision and Statement" presenting its Second County Integrated Development Plan for the period 2018-2022, https://roggkenya.org/wp-content/uploads/docs/CIDPs/West-Pokot_CIDP_2018-2022_County-Integrated-Development-Plan.pdf, accessed 28th February 2019, p.78.

[34] Sub-catchment 2BC is the Turkwel river catchment to its confluence with the Malmalte river downstream of the dam.

[35] Rift Valley Basin Plan, Kenya Water Security and Climate Resilience Project, Ministry of Water and Sanitation, Water Resources Authority, April 2020. Tullow Kenya is listed in this master plan document as a key stakeholder consulted by the project.

[36] Various emails dated April 2020 from the Tullow Water Lead stating up to 40,000 m^3/day to be required. This is based on 16,500 m^3/day water for oil production and 17,800 m^3/day provisions for community water supply along the pipeline (draft letter from Tullow Lead dated 1st July 2020).

The Rift Valley Basin Plan[35] has recently stated that Turkwel dam will not only be able to supply the future demands associated with the Tullow Oil field developments in Turkana County, but also future water demands associated with the proposed LAPSSET resort city at Kalokol[37] in Turkana County." These potential requirements are beyond the scope of this report.

3.6 Water demand in lower Turkwel

The water demand in lower Turkwel will have a bearing on the Reserve release requirements that the Water Resources Authority requires from the dam. The dam is existing, and is owned by KVDA but currently operated by Kengen. As reported later in this report, the Guidelines for Water Resource Allocation require the Reserve for a regulated river to be based upon a holistic multi-disciplinary assessment of the river's ecological and basic human needs (Section 8.2).

Preliminary water demand estimates in lower Turkwel have previously been reported by the Consultant to Tullow,[38] with irrigation requirements by far the biggest water demand, estimated amounting to 6.95 m^3/s without inclusion of KVDA's sugar plantation plans. Further study into this water demand aspect by the Consultant was in progress, and a hydro-census of the river downstream of the dam and preliminary water balance was conducted last year by a Tullow team.[39] This work was not yet concluded and has been overtaken by the unforeseen events this year including the global Covid-19 pandemic impact on the work.

[37] The resort city has generally been mooted in documents as being further south at "Eliye" rather than "Kalokol".
[38] Strategic Water Supply for Development – Turkwel Dam Option – The South Lokichar Development and other Water Demands – An objective perspective and way forward by Sean Avery, October 2018. The conclusions in this report were based on a much smaller Tullow water demand than is now being sought in 2020, hence these assessments need to be revised.
[39] Strategic Water Supply for Development, Technical Report 12, Turkwel River Preliminary Water Balance, Richard Boak (Consultant) and Johana Ekwam, July 2019.

4 RIVER TURKWEL HYDROLOGY

4.1 Dam hydrological design reports

The hydropower potential of Turkwel Gorge's 1,000 feet drop in elevation was noted by geologists from Kenya's Mines and Geology Department in the 1950s.[13] The subsequent valuable studies of the Turkwel dam and basin hydrology have included the following:

- 1975 Turkwel Basin Hydrological Survey, prepared by FAO for the Government of Kenya in connection with the Minor Irrigation Projects (based on the work of P.Tollenaar) [40]
- 1976 Turkwel Dam and Reconnaissance Study done by Viak / Norplan for KVDA
- July 1979 Turkwel Gorge Multipurpose Project Investigations, done by Norconsult for Ministry of Water Development [43]
- 1982 Water Resources Study for the Regional Development Plan for Kerio Valley Basin, prepared by Sogreah for KVDA
- May 1983 Hydrology Survey Final Report for the Turkwel Gorge Multipurpose Project, prepared by Norconsult for KVDA / Ministry of Water Development Nairobi
- 1983 Hydrology Report for the Preliminary Design Phase Engineering Report, Turkwel Gorge Multipurpose Project, Dam - Hydropower Plant - Transmission Line (extracts on climatology and hydrology were seen) [9]
- 1987 Vol 1-2 Hydrology of the Final Design Report, Turkwel Gorge Multipurpose Project, prepared by Sogreah for KVDA (not available from either KVDA, Kengen or Sogreah themselves)
- 1987 Turkwel River Basin Hydrology Report and series of Annexes prepared by WLPU Consultants for KVDA. The key main documents in this series were not located (notably the main hydrology report and Annex C).

Historical data for the Consultant's hydrological review for Tullow were obtained from various available supporting documents, some from the Consultant's archive, or were viewed in the KVDA library archive or files in Eldoret, Kapenguria and at the Turkwel dam.

4.2 Runoff Records

4.2.1 River gauging station records

The historic hydrology study inputs to the Turkwel dam design utilised the Basin 2B river flow database listed in Table 6.[44] The final design hydrology report prepared by Consulting Engineers Sogreah was never found. Fortunately, useful hydrological extracts and documents prepared by Norconsult and WLPU Consultants were located. Norconsult had earlier undertaken the Feasibility Study whilst WLPU became involved later with responsibility for reviewing the Sogreah design work.

In addition to the database in Table 6, WLPU also explored flow data from rivers in adjoining basins rivers in both Uganda and within Kenya, namely RGS 1BE1, 1BE6, 1BC1, 1DA2, 2B9. Norconsult included data on the Malmalte river and other gauging stations upstream in the Malmalte catchment, this river being the most important tributary of the Turkwel, with a significant catchment area joining the Turkwel downstream of Twin Islands.

[40] FAO, 1975, Turkwel Basin Hydrological Survey as part of the Turkana Minor Irrigation Projects (report by P.Tollenaar).

Flow records from 1956 to 1971 at RGS 2B07 on the Suam river upstream from the dam were the basis for the initial hydrological assessment presented in the Feasibility Study for Turkwel dam in 1979.[43] The Preliminary Design in 1983 made use of further data at RGS 2B07 from 1979 but with the added value of four years of data at RGS 2B27 established downstream from Turkwel Gorge at Twin Islands. A report annex dated 1987 by WLPU Consultants extended the Sogreah generation of several 100-year flow data series for the dam[41] (the Sogreah work has not been seen by the Consultant). During this time, fundamental problems had been identified with the RGS 2B07 record at Kongelai and to overcome these, the station was relocated downstream in 1986, the new site being named RGS 2B33 (the present-day site).

The flow record at another gauging station (RGS 2B27 downstream of the dam site) was fundamental to the dam design hydrology estimates, and the yield estimates for Turkwel were being refined as data accumulated at RGS 2B27 right up to just before the dam was commissioned. Once the dam wall was closed in January 1990, RGS 2B27 was no longer operated, and KVDA removed the cableway.[42] RGS 2B33 thus became the most important station for ongoing monitoring of reservoir inflows and floods.

Table 6: River gauging station records [43] [44]

RGS station number	River	Location	Catchment area (km^2)	Date RGS established [+]
2B02	Kaptega	Mt Elgon	58	1956
2B05	Suam	Mt. Elgon	135	1953
2B07 / 2B33 [++]	Suam	Kongelai	1,350	1956 / 1987
2B20	Kanyao	Kanyao	700	1974
2B23	Kanyangareng	Kanyao	1,900	1975
2B27 A/B	Turkwel	Twin Islands	5,900	1978
2B09	Marun	Near Sigor	1,340	1955
2B30 [45]	Malmalte	Kainuk	3,800	1982 [+++]
2B22	Turkwel	Katilu	11,000	1974
2B03	Turkwel	Lodwar	25,000	1951 - 1960
2B21	Turkwel	Lodwar	25,000	1974 -

Notes:
[+] Records published to 1985 [44] and in one case to 1988 [46]
[++] 2B7 relocated to a better location at 2B33 downstream
[+++] 2B30 relocated from RGS 2B26 at Loyapat to new bridge at Kainuk

4.2.2 RGS 2B33, River Suam at Kongelai

(a) RGS 2B33 – observer daily gauge height readings

It is usually adequate to carry out systematic recording of river water level twice-a-day, supplemented by more closely-spaced readings during floods.[47] At RGS 2B33, the routine

[41] Turkwel River basin Hydrology, Correlation and Extension of Suam and Turkwel Flow Records, Annex K, WLPU Consultants, November 1987.
[42] Personal communication, Daniel Kimetto, KVDA hydrologist.
[43] Turkwel Gorge Multipurpose Project, Feasibility Study, Norconsult, July 1979.
[44] Turkwel River Basin Hydrology Annex K, WLPU Consultants, November 1987.
[45] Turkwel Gorge Multipurpose Project, Hydrological Survey, Final Report, Norconsult, May 1983.
[46] Turkwel Hydrology, Notes on WLPU recorded river levels at Turkwel Gorge, April 1987 to September 1988, WLPU Consultants, October 1988.
[47] Guide to Hydrological Practices WMO-No.168, 1981, page 2.46.

observations were made daily at 0900 and 1600 hours. In addition, automatic water level chart recorders were installed during the dam design period at this and other gauging stations.

The daily observer water level record at RGS 2B33 since Turkwel dam was commissioned has been plotted by the Consultant and there is a near continuous record till the end of 2002 (Figure 10). Thereafter the record is near non-existent. This is a poor quality gauge height record.

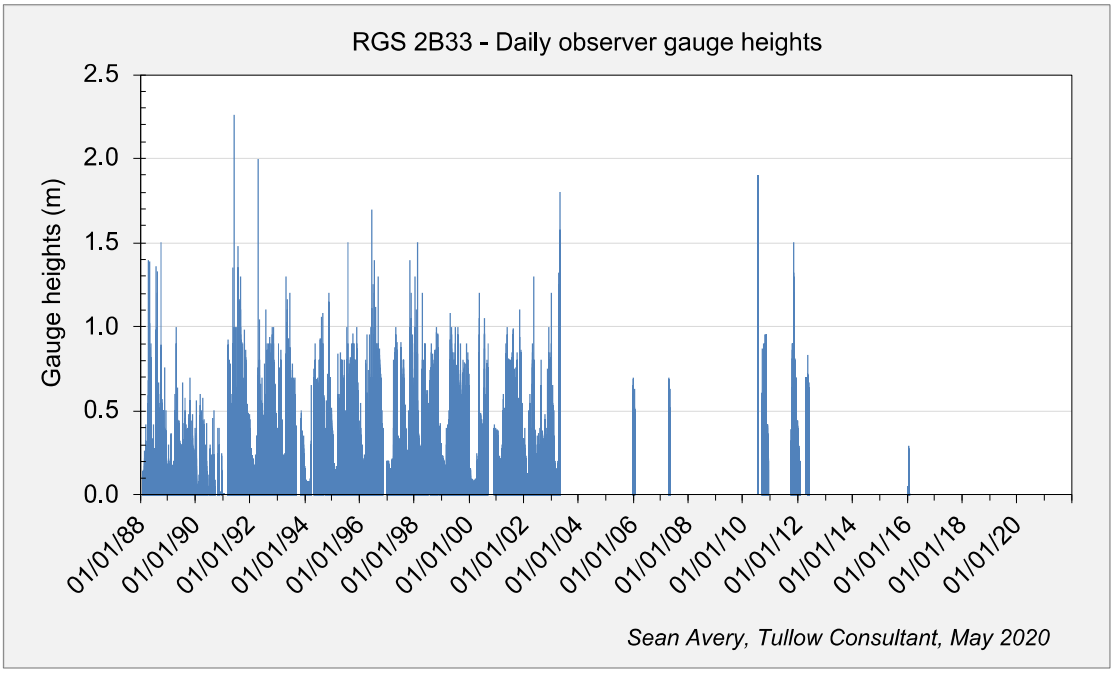


Figure 10: RGS 2B33 - Gauge height record

(b) RGS 2B33 - current meter gaugings

River discharge is the rate at which water flows through a river cross-section.[48] This is measured accurately by means of calibrated current meters. As continuous current meter readings are not feasible, periodic measurements are made to establish the relationship between stage (gauge height) and discharge.[48] This relationship is called the gauging station "rating".

But the "rating" may not be constant. The riverbed is in constant flux with loose sediment movement and erosion, and regular current meter gaugings are essential to capture ongoing resultant rating changes. Unless this measurement work is sustained, the gauge height records cannot be confidently converted to discharges.

At RGS 2B33, one can measure low flows by wading across the river with a current meter, taking current velocity readings at evenly spaced verticals. During medium to high flows, wading is no longer possible and at such times the current metering equipment has to be conveyed across the river by some other safe means. This can include deployment from a bridge, or from a boat, or from a purpose-built cableway structure spanning the river.

In November 1987, RGS 2B33 was equipped with a cableway spanning the Suam river. An intensive programme of gauging was undertaken to establish the station rating over the full range of water levels at the gauging station (Figure 11).

From 1988 to 1989 there were 45 current meter gaugings, but in 1990 the station was visited only five times, and by 1993 current meter gaugings had virtually stopped (Figure 12). In the 24 years from 1993 to 2016 there were only 32 gaugings, and the water level gauge was missing

[48] Guide to Hydrological Practices WMO-No.168, 1981, Page 2.47.

on over 40% of the occasions, having been washed away.[49] In addition the cableway was washed away twice, and was missing when the Consultant first visited the station in 2015.

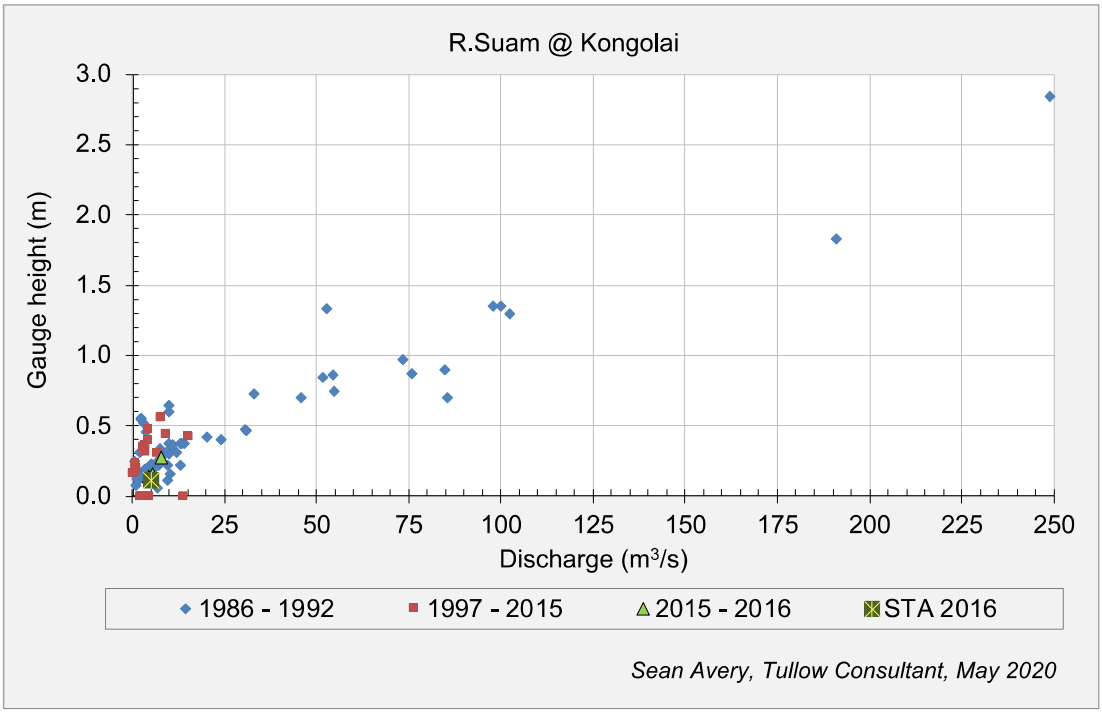


Figure 11: RGS 2B33 - current meter gaugings (full flow range)

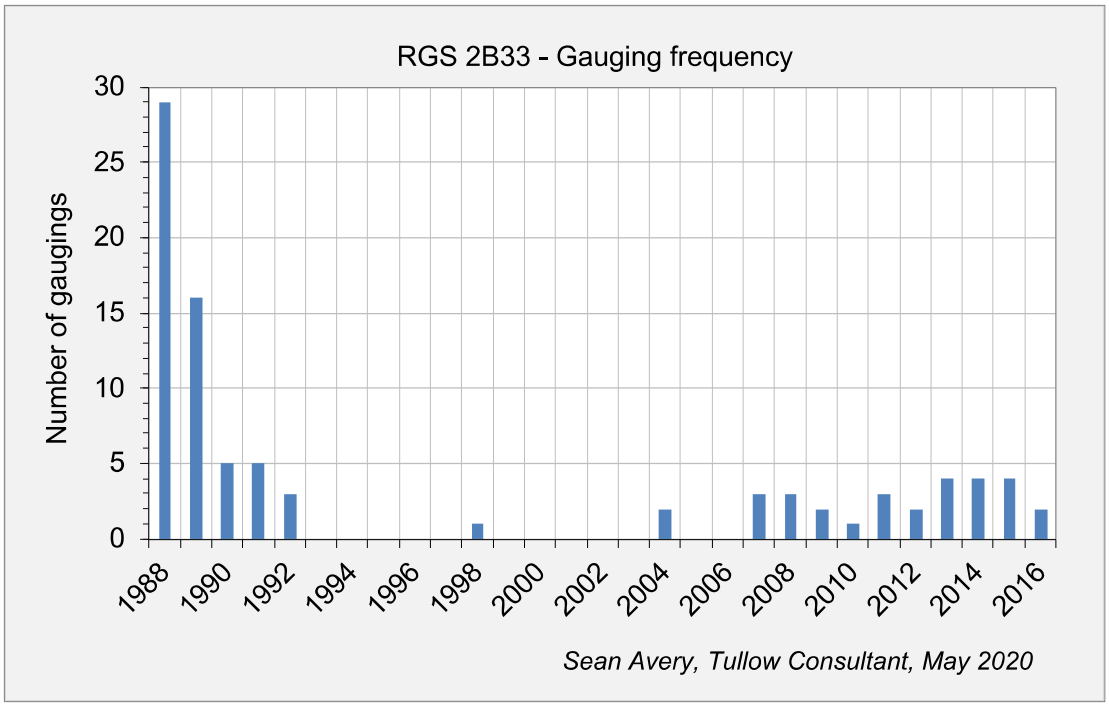


Figure 12: RGS 2B33 - current meter gauging frequency

[49] Current meter gauging record with details of when the gauge was washed away has been provided by the WRA Kapenguria office. Information on cableway wash-away provided by Daniel Kimetto of KVDA.

The scatter in the current meter gauging record plotted in Figure 13 demonstrates the extent to which the gauging station rating was liable to change as ideally all points should fall on one line. And apart from the 1988/89 period, there were no flow readings greater than 15 m^3/s, so the all-important medium to high flow rating has not been checked at all since 1989 (Figure 11).

The Consultant did one gauging together with KVDA in December 2016. The result plotted in Figure 13 shows the extent of rating shift that had occurred. The gauge height of 0.11 metres in December 2016 was up to 0.50 metres higher in earlier years at the same discharge.[50]

In the absence of continuity of current meter gaugings since 1992, the Consultant concluded the database at RGS 2B33 to be inadequate for the purpose of accurate hydrological assessment of inflows to Turkwel dam.

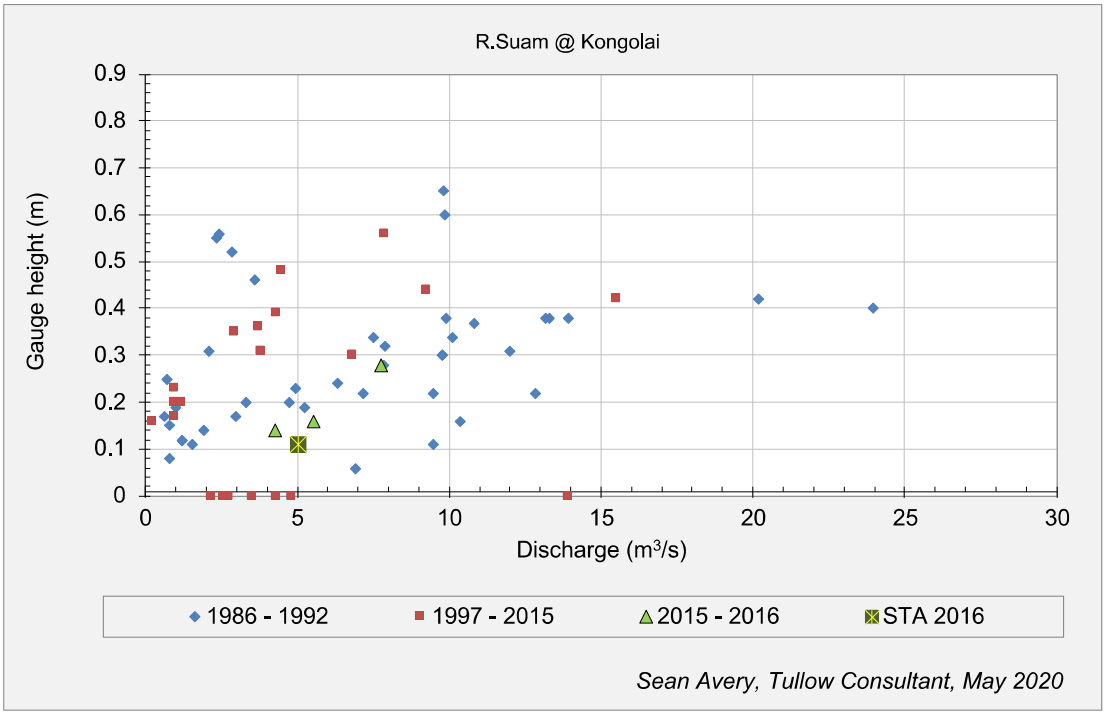


Figure 13: RGS 2B33 - current meter gaugings (low to medium flow range)

4.2.3 River gauging station rehabilitation

The river gauging network in Figure 14 (listed in Table 7) was inspected partially in 2015 and fully in February 2016,[51] and a status report was prepared.[52] KVDA staff had advised that with the exception of distant gauging stations on Mount Elgon, the Suam / Turkwel river gauging network had become dysfunctional since the Turkwel dam was commissioned. In some cases, this was due to insecurity, and in other cases it was attributable to persistent flood damage (Figure 15). In June 2016, findings were presented at a stakeholder workshop in Lodwar organised by Tullow. Recommendations were discussed with the aim to restore baseline hydrological monitoring throughout the basin, and this would also encompass comprehensive water abstraction surveys to enable naturalisation of the river discharges.

[50] This looks likely the channel has eroded, but rating shifts can be attributable to inadvertent re-setting the staff gauges to a different datum after being washed away.
[51] Strategic Water Supply for Development – Turkwel Dam Option – Field Reconnaissance Report 1, Hydrology, prepared by Sean Avery, Consultant to Tullow Kenya BV, February 2016.
[52] Lower Turkwel and Kerio Basin Status Review Report, river gauging station review prepared by Sean Avery, Consultant to Tullow Kenya BV, July 2017 (fieldwork assisted by Daniel Kimetto of KVDA, site visits in 2015 and 2016, findings presented at a workshop in Lodwar in June 2016).

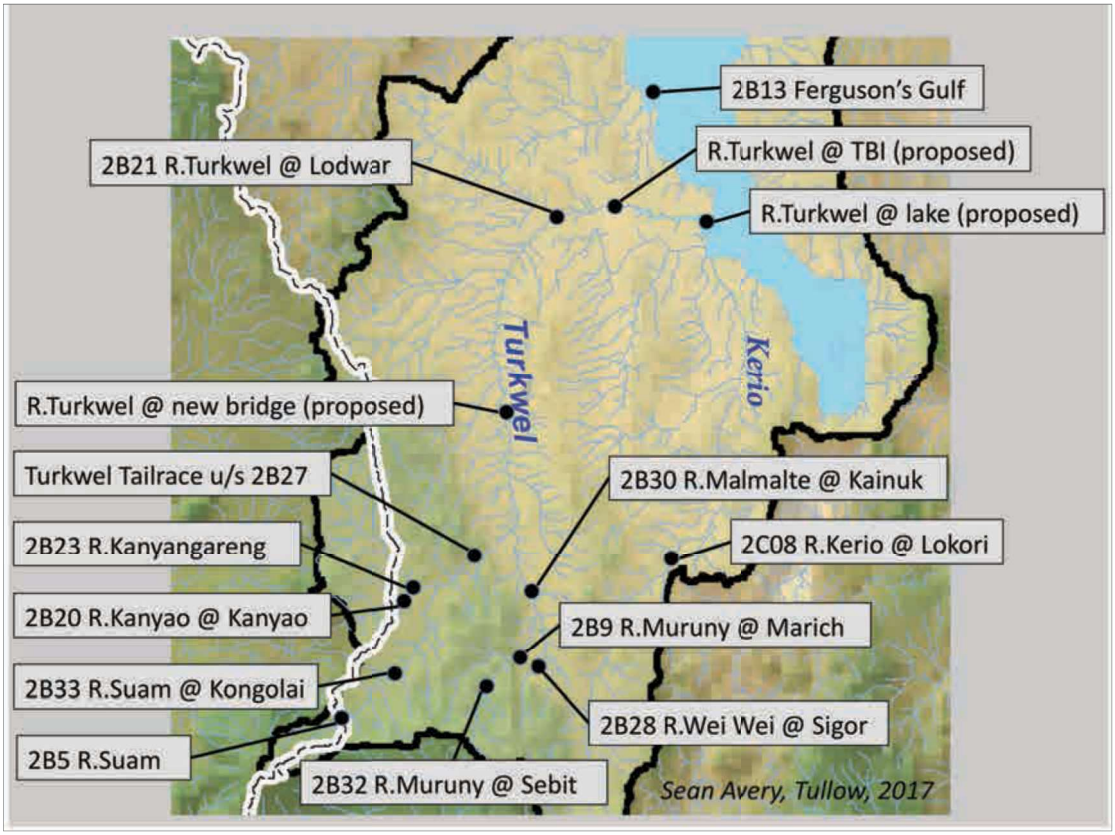


Figure 14: River gauging station distribution in Turkwel and Lower Kerio

Figure 15: RGS 2B33, River Suam at Kongelai – 2016 and 1988 images [53]

[53] Comparison of the 2016 and 1988 images suggests the channel bed has degraded. Since 1988, the lower gauge base had been encased in concrete and in 2016 that concrete base had been undercut by erosion. The 1988 bed upstream (to the left of the staff gauge) looks sandy in 1988 whereas the 2016 bed upstream has bare rock exposures.

The key initial recommendations included restoring the staff gauges and cableway across the Suam river at Kongelai (RGS 2B33). A sufficient period of good quality current daily flow data was considered a necessary pre-requisite for proper calibration of the river basin modelling exercise that was planned by the Consultant working with the Tullow team.

To better understand water balance in the river downstream of Turkwel dam, the revival and establishment of new river gauging stations between the dam and Lake Turkana was recommended. The Malmalte river is an important perennial tributary of the Turkwel whose confluence is not far downstream of Turkwel dam, and relocation of RGS 2B30 on the Malmalte river at Kainuk was strongly recommended, together with revival of gauging stations upstream of Kainuk on the Marun (Muruny) river (locations shown in Figure 14). And as Tullow's South Lokichar oilfield development zone falls within both the Turkwel and Kerio sub-basins, the revival of RGS 2C08 on the Kerio river at Lokori was recommended. The Lokori site access has also been hampered by insecurity in recent years.

A gauging station rehabilitation contract was arranged through the Water Resources Authority, and this contract was financed and managed by the Tullow water team. The work was supported by GIZ who provided technical support to the Kapenguria office of the Water Resources Authority until December 2018. At the time of this report, useful flow data output had regrettably not yet been available from any of the gauging stations.

Fortunately, the absence of hydrological inflow data has been overcome by application of the reservoir water balance model originally developed as part of Turkwel's dam monitoring procedures. KVDA's dam monitoring staff had been required to estimate monthly inflows to the Turkwel reservoir by means of this model.[54] This water balance model approach was successfully applied in the Tullow preliminary hydrology review,[5] and is developed later in this report.

Table 7: River gauging station status at time of 2016 reconnaissance [52]

RGS Ref	Water body @ Location	Latitude (degrees)	Longitude (degrees)	Comments
2B5	R.Suam @ Mt Elgon			Functional
2B33	R.Suam @ Kongelai	1.480024	35.031071	Existing, rehab. needed
2B20	R.Kanyao @ Kanyao	1.794041	35.050975	Abandoned, restore
2B23	R.Kanyangareng @ Kanyao	1.801026	35.060585	Existing, rehab needed
2B27	R.Turkwel @ Twin Islands	1.922285	35.359397	Abandoned, relocate to dam tailrace
New	R.Turkwel @ New Bridge	2.100168	35.436531	New station near Katilu
2B21	R.Turkwel @ Lodwar	3.113758	35.605190	Existing, rehab. needed
New	R.Turkwel @ TBI	3.140081	35.864280	New location near TBI
2B13	L.Turkana @ Kalokol	3.551244	35.883945	Existing, rehab. needed
2B32	R.Muruny @ Sebit	1.403262	35.329773	Existing, rehab. needed
2B28	R.Wei Weir near Sigor	1.473896	35.489000	Existing, rehab. needed
2B9	R.Muruny @ Marich	1.530591	35.448366	Location to be verified
2B30	R. Malmalte @ Kainuk	1.771484	35.496604	Existing, relocate
2C8	R.Kerio @ Lokori	1.914841	36.006337	Existing, rehab. needed

[54] Turkwel Dam, Technical Assistance and Training for Dam Monitoring, Recommendations for analysis of dam behaviour – Procedure 40 0204, Sogreah Consulting Engineers, September 1995.

4.2.4 Historic mean annual runoff estimates at the dam site

The closest river gauging station to the Turkwel dam site was RGS 2B27, established in 1978 below the Turkwel gorge at a location named "Twin Islands" (see location on Figure 5 and Figure 14). This station's establishment was part of the Turkwel dam survey that was initiated by FAO in 1975.[40] Flow data collection continued thereafter until natural flows ceased with closure of the dam in 1990. The history of revisions to the dam design estimates of mean annual inflow is as follows:

The first tentative hydrological computations by FAO in 1975 had derived a mean annual inflow of 18.52 m^3/s, of which it was stated 50% would be lost through evaporation from the lake impounded by the dam.[40] After one year of gauged data had been collected during the period 1978/79, the long-term dam inflow was estimated to be 24 m^3/s, but with a large 25% margin of error, the range of estimates being from 17 to 29 m^3/s.[43] The flow estimate was thereafter progressively reviewed and reduced as gauged data were accumulated: 1983, 24 m^3/s;[55] 1983, 20 m^3/s;[56] 1986, 18 m^3/s.[44]

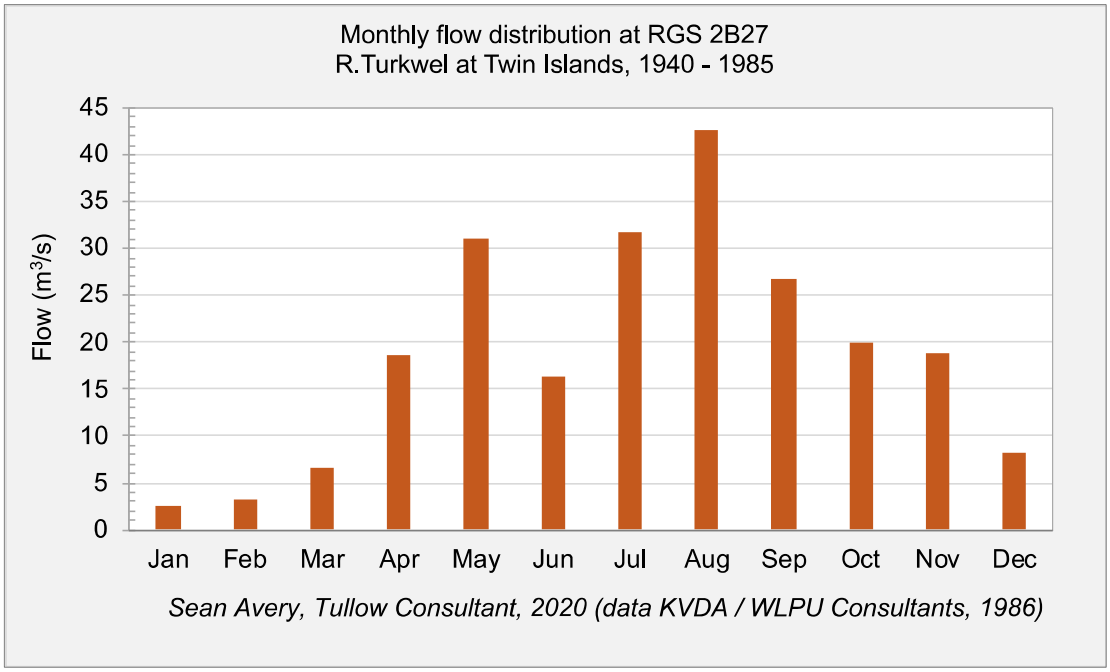
By 1989 both WLPU and Sogreah were still debating 17 to 18 m^3/s as the long-term mean annual inflow to the reservoir. WLPU had undertaken to produce an updated flow record in 1989, but that document has not been found.[57]

In 1992, the JICA team of Nippon Koei presented Kenya's National Water Master Plan in which flow simulations were undertaken for all major river basins including the Turkwel and Kerio basins. Unfortunately, the data published for Turkwel dam were inconsistent. The annual mean discharge in the flow-duration analysis was 24.6 m^3/s, whereas the tabulated rainfall runoff model simulation computed the naturalised mean monthly discharge to be 14.3 m^3/s.[58] The same JICA study team updated Kenya's national master plan 20 years later in 2012 and 2013, but their report unfortunately did not include individual river flow sequences.

[55] Norconsult, 1983, Turkwel Gorge multi-purpose project, Hydrological Survey, Final Report May 1983.
[56] Sogreah, 1983 (date uncertain), Hydrology Report for the Preliminary Design Phase Engineering Report, Turkwel Gorge Multipurpose Project, Dam – Hydropower Plant - Transmission Line (extracts only were seen).
[57] Letter dated 14th November 1989 from WLPU Consultants to KVDA (on file in KVDA office at Turkwel dam).
[58] Figure B.10.9 and Table B10.9.1, Kenya National Water Masterplan, JICA / Nippon Koei Study Team, 1992.

4.2.5 Historic natural low-flow frequency statistics at Turkwel dam site

The flows reaching Turkwel dam have earlier been noted to be largely generated from rainfall on Mount Elgon. This fact is illustrated by the similarity of the histograms of average monthly rainfall at Andersen Orchards on the foot slopes of Mount Elgon compared to the average monthly flow histograms near the dam site (Figure 16). On average, the driest river flows at the dam site occurred over the period from December to March, and flows were highest in August.



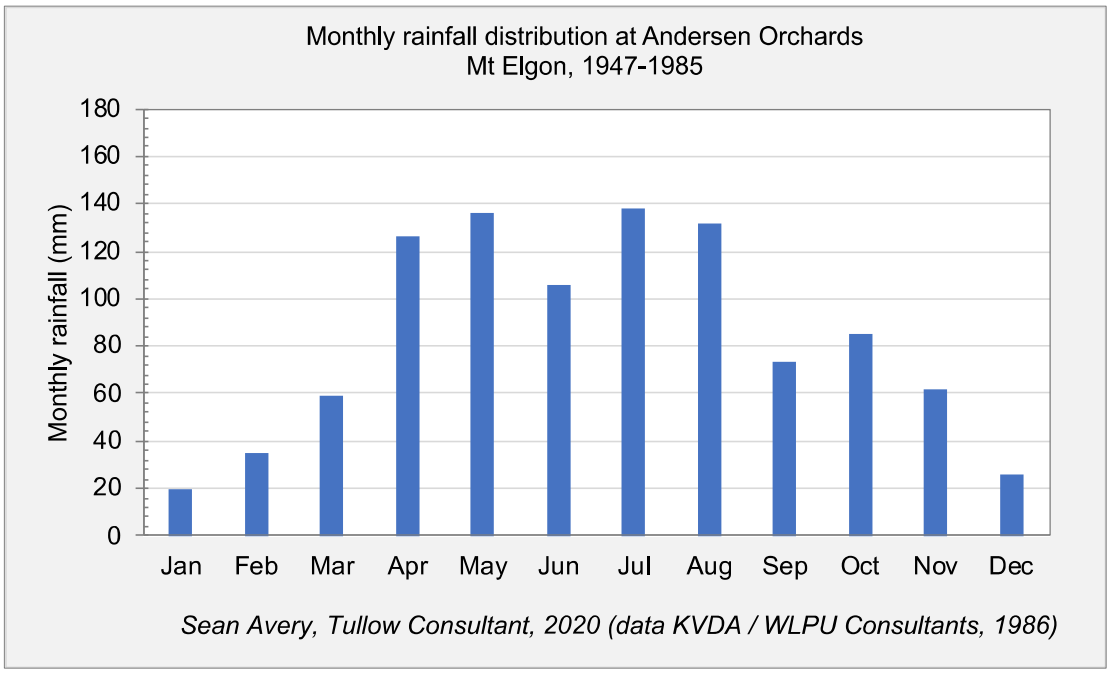


Figure 16: RGS 2B27 - Average monthly flow and rainfall distributions compared

The Consultant has analysed the pre-dam monthly flow series generated by WLPU Consultants using standard low-flow frequency analysis methodology. [44] [59] A climatic year from August to July was chosen to avoid splitting the dry season. The lowest flow was abstracted from each climatic year of record for periods of 1, 3, 6 and 12 months duration. Each series was ranked in descending order of magnitude, and a recurrence interval computed for each value in the series. These were then plotted on a graph (Figure 17).

This river was seasonal, and would be dry for at least a month in 60% of years. Periods of zero flow (drought) could last between 3 to 6 months. One of the impacts of Turkwel dam has been to replace this natural seasonality with a discharge that is regulated according to national power generation requirements.

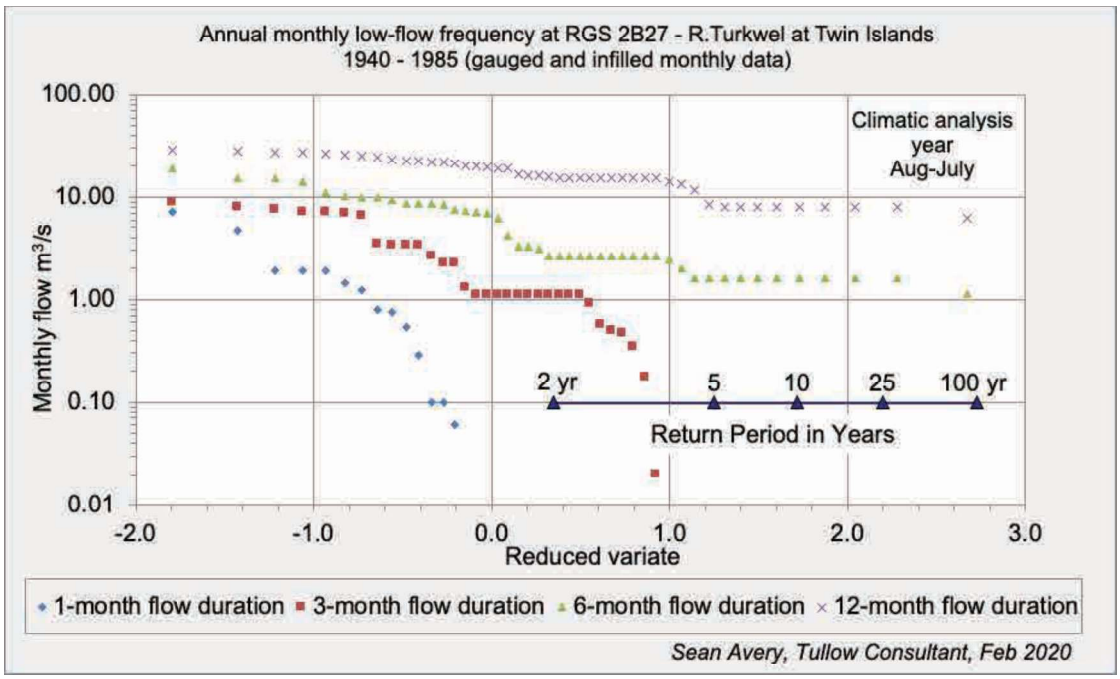


Figure 17: Flow frequency curves for historic natural Turkwel Gorge flows

[59] Guide to Hydrological Practices, Volume II, World Meteorological Organisation, WMO No.168.

4.2.6 Historic natural flow-duration characteristics at Turkwel dam site

The pre-dam monthly flow-duration has also been analysed by the Consultant for RGS 2B27 at Twin Islands. This standard hydrological analysis methodology derives the percent of time that the flow of the river was greater than given amounts, regardless of continuity of time (Figure 18).[59]

The Turkwel river's monthly flow during this period was zero for 12% of the time, and reached 112 m^3/s. The daily flows reached much higher values, with instantaneous flood peaks ranging from 370 to 1,293 m^3/s (Section 7.1, page 7-1). The average daily flow (ADF) is also plotted as a dashed line in Figure 18, this mean representing the theoretical flow-duration curve in the event that the river was 100% regulated. Flow regulation has ecological drawbacks as the hydrological diversity of the river is altered. In the case of the Turkwel however, its most important tributary joins not far downstream of the dam, this being the Malmalte river. The Malmalte was perennial, its annual average flow being a very useful 44% of the Turkwel flow estimated at Twin Islands.[60]

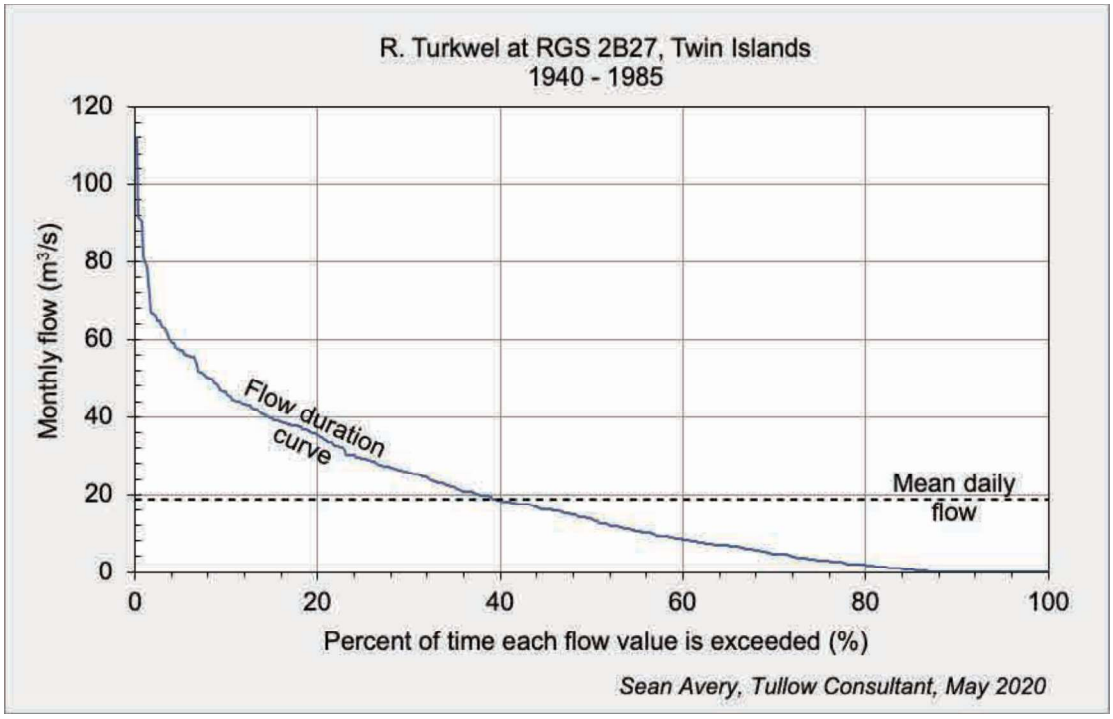


Figure 18: Flow duration at RGS 2B27 from 1940 - 1985

[60] River Malmalte flow data from Table 2.25 in final Turkwel EIA prepared by Sogreah in 1991. Flows were measured from 1982 to 1989. The annual discharge varied from 3.94 to 13.54 m^3/s, and averaged 8.39 m^3/s, almost half the final Turkwel flow estimate at Twin Islands of 18 m^3/s. No recent flow data were available for the Malmalte apart from some spot gaugings by the Consultant and Tullow, and upstream irrigation abstractions will have impacted low flows reaching Kainuk.

4.3 Rainfall

4.3.1 Baseline rainfall distribution over Turkwel dam's catchment

As noted earlier, before the dam was built, average annual rainfall over the Turkwel catchment was estimated to be 825 mm, ranging from 680 mm over the northern Kanyangareng sub-catchment, 925 mm over the Kanyao sub-catchment, to 1,125 mm over the Suam sub-catchment above Kongelai to Mount Elgon (sub-catchment data are annotated on an original catchment map reproduced in Figure 5). This analysis was originally presented in the Norconsult feasibility study dated 1979, which was based on eight years of rainfall data from 1966 to 1973.[43]

4.3.2 Rainfall monitoring by KVDA

Until the early 1990s and 2000s, KVDA gathered records of the many rainfall gauging stations within the catchment as part of ongoing monitoring following the commissioning of Turkwel dam.

The climate station for monitoring the reservoir at the dam itself recorded uninterrupted rainfall data until 2009. Thereafter the record is fragmented until it ceased altogether in 2014. When visited by the Consultant in 2015, the dam's climate station was totally dysfunctional, and its rehabilitation was strongly recommended.

Tullow established a climate station at Turkwel dam as part of this hydrological review and to assist restore dam monitoring data continuity. The location of the original climate station site on the reservoir within the intake compound had been recommended for data continuity reasons, but as the new equipment required reliable mobile phone links, the equipment was instead installed by Tullow in the KVDA office compound below the dam. Recording commenced in September 2018.

4.3.3 Remote-sensed rainfall data

Conventional rainfall data acquisition has become geographically less widely distributed and less reliable in recent years, and procurement of the data from the Kenya Meteorological Department is costly. However, freely accessed rainfall data generated from satellite sensors have become available, although ground-truthing against reliable ground data is advisable. The Consultant's findings in an earlier study of Lodwar rainfall data showed one satellite-based product delivering a 24% positive bias compared to the Kenya Meteorological Department's Lodwar station, whilst another satellite-based product was delivering a significant negative bias.[61]

As part of this hydrological review, the Consultant tested both the above satellite-derived datasets, and the CHIRPS [62] dataset was found representative within the Turkwel dam catchment. The daily rainfall data were accordingly accessed from the internet.[63]

[61] Sean T. Avery and Emma J. Tebbs, Lake Turkana, major Omo River developments, associated hydrological cycle change and consequent lake physical and ecological change, *Journal of Great Lakes Research* 44 (2018) 1164-1182.
[62] CHIRPS = Climate Hazards Group InfraRed Precipitation with Station data.
[63] Funk, Chris, Pete Peterson, Martin Landsfeld, Diego Pedreros, James Verdin, Shraddhanand Shukla, Gregory Husak, James Rowland, Laura Harrison, Andrew Hoell & Joel Michaelsen. "The climate hazards infrared precipitation with stations—a new environmental record for monitoring extremes". *Scientific Data* 2, 150066. doi:10.1038/sdata.2015.66 2015.

4.3.4 Remote-sensed rainfall data ground-truthing

The Andersen Orchards rainfall record on the lower slopes of Mount Elgon is an especially important ground station as this is representative of the important water tower contributing to Turkwel dam. The Andersen Orchards historic rain gauge did not meet stringent WMO requirements, but the record was deemed "invaluable" by the Turkwel dam design team as it was continuous since 1945.[64]

The Consultant has established that the CHIRPS monthly rainfall distribution profile from 1981 to 2019 at the Andersen Orchards location (Annex 2) is comparable to the ground data from 1947 to 1985 (Figure 19). In later years, the long rains period from April is drier, whilst the short rains period from July is wetter.

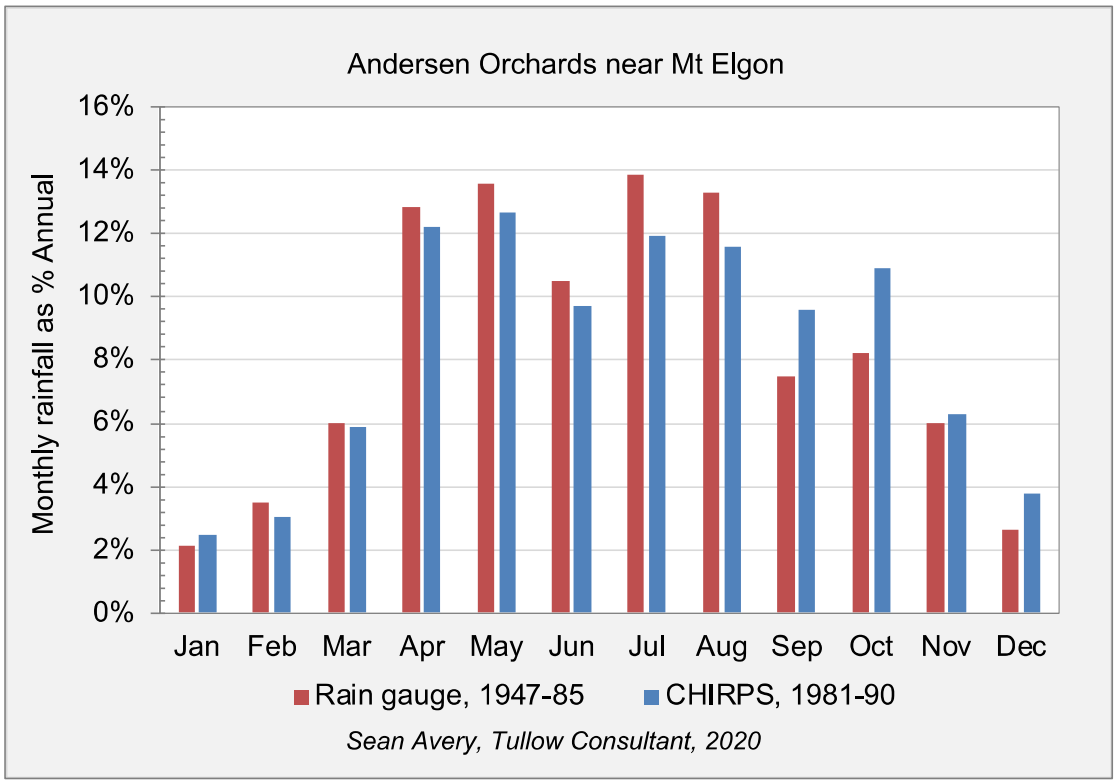


Figure 19: Andersen Orchards rainfall – historic and satellite rainfall distribution

[64] Turkwel River Basin Hydrology, Annex A, KVDA / WLPU Consultants, September 1986.

A double-mass analysis by the Consultant shows the CHIRPS satellite data generating comparable cumulative rainfall volume to the Andersen Orchards rain-gauge (Figure 20, for the overlapping data period 1981 to 1985). A cautionary note above by WLPU Consultants about stringent compliance with WMO requirements[64] had warned that the resultant systematic errors of the rain-gauge may lead to under-recording, and that tends to be confirmed by the double-mass plot (perhaps 4% difference).

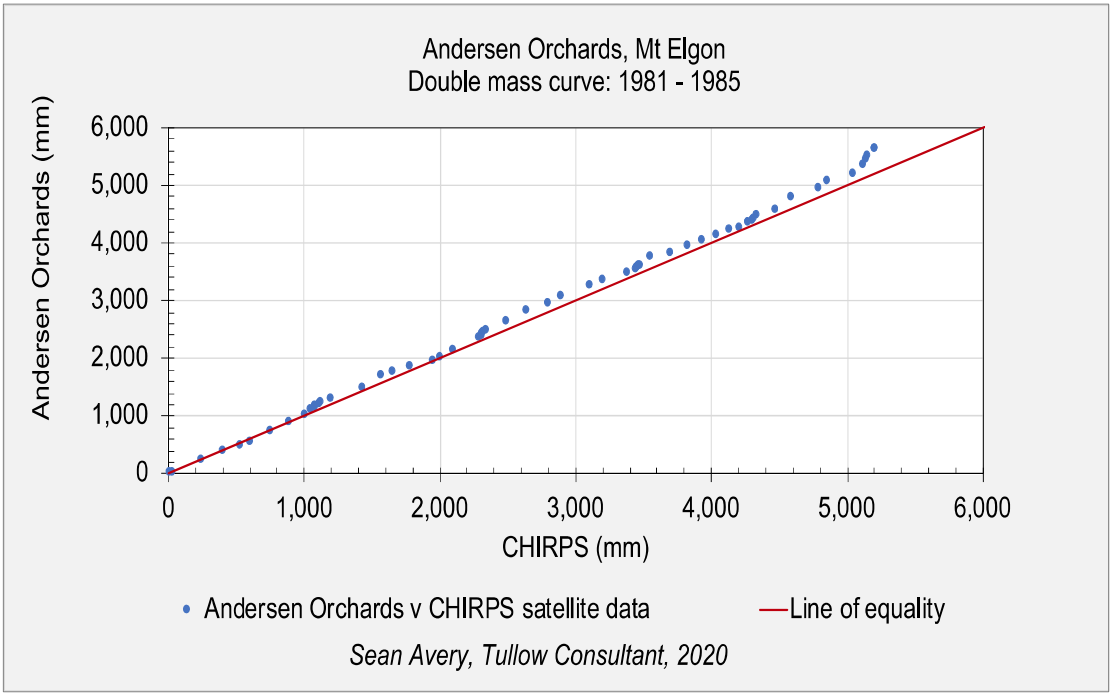


Figure 20: Andersen Orchards rainfall – historic and satellite data source comparison

4.3.5 Rainfall trends in Turkwel dam's catchment

The Consultant combined the Andersen Orchards rain-gauge data with the CHIRPS remote-sensed data, and plotted the combined annual rainfall series. The rolling decadal annual rainfall mean expressed as a ratio to the long-term mean was superimposed, and this demonstrates an increasing annual rainfall trend (Figure 21).

Representative rainfall locations throughout the Turkwel catchment were also reviewed. For direct comparison, these were plotted in non-dimensional form, each annual rainfall being expressed as a ratio of the long-term mean of that location (Figure 22).

Finally, daily rainfall data over the entire Turkwel catchment were accessed (Figure 23). The following observations are noted on the overall catchment results:

- The pre-dam design period included the extreme 1984 drought, which is still the year with the lowest annual rainfall on record for this catchment (Figure 23).
- The Norconsult-derived dam design annual catchment rainfall based on rainfall records from 1966 to 1973 averaged 825 mm (Table 1).
- The CHIRPS annual catchment rainfall for the dam design and construction period up to 1990 averaged 864.5 mm (Figure 23), similar to the design data.
- The CHIRPS annual catchment rainfall for the dam operation period 1991 to 2019 has averaged 957.2 mm, an increase of 16% over the design data.

The results overall reflect the increasing rainfall trend. Also, a greater inter-annual amplitude of variability is evident in recent years.

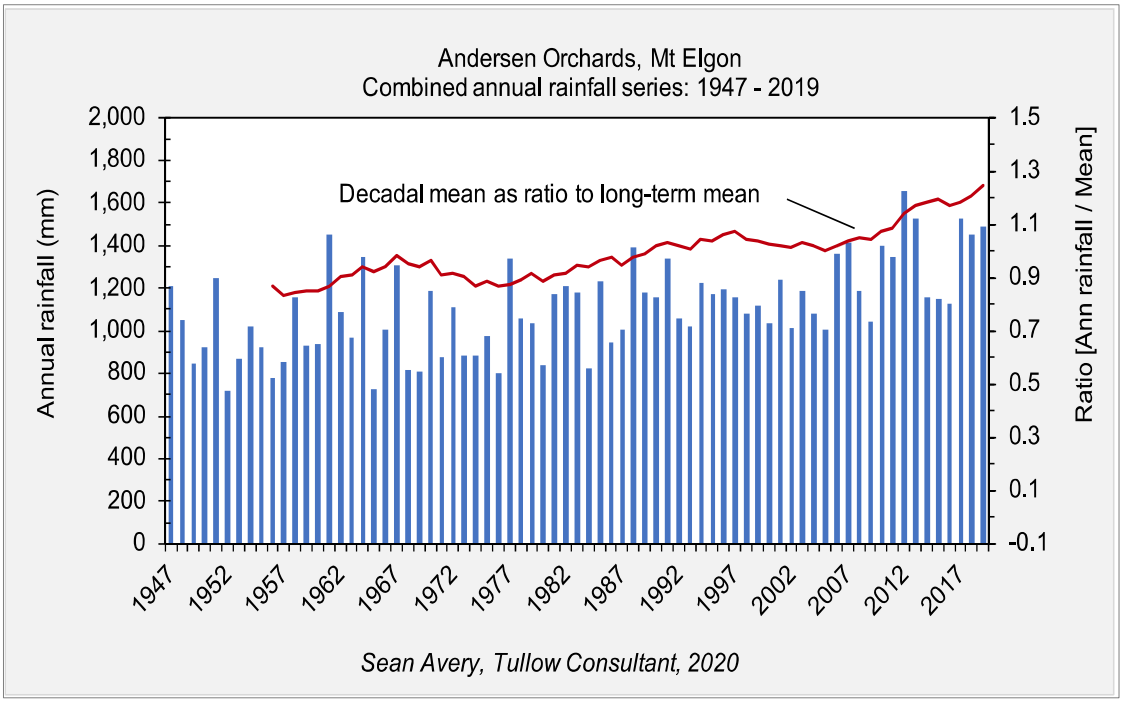


Figure 21: Andersen Orchards annual rainfall series

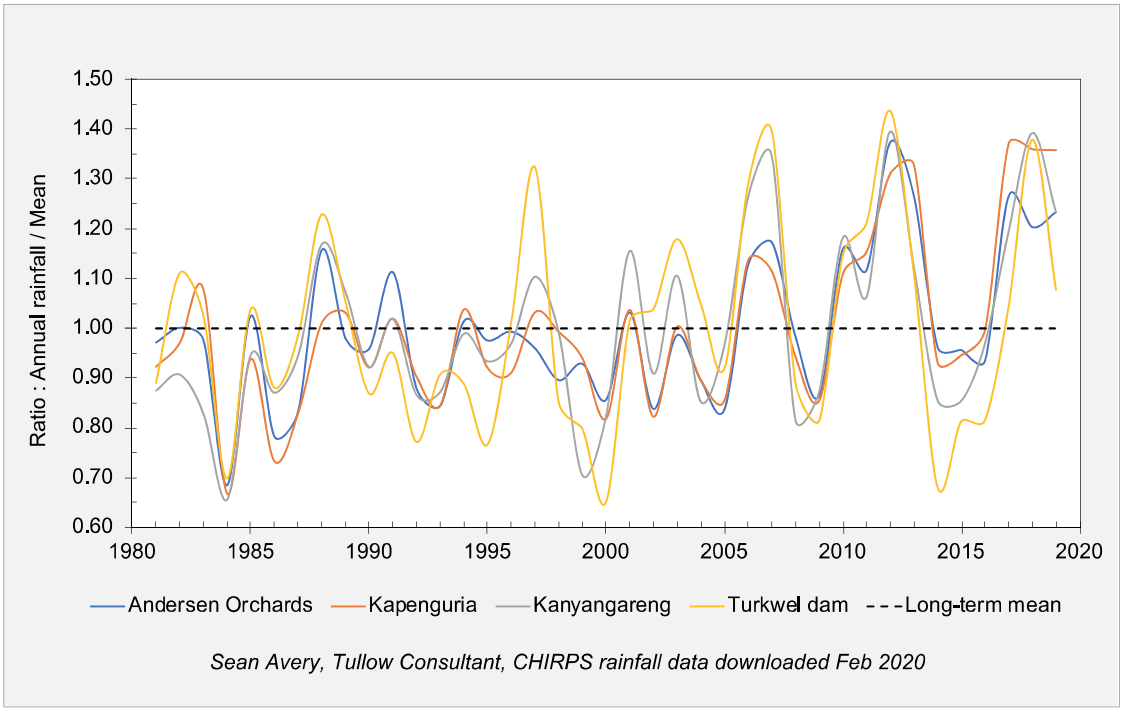


Figure 22: Annual rainfall trends at different locations within Turkwel catchment

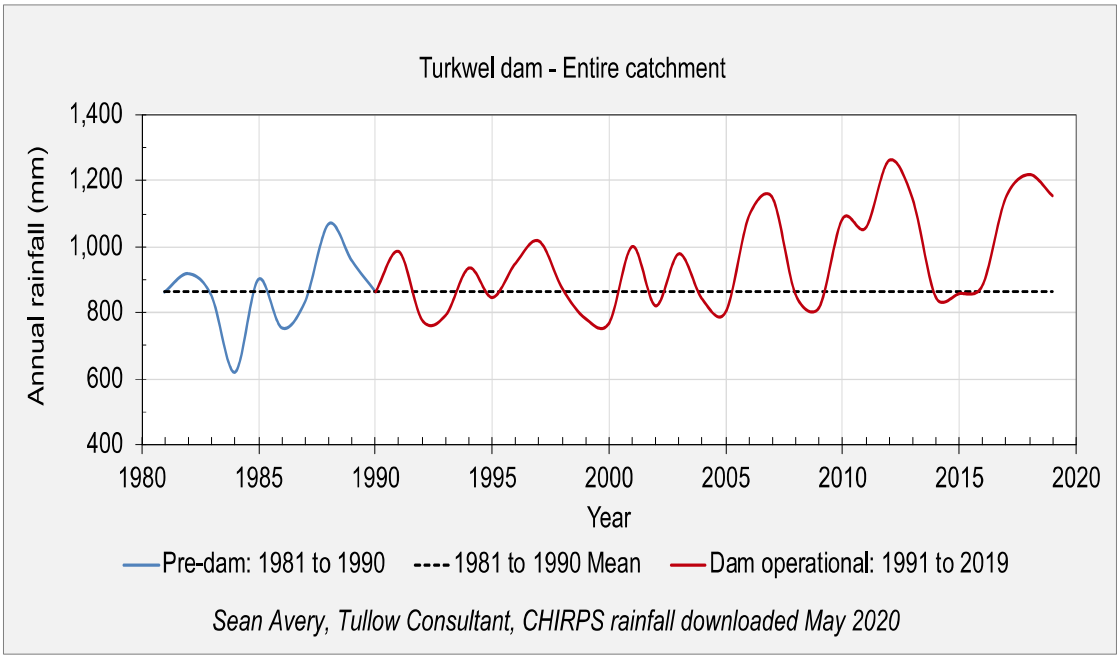


Figure 23: Annual rainfall over entire Turkwel dam catchment

4.3.6 Climate change

Recent climate trends and projections for future climate have been reviewed in an earlier Tullow report.[65] No statistically significant trends in rainfall since 1960 were reported, although a reported increasing but insignificant trend in the proportion of rainfall falling within heavy events was noted. The Tullow study concluded that climate change effects did not change the choice of Turkwel dam as the strategic water source for the South Lokichar Development.

The trends presented by the Consultant in this hydrological review report are consistent with the Tullow climate change study expectations. They are also consistent with the increasing runoff forecast in the JICA National Water Master Plan 2030.[66]

4.4 Reservoir water balance modelling

4.4.1 Reservoir water balance equations

The various elements in the Turkwel reservoir water balance are schematically illustrated in Figure 24, and the formula is as follows:

$\delta V / \delta T = Q + P_S + Q_{GWI} - E_S - Q_{TURB} - Q_{COMP} - Q_{SPILL} - Q_{GWO} - Q_{ABS}$ ..... Equation 1

where:

[65] Strategic Water Supply for Development, draft Technical Report 9, Climate change and Turkwel dam, Richard Boak, Tullow Oil Kenya BV, October 2017.

[66] This increase in Rift Valley runoff by 2030 as forecast by the National Water Master Plan 2030 had been noted in the Consultant's preliminary hydrological review of the dam in 2015.[6]

δV = Reservoir volume change (calculated from the rise or fall in water level)
δT = Time interval
Q = River inflow volume
P_S = Direct precipitation volume on the reservoir surface
E_S = Evaporation loss volume from the reservoir surface
Q_{TURB} = Volume of water discharged downstream through the turbines
Q_{ABS} = Direct abstraction volume from the reservoir
Q_{COMP} = Compensation flow release and / or periodic low-level outlet flushing release volume
Q_{SPILL} = Spillway discharge volume downstream
Q_{GWI} = Groundwater and seepage inflow volume
Q_{GWO} = Groundwater and seepage outflow volume

A monthly modelling timestep has been adopted by the Consultant.

δV = Water level change (m) x Mean reservoir surface area (m^2) in the time interval
Q = Unknown quantity (as there is no flow gauging)
Q_{TURB} = calculated as a function of water level and power generated
E_S = Daily evaporation rate (mm/d) x Reservoir surface area (m^2)
P_S = Monthly rainfall (mm) x Reservoir surface area (m^2)

By re-adjusting the water balance equation, the unknown river inflow to the reservoir can be calculated as all other parameters are measured directly or indirectly, thus:

$Q = \delta V / \delta T - P_S - Q_{GWI} + E_S + Q_{TURB} + Q_{ABS} + Q_{COMP} + Q_{SPILL} + Q_{GWO}$ …… Equation 2

The equation is further simplified as there has never been any discharge over the spillway, nor any compensation or dam bottom outlet releases. There are currently no direct abstractions from the reservoir other than the turbine discharge, and the small amount used for domestic water supply needs is taken from the turbine tailrace downstream (to supply the Kengen camp and associated facilities). The reservoir geology is impermeable and groundwater seepages in and out can be assumed zero. Thus, the simplified reservoir balance becomes:

$Q_{SPILL} = Q_{COMP} = Q_{ABS} = Q_{GWI} = Q_{GWO} = 0$ …….……. Equation 3
$Q = \delta V / \delta T + Q_{TURB} + (E_S - P_S)$…… Equation 4

where $(E_S - P_S)$ = Net Evaporation Loss after taking account of net rainfall on reservoir surface

The following measurement inputs are necessary to carry out the water balance computation: the reservoir water level is recorded twice daily at the dam; rainfall and pan evaporation were originally measured daily at the dam and can be estimated; power generation is accurately measured constantly in the power station.

The computations are simple as algorithms relating surface area and storage volume to water level had been derived from the reservoir elevation/area/storage curves, and the turbine power generation is a known function of head and power. But the reservoir and hydraulic characteristics may be changing with time, so the water balance steps have been carefully checked in the following sub-sections.

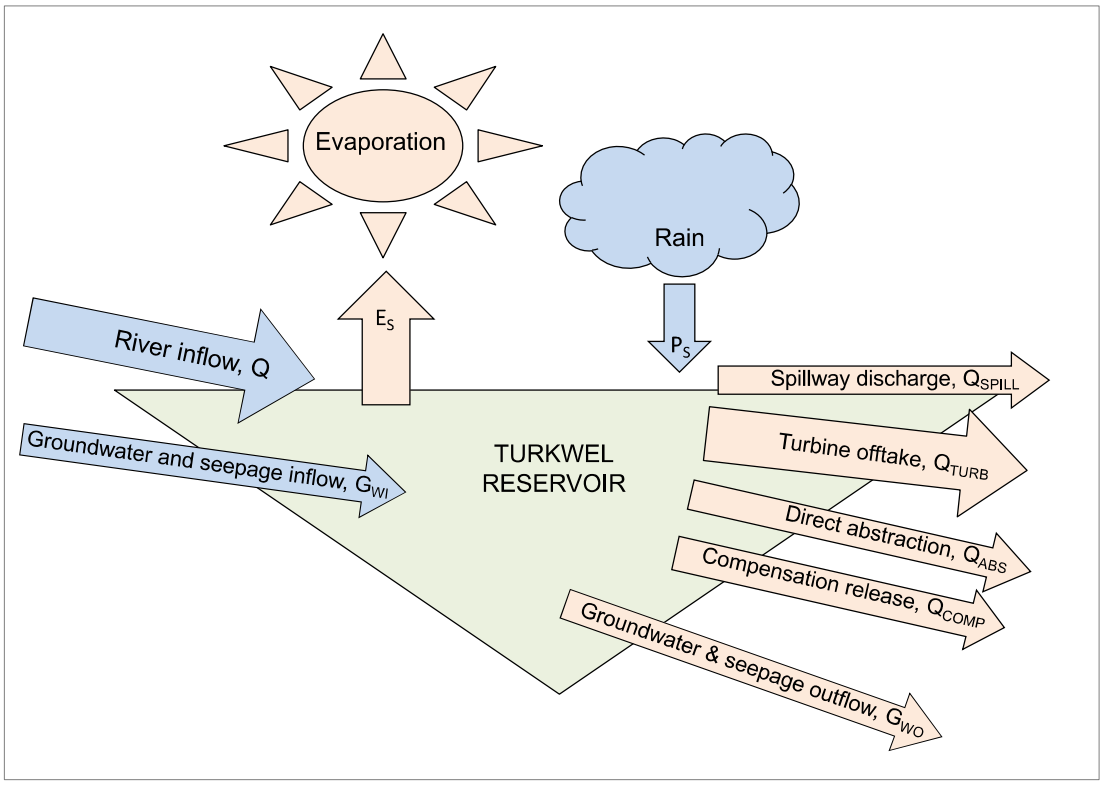


Figure 24: Turkwel reservoir water balance

4.4.2 Reservoir water level fluctuations

At the time the dam was commissioned, water level staff gauges had been installed at the power station intake covering the full range of water levels extending up beyond full supply level (Figure 25). The gauges are mounted alongside the steep reinforced concrete ramp that is used to lower maintenance equipment to the underwater intake screens (the intake is hidden 30 metres below the water in Figure 26). Each staff gauge was set exactly relative to mean sea level. These gauges were read manually on a twice-daily basis, and due to the long sight distances involved, binoculars were used.[78] It has been previously suggested by the Consultant that the gauges be rehabilitated as the numerals on the lower gauges were fading and were hard to read in places, and the gauges may no longer be mounted accurately relative to mean sea level datum.[78]

In order to convey water level readings electronically to the power station control room, Kengen operate an independent radar-type water level gauge fixed to the face of the dam (Figure 27).

During the 2017 survey, the KVDA staff gauges were consistently noted by the Consultant to be reading about 0.30 metres higher than the water elevation readings recorded in the Kengen control room ledger.[78] A member of the KVDA monitoring team was present when the datum discrepancy was noted.[78] The discrepancy could be the mean sea level setting of either gauge.

The reservoir's monthly water elevation record is presented in Figure 28. This has been analysed to derive a water elevation-distribution histogram (Figure 29) and a water elevation-duration curve (Figure 30). The following summary comments on this data period are applicable:

- The reservoir has never reached anywhere near full supply level (1150 m ASL).
- The reservoir has exceeded the optimum generation level only 14% of the time.
- The reservoir has fallen below the minimum generating level 5.4% of the time.

These results show that reservoir has failed on occasion to meet generating requirements.

Figure 25: Water level gauges at Turkwel reservoir above FSL

Figure 26: Intake screen maintenance ramp with water level gauges alongside

Figure 27: Kengen radar water level gauge gantry and transmitter

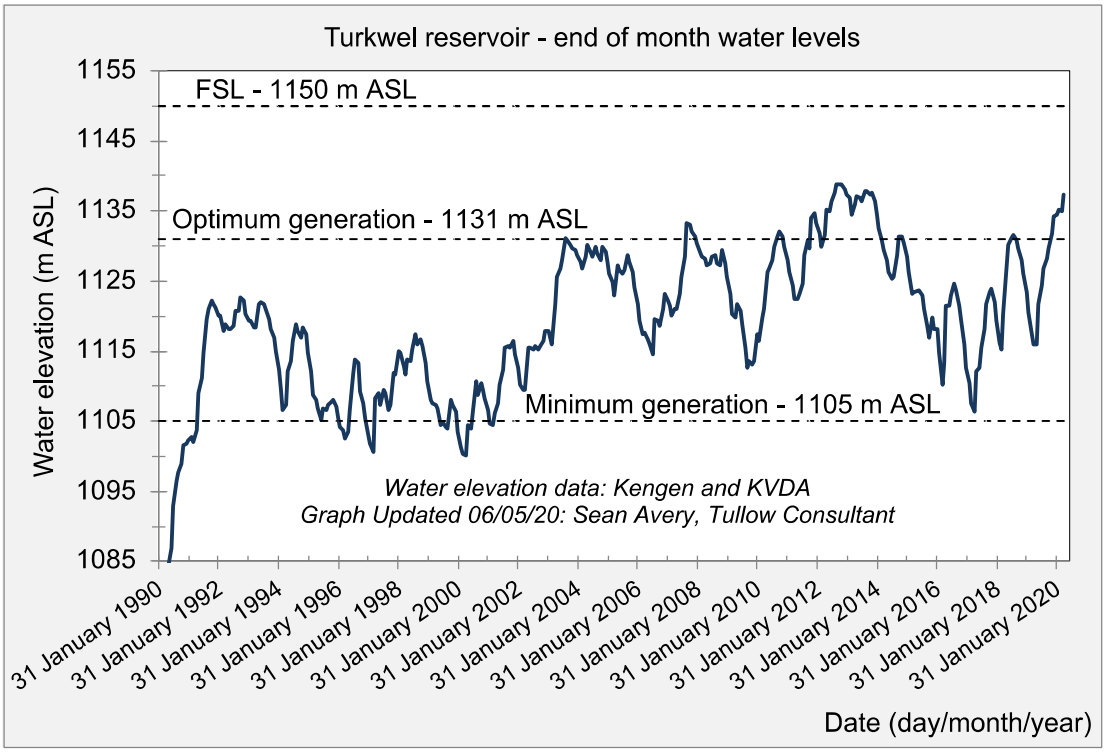


Figure 28: Turkwel reservoir's monthly water elevation record

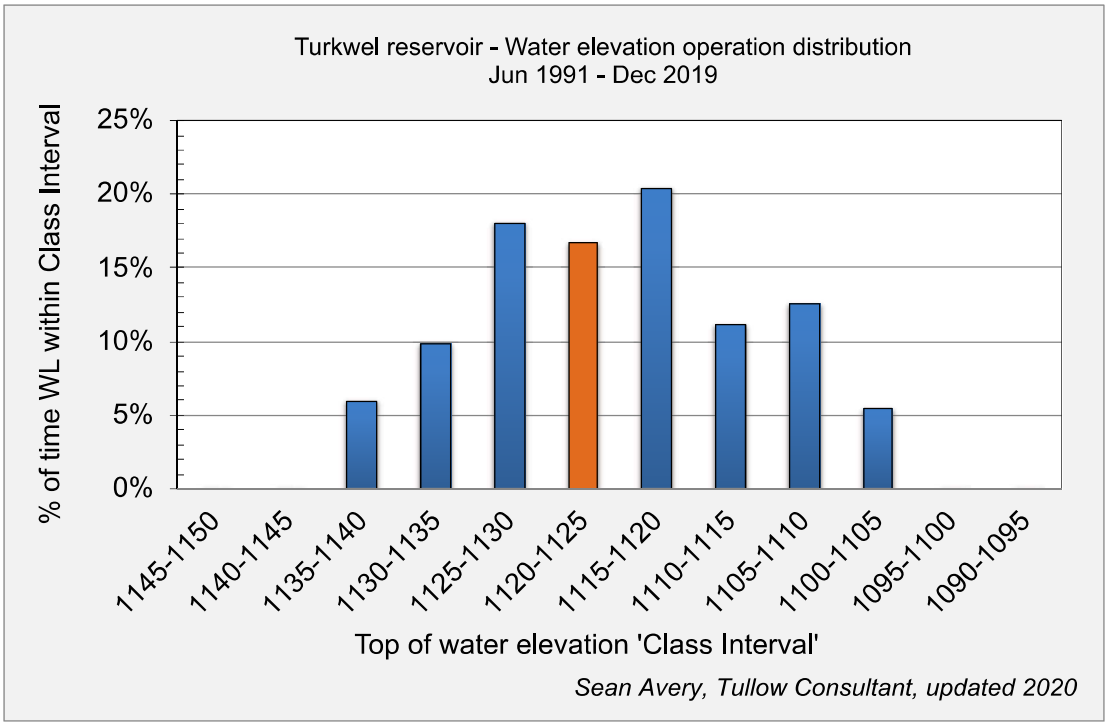


Figure 29: Histogram of Turkwel's water level operation ranges

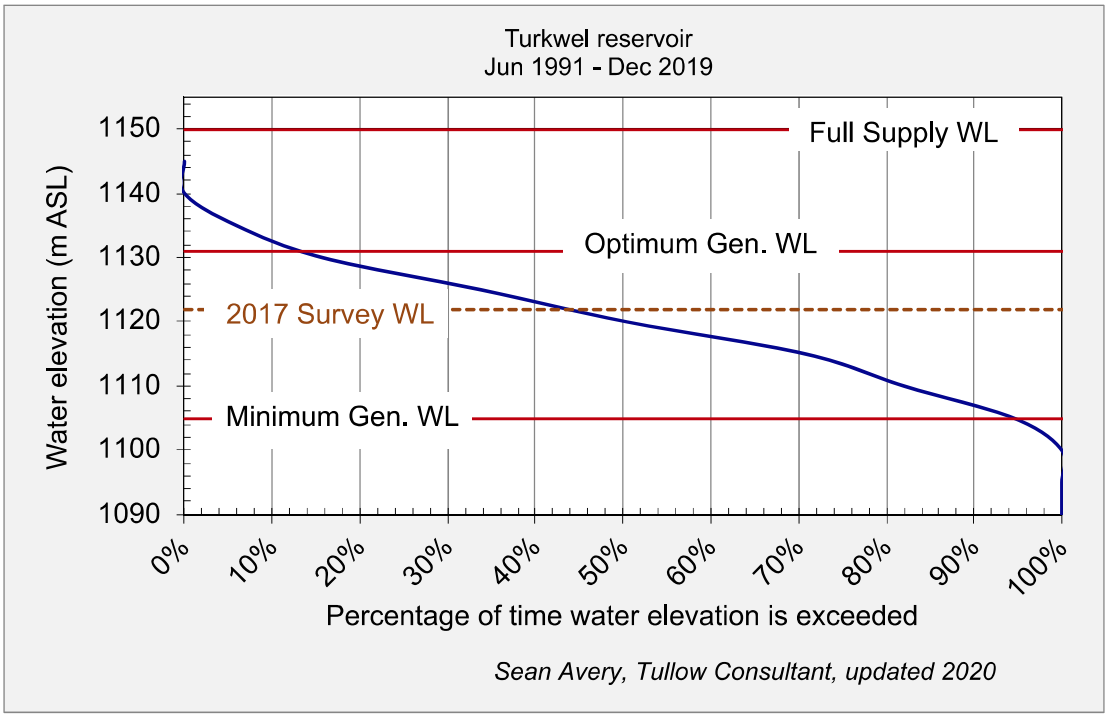


Figure 30: Turkwel reservoir's elevation exceedance curve

4.4.3 Reservoir elevation / area / storage relationship

The baseline elevation / area / storage relationship for Turkwel reservoir has been abstracted by the Consultant from various project design documents prepared by the dam design consultants. These results were presented in an earlier report.[77] These relationships were checked through bathymetric survey reported later in this report (Figure 57, Figure 58). There was some shrinkage of the shoreline, but as there have been no routine bathymetric surveys since the dam was commissioned, the bathymetric progression cannot be mapped. By applying the original elevation / area relationship over the period since the dam was commissioned, a conservative estimate of reservoir inflows is computed. For modelling the reservoir into the future, the elevation / area relationship can be re-defined, either through topographical survey of the main deposition zone upstream, or through bathymetric survey when that zone is inundated, or a combination of both. Beyond the inundation zone, there will be no changes except through riparian farming activities.

Table 8: Turkwel dam baseline elevation / area / storage

Elevation (m ASL)	Area (hm^2)	Volume (hm^3)
1045	2.620	0.066
1050	5.000	0.258
1055	7.650	0.570
1060	13.000	1.068
1065	25.800	1.992
1070	55.000	3.922
1075	109.790	7.919
1080	197.000	15.442
1085	319.840	28.221
1090	473.000	47.932
1095	651.890	75.940
1100	863.000	113.659
1105	1,116.500	162.951
1110	1,422.000	226.176
1115	1,787.990	306.143
1120	2,228.000	406.211
1125	2,751.730	530.412
1130	3,330.000	682.294
1131	3,424.164	730.310
1135	3,953.320	864.093
1140	4,690.000	1,079.518
1145	5,598.140	1,336.087
1150	6,608.000	1,641.029
1155	7,923.000	2,037.000
1160	9,237.000	2,433.000

Source: Sogreah, 1983

4.4.4 Reservoir surface rainfall

Rainfall data were collected by KVDA at three locations at the dam and for different time periods (Columns 3 to 5 in Table 9). The dam monitoring station was presumed to be the one located at the dam power station intake on the reservoir. Twin Islands and the KVDA office locations are below the dam. The Consultant has accessed CHIRPS remote-sensed rainfall data and the double-mass analysis shows volumetric comparability with the KVDA data (Figure 31, and Columns 4 and 5 in Table 9). The KVDA data are fragmented and an increase in rainfall at the dam is not properly reflected.

The preliminary dam design documents stated the average annual rainfall over Turkwel reservoir to be "about 650 mm".[9] The Consultant has found the CHIRPS annual average rainfall over the reservoir for the period 1981 to 1985 to be slightly higher, but consistent with the design value (Column 6 in Table 9, Annual = 700.3 mm).

The Consultant thus extended the CHIRPS rainfall analysis within a polygon enclosing the typical reservoir surface area. The average annual was 763.3 mm for the period 1991 to 2019 (Table 9, Column 8). This was an increase over the shorter period 1990 to 2008 (Column 7 in Table 9, Annual = 728.9 mm). The annual rainfall totals over the reservoir are plotted in Figure 32, showing that there can be marked variability between years.

Table 9: Rainfall measured at Turkwel dam

	CHIRPS KVDA office 1981 to 2007 (mm)	Twin Islands * 1980 to 2007 (mm)	Turkwel dam monitor ** 1990 to 2008 (mm)	CHIRPS KVDA office 1990 to 2008 (mm)	CHIRPS over reservoir rainfall 1981 to 1985 (mm)	CHIRPS over reservoir rainfall 1990 to 2008 (mm)	CHIRPS over reservoir rainfall 1991 To 2019 (mm)
1	2	3	4	5	6	7	8
Jan	8.7	23.5	14.4	10.4	7.8	12.2	10.5
Feb	16.1	31.9	24.2	15.1	20.6	18.8	16.1
Mar	56.5	50.8	40.6	53.8	74.0	64.7	62.0
Apr	98.6	88.9	84.0	87.9	118.3	106.1	119.0
May	72.9	76.5	88.0	74.9	66.7	99.9	102.4
Jun	53.8	44.5	38.1	56.2	48.4	70.6	72.2
Jul	63.1	69.6	62.4	62.5	76.8	77.6	82.8
Aug	58.2	43.5	41.3	58.9	83.2	75.4	77.8
Sept	30.1	42.7	24.4	30.2	33.1	34.9	36.7
Oct	49.7	48.9	64.3	53.8	67.2	85.3	91.7
Nov	44.4	71.7	71.8	43.4	84.5	61.8	67.2
Dec	20.9	27.0	14.9	21.5	19.5	21.6	24.9
Ann	572.9	521.8	568.4	568.6	700.3	728.9	763.3

*Notes: * 12% data is missing (can be infilled through cross-correlation with Sebit rainfall)*
*** data available beyond up to 2014 but with gaps*

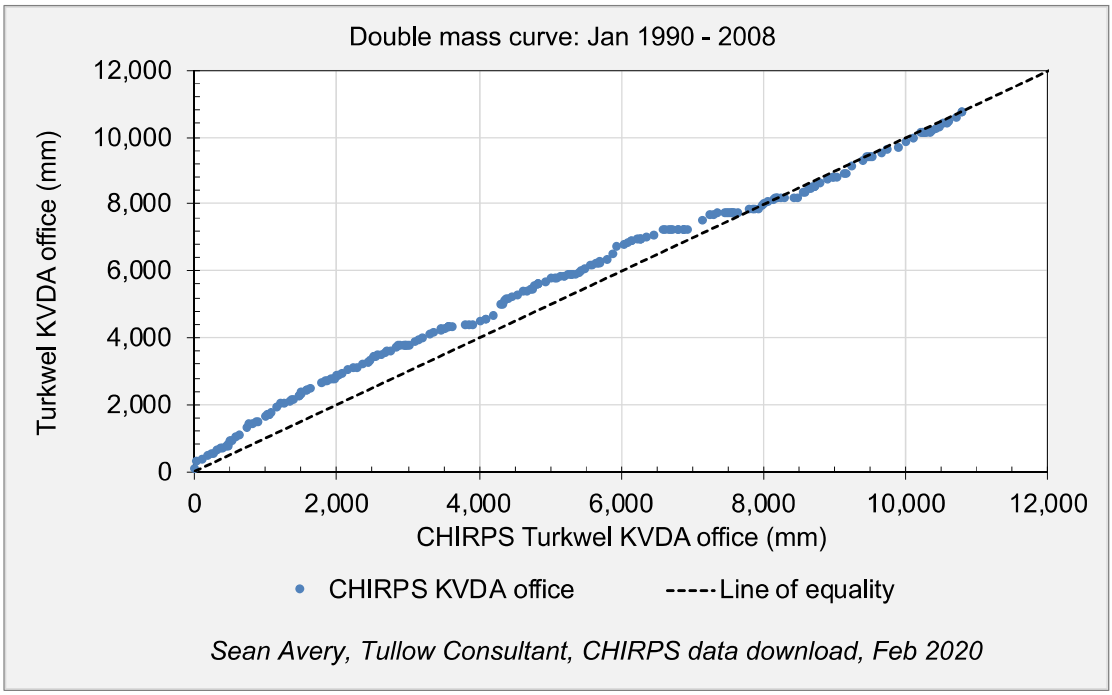


Figure 31: Rainfall at Turkwel camp - Cumulative comparison with CHIRPS dataset

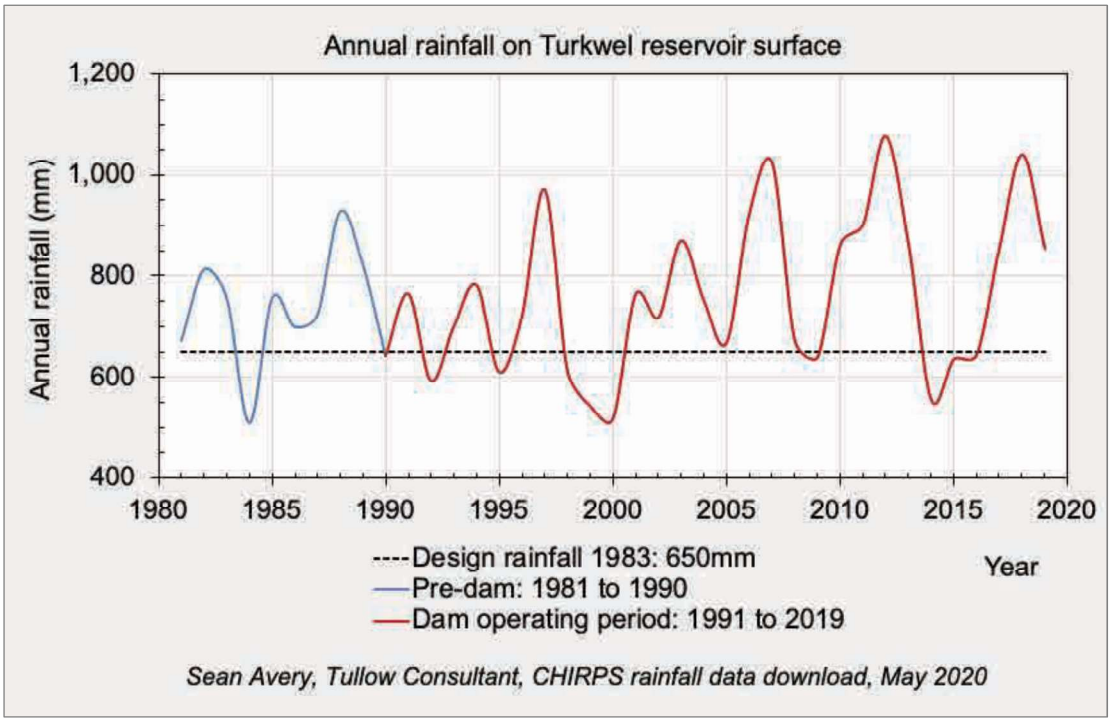


Figure 32: Annual rainfall on Turkwel reservoir, 1981 to 2019

4.4.5 Evaporation

The dam's preliminary design in 1983 utilised earlier work by Woodhead [67] in which the Penman formula was used to demonstrate a linear evaporation relationship with altitude. Based on this relationship, and adopting a mean altitude of 1,100 m ASL, the dam design team estimated potential evaporation at Turkwel dam to be 2,300 mm per year.[9]

In 1988, the Ministry of Water Development (MoWD) prepared a manual on evapotranspiration for the whole of Kenya. Based on that work, Turkwel Dam's evapotranspiration rate is roughly 2,200 mm/yr.[68]

The KVDA dam monitoring team provided pan evaporation data for Turkwel from 1984 to 1998, but there were major data gaps from 1991 onwards, before monitoring ceased altogether (Annex 5).[6] The annual pan evaporation ranged between 2,256 and over 3,011 mm, and averaged 2,719 mm, and the rate of evapotranspiration changed little throughout the year (Table 10).

Using formulae derived in the evapotranspiration manual for Kenya, the evapotranspiration derived from the KVDA dam monitoring pan data is 2,719 x 0.85 = 2,311 mm/y.[68]

Table 10: Pan evaporation at Turkwel, 1983 to 1999 (KVDA dam monitoring)

	KLDA Pan evaporation (mm)	Pan coefficient	E_T (mm)
Jan	239.0	0.85	203.1
February	238.0	0.85	202.3
March	247.8	0.85	210.6
April	214.6	0.85	182.4
May	210.9	0.85	179.2
June	213.3	0.85	181.2
July	210.1	0.85	178.5
August	221.6	0.85	188.3
September	240.6	0.85	204.5
October	240.8	0.85	204.6
November	217.2	0.85	184.6
December	225.4	0.85	191.5
Annual	2,719		2,311

Notes: The KVDA record is fragmented (see Annex 5)

[67] Woodhead, T., Studies of Evapotranspiration in Kenya, EAAFRO, 1968.

[68] Ministry of Water Development, Irrigation Section, Evapotranspiration in Kenya, by J. Kalders, September 1988. Equation 23: E_T = 814.2 + 0.5474 x Pan Evaporation (Class A Pan). This equation calculated a pan coefficient = 0.85.

4.4.6 Reservoir net evaporation loss

The dam's preliminary dam design assumed that on average 650 mm/y rainfall would have fallen over the reservoir area, and that 50 mm of this would have run off (Sogreah assumed 7.6% runoff coefficient). The design assumed that by creating the reservoir, the effective rainfall was increased by 600 mm, and that the net evaporation loss from the reservoir was computed to be 2,100 - 600 = 1,500 mm/y.[9]

KVDA records since the dam was commissioned show an average annual rainfall of 568 mm for Turkwel (Column 4 in Table 9). This is less than the 650 mm that had been assumed in the design, and the quality of data is uncertain. For this review, the Consultant accessed CHIRPS daily rainfall within a polygon enclosing the typical reservoir open water surface area. This rainfall averaged 763.3 mm/y over the time since the dam was commissioned (Column 8 in Table 9).

Adopting the same approach as the design, the updated data result in a net evaporation loss of 1,606 mm/y (Table 11), only slightly higher than had previously been adopted. Losses have varied between 3 and 10% of inflow over the period the reservoir has operated (Table 12).

Table 11: Net evaporation loss from reservoir surface

	E_T (mm)	Effective rainfall (mm)	Net evaporation loss (mm)
Jan	203.1	9.7	193
February	202.3	14.9	187
March	210.6	57.2	153
April	182.4	109.9	72
May	179.2	94.6	85
June	181.2	66.7	115
July	178.5	76.4	102
August	188.3	71.8	117
September	204.5	33.9	171
October	204.6	84.7	120
November	184.6	62.0	123
December	191.5	23.0	169
Annual	2,311	705	1,606

Table 12: Net evaporation loss as % Turkwel average inflow

Turkwel reservoir operating levels	Evap. loss (m^3/s)	Evap. loss as % Turkwel inflow
Minimum operating level 1105 m ASL	0.569	3.2%
Optimum operating level 1131 m ASL	1.744	9.7%
Full supply level 1150 m ASL	3.365	18.7%

4.4.7 Turbine discharge calibration

(a) The Turkwel turbine tailrace

The Turkwel power station draws water through the dam's reservoir intake into a low-pressure tunnel. The tunnel delivers to a high-pressure penstock that drops the water over 300 metres elevation down to two Francis turbines within the under-ground power station. After driving the turbines, the water discharges to a deep chamber whose outlet is a tunnel leading to the open tailrace pond. The tailrace is an excavated pond 180 metres long and about 20 metres wide (Figure 33). The water enters the pond below water level and thereby dissipates its velocity energy through swirling within the pond water body.

The tailrace dimensions were surveyed by the Consultant in 2016 in order to assess the water storage capacity.[69] The pond is deep and there are resident crocodiles, so the survey was done from the bank by means of an Ott acoustic Doppler current profiler. A rope was strung across the width of the tailrace channel and the profiler was pulled back and forth. Data were transmitted to a hand-held data-logger with the operator on the bank.

The longitudinal average cross-sectional depth profile of the tailrace is plotted in Figure 34. The deepest section is directly opposite where water enters from the turbines. This section averaged 8 metres depth across its width, and was 10 metres at the deepest point. The pond standing water level is governed by the outflow sill level where the footbridge is located (Figure 35). With water standing at sill elevation, 14,200 m^3 of water are ponded.

When the turbines are discharging, the pond water level rises, overflows the outlet sill beneath the tailrace footbridge, then passes on downstream to join the original Turkwel river channel from the dam.

Figure 33: Turkwel tailrace viewed from the footbridge looking upstream

[69] Strategic Water Supply for Development - Turkwel Dam Option – Depth and Velocity Measurements in the Power Station Tailrace - April to July 2016, by Sean Avery, Tullow Consultant.

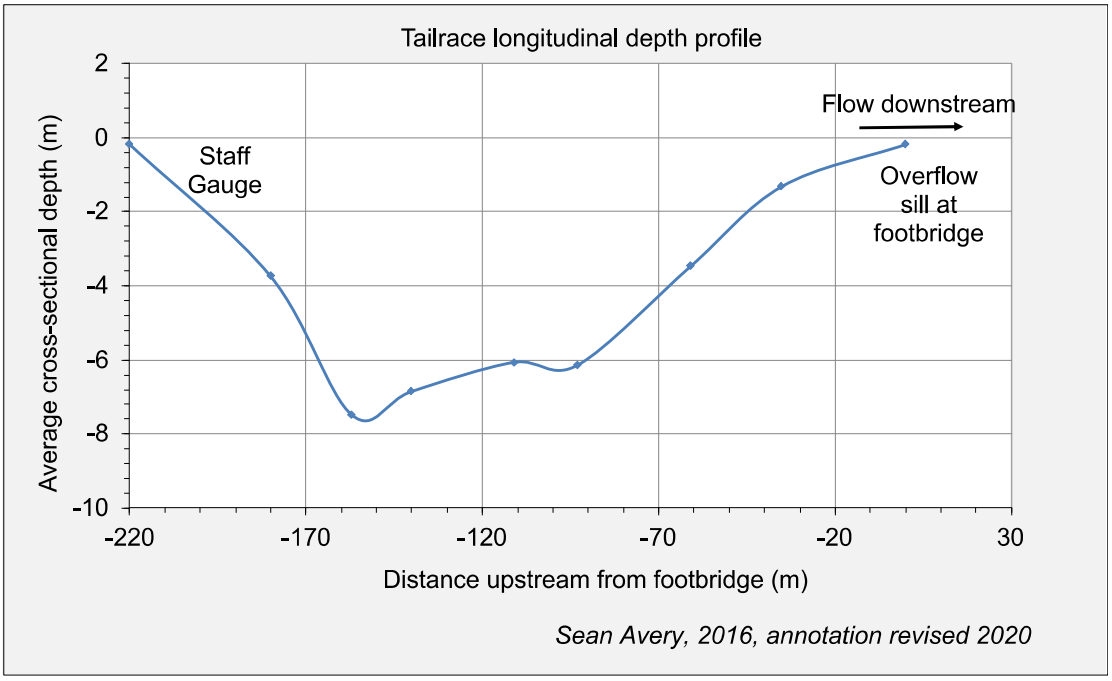


Figure 34: Tailrace longitudinal bed profile

Figure 35: Footbridge spanning the Turkwel tailrace outlet sill

(b) Turbine discharge flow meters and discharge algorithm

The Turkwel power station was commissioned with flow meters to constantly monitor the water discharge through the turbines, but the discharge records at the dam show that these meters did not work for long. The periodic dam inspection reports overcame this lack of flow data by computing turbine discharge from the standard algorithm that relates hydropower generation to the head and discharge driving the turbines, as follows:

Power = Head x Flow x Turbine efficiency x Density of water x Acceleration due to gravity
……. Equation 5

Each Francis turbine at Turkwel is rated at 53.7 MW when passing 17 m^3/s of water under net pressure head of 356 metres. The applicable equations developed through the dam monitoring inspection reports specifically for computing the Turkwel machine (turbine) discharges were as follows:

Q_{TURB} = Power x K ……. Equation 6
K = 427 / (WL -775) ……... Equation 7

where
Q_{TURB} = Turbine discharge in the month (in hm^3)
427 = constant based on 86% efficiency
Power = Energy generated in the month (in GWh)
WL = Average reservoir water elevation in the month (in m ASL)
775 = turbine tailwater elevation (in m ASL)

The reservoir water elevation (WL) and energy generation (Power) are constantly monitored in the power station's control room. With this information, the turbine discharge Q_{TURB} can be computed with reasonable certainty. The factor K declines linearly as the reservoir water elevation (head) rises, as illustrated in Figure 37, although KVDA and Kengen have adopted a fixed factor 1.345 in their turbine "machine" discharge computations (also illustrated in the figure).[70]

The last dam monitoring report seen by the Consultant was dated 2002, so it was considered necessary to check the current applicability of the above design equations as the turbine vanes do wear. A programme of tailrace gauging was thus commenced by the Consultant in 2016, and this task was undertaken periodically by Tullow staff until 2019. Knowing the energy generated, and by measuring the turbine discharge, the factor K was back-calculated thus:

K = Q_{TURB} / Power …… Equation 8

(c) Flow gauging the turbine discharge from the tailrace

Standard flow current metering methodology was adopted by the Consultant and the Tullow field team to gauge the turbine discharge passing downstream under the tailrace footbridge.[69]

A range of current meters was deployed as follows:

- Conventional Valeport BFM 002 open channel current meter with suspension kit
- Ott River Discharge Measurement System (Acoustic Doppler Current Profiler, ADCP)
- Teledyne Streamflow ADCP (suitable for shallow rivers)

The tailrace cross-section was divided into a number of vertical sections at which depth and water velocity were measured. The Valeport instrument with its heavy sinker weight were man-

[70] There are "machine discharges" (turbine discharges) recorded on KVDA and Kengen ledgers that were derived using a fixed "factor" K=1.345, irrespective of changing water elevations. These records will tend to over-estimate machine discharges as K=1.345 is only applicable at water elevation = 1090 m ASL.

handled by cable from the tailrace footbridge, the water depth was measured, and the velocity measured by a revolution counter. The current meter was positioned in the water relative to the bed according to the standard two-point method.[71] The modern ADCP instruments conveniently float on the water and automatically measure the depth and water velocity profile, with the data transmitted to a hand-held datalogger held by the operator. The ADCP instrument was either deployed downstream from the bridge, or from a rope strung across the tailrace upstream of the bridge.

Water elevations at the gauging section were measured from a temporary bench-mark on the bridge abutment by means of a Leica laser distance meter.

On each gauging occasion, the coincident turbine generation data and Turkwel reservoir water elevation data were obtained from the Kengen power station control room.

The tailrace bridge spans a sill in the tailrace that is uniform, and the bridge and sill together provide the outlet hydraulic control from the pond (Figure 35). A reliable stage-discharge rating was demonstrated at this point by the Consultant's 2016 current meter gaugings [69] (Figure 36). The subsequent Tullow flow gaugings are not included in this graph as the stage (water elevation) was not recorded on those occasions.

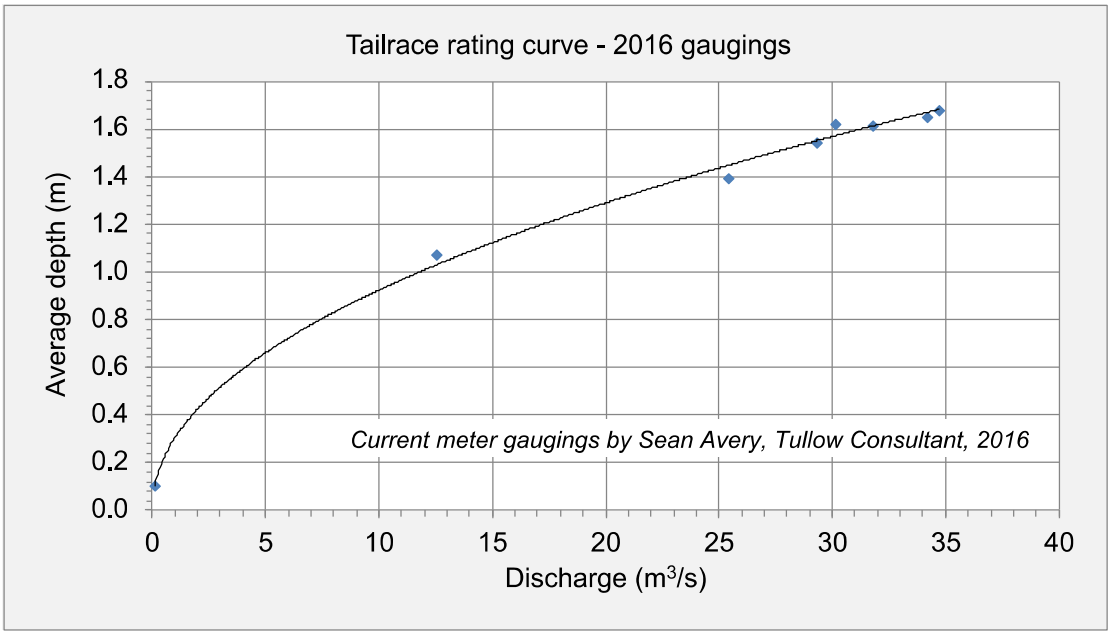


Figure 36: Tailrace flow gauging section rating

(d) Tailrace flow gauging results and resultant "factor" computation

The current meter gauging and coincident energy generation data (power) were used by the Consultant to compute the actual "factor" in the above turbine discharge equation (Equation 6). As expected, the "factor" correctly varied with reservoir water elevation, and the filtered results fit along the theoretical factor straight line derived in the dam inspection reports (Figure 37). Thus, these results have confirmed the validity of algorithmic computation of turbine discharges from water elevation and power generated.

[71] Guide to Hydrological Practices, Vol. I, WMO- No.168, 1981, page 2.53.

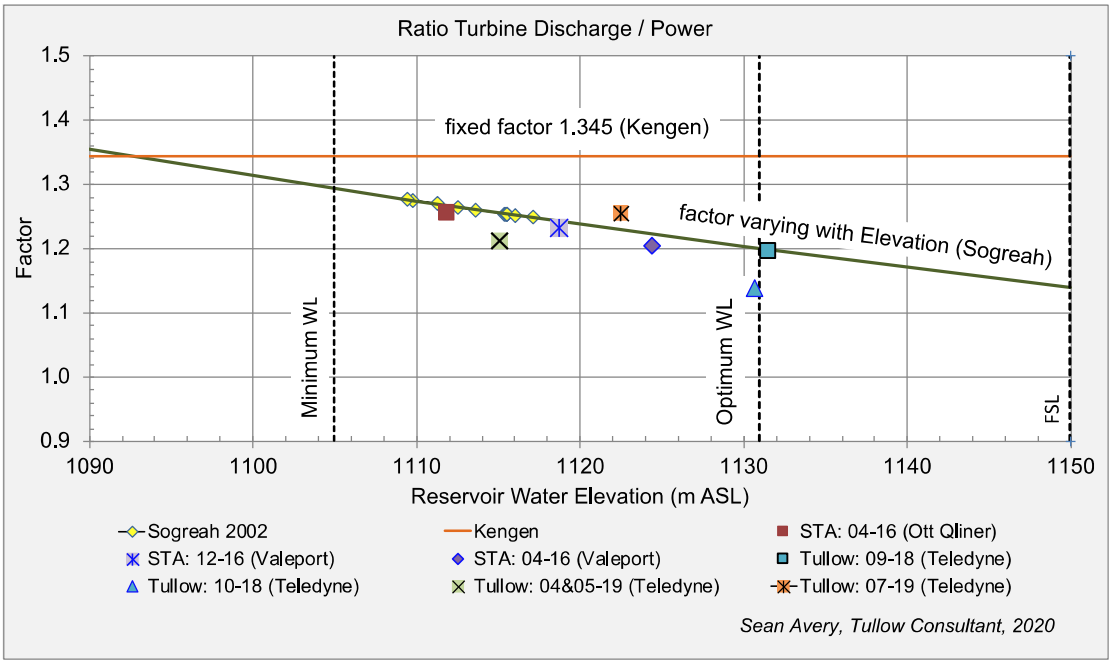


Figure 37: Turkwel turbine discharge calibration

(e) Ongoing monitoring of turbine discharges

As the turbine discharge data are invaluable to the dam's hydrological monitoring, tailrace water level gauge monitoring had been included by the dam design team as part of routine dam monitoring. However, this monitoring has not been sustained, and following 30 years of immersion in the tailrace, the lower portions of the staff gauge no longer exist (Figure 38).

As part of the Consultant's study, in 2016 a water level recording diver was strapped underwater to the existing gauge post by Tullow staff assisted by the Consultant. These measurements were not retrieved due to other priorities in Tullow's field operations.

Establishment of a flow monitoring station in this tailrace was amongst the tasks to have been actioned by the Water Resources Authority with Tullow support (reference relocation of RGS 2B27 in Figure 14, and Table 7). As the turbine releases are neither constant nor continuous, an automatic water level radar gauge or diver is required to effectively record the water level changes.

Figure 38: Existing tailrace water level staff gauge

4.5 Reservoir water balance results

4.5.1 Reservoir inflows

The data period January 1996 to December 2019 was analysed by the Consultant as the generation record was available throughout (Annex 6). In spite of the dampening effect of the reservoir storage buffer and the monthly time step, considerable variability of reservoir inflows is reflected in the water balance hydrograph (Figure 39). Some smoothing of the model time-step could have been tested, but this was unnecessary for the exercise in hand.

The cumulative volume of each component of the water balance is plotted in Figure 40 and tabulated in Table 13. During the period analysed, 88.5% of the inflow was discharged downstream through the turbines. The net evaporation loss was 6.9%. The reservoir elevation had risen over the analysis period, with 4.6% going into storage.

Table 13: Reservoir water balance from 1996 to 2019

Water component	Volume (hm^3)	Average rate (m^3/s)	As percentage of reservoir inflow
Reservoir inflow	13,681	18.00	-
Net evaporation loss	942	1.25	6.9%
Turbine discharge	12,108	16.01	88.5%
Volume into storage	634	0.8	4.6%

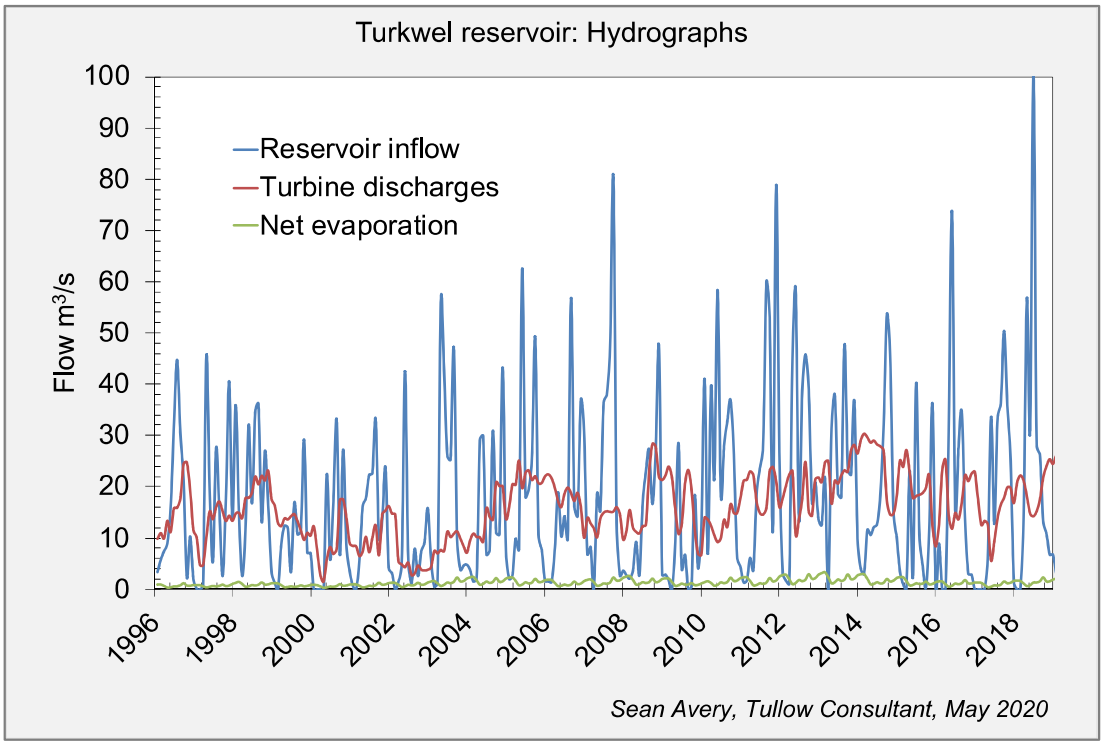


Figure 39: Turkwel reservoir hydrographs, 1996 to 2019

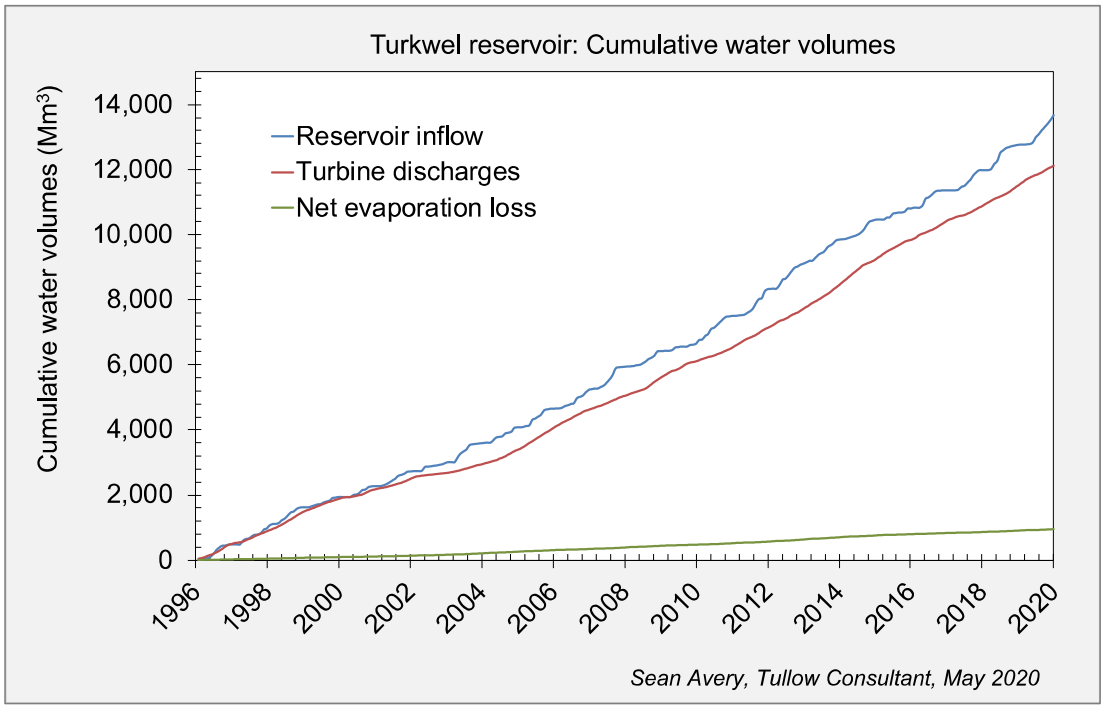


Figure 40: Cumulative water volumes, 1996 to 2019

4.5.2 Reservoir inflow and catchment rainfall integrity test

The integrity of the catchment rainfall and reservoir inflow results was tested through standard double-mass analysis in Figure 41 below. The curvature of the data plot indicates an increasing runoff proportion relative to rainfall, which would be consistent with earlier findings in this report.

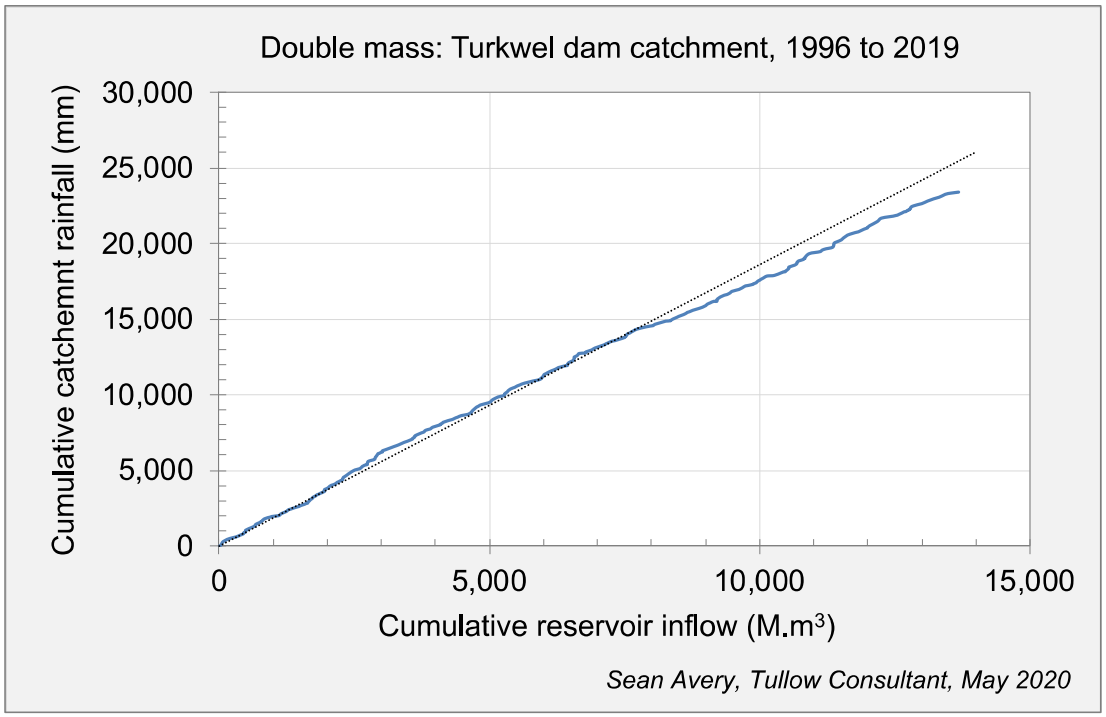


Figure 41: Turkwel catchment rainfall / runoff double-mass test

4.5.3 Turkwel past and recent flow and catchment rainfall integrity

The historic and recent flows at the dam site have been contrasted by double-mass plotting in Figure 42. The Turkwel cumulative flow data from different periods are plotted on the y-axis. The cumulative Mount Elgon rainfall recorded at the Andersen Orchards location is plotted on the x-axis. Note that there was a rainfall data source transition point in 1981 from the rain-gauge to the CHIRPs data. The double-mass plot has clearly illustrated the evolution of the yield assessments for the dam, as follows:

- 1961 – 1978: The dam's preliminary design had generated an average daily flow (ADF) of 22.6 m^3/s from an infilled data series.

- 1978 – 1985: With several years actual gauged data available downstream of the dam, the ADF was reduced to 18.2 m^3/s. This gauging station was operated till the dam started filling in 1990 and the dam design team was at that time still debating the long-term ADF being between 18 and 19 m^3/s. There is an inflection point in the graph when the ADF changed. The infill equation previously used by the design team to generate the 1961 to 1978 series had been over-predicting flows.

- 1991 – 2012: These "test flows" were provided by KVDA in lieu of reservoir inflows and were used in the Tullow preliminary hydrology review. The accompanying computation methodology was not provided by KVDA, so these data are marked in the graph as "uncorrected" (and plotted up to 1995 only). The data averaged 15.4 m^3/s, and these were probably the machine discharges rather than reservoir inflows (in other words evaporation losses need to be added to determine reservoir inflows).

- 1996 – Dec 2019: These reservoir inflows were generated by the Consultant's water balancing. The resultant 18.0 m^3/s ADF matches the final flow estimate that the design team had earlier derived from the Twin Islands gauged flow data. Note also that the slight curve compared to the dotted straight line would be consistent with an increasing percentage runoff trend, as noted above.

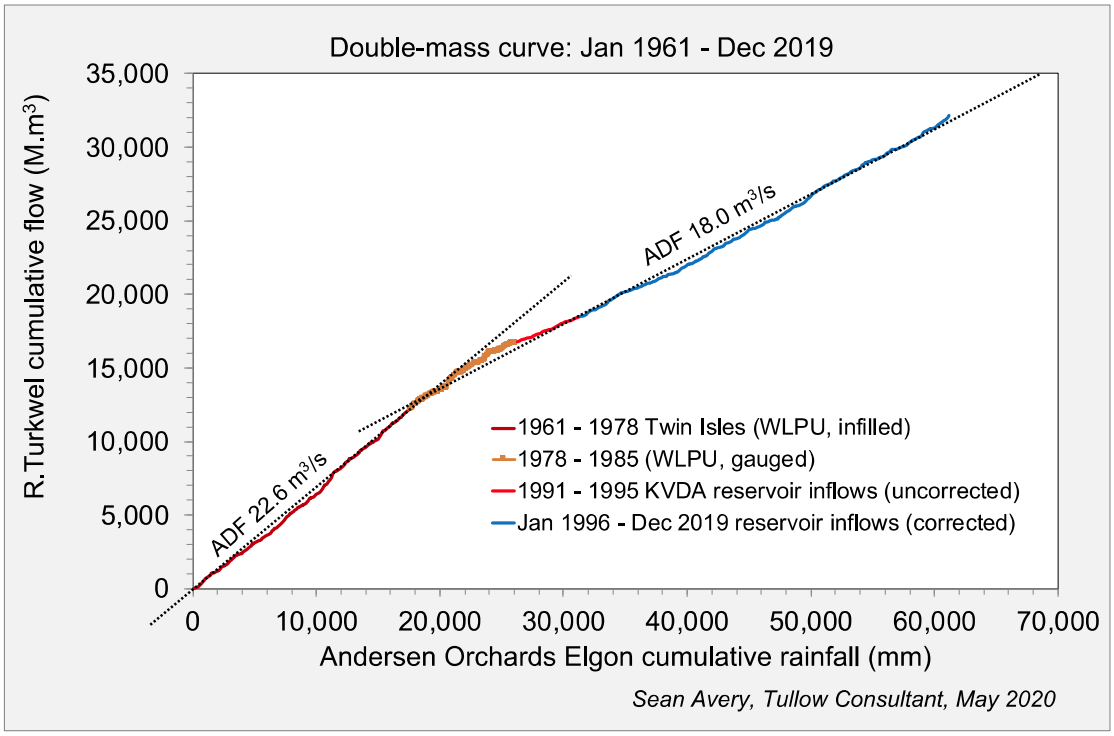


Figure 42: Double-mass analysis - Turkwel flows and Mount Elgon rainfall

4.5.4 Reservoir drawdown impact due to direct abstraction

The Turkwel reservoir fell below its minimum generation level on 511 days over the period January 1996 to December 2019 (for over 5% of the period, see Figure 29). On average the turbines are running 12.5 hours per day, which is not high. The power station is being managed very close to the limits of the existing water resource in order to maximise power generation.

The Lokichar South Development Project plans to abstract up to 40,000 m^3/d (0.46 m^3/s) from Turkwel.[36] This is 2.55% of the reservoir inflow, and if abstracted direct from the reservoir, this is equivalent to increasing the net evaporation loss from the reservoir by 37%. This in turn will draw down the reservoir water elevation profile.

This planned abstraction would have taken the historic reservoir operation closer to, and on occasion breaching its minimum generation limits (Figure 43). By operating at a lower elevation, there is a reduction in reservoir surface area and hence a saving in evaporation loss that was taken into account in developing the graph. Note that the reservoir intake tunnel invert is only 14 metres below the minimum generation elevation (Figure 44), and in order not to breach the minimum generation level, Kengen would need to reduce their turbine discharges and associated power generation.

Another option that had been considered by Tullow is to abstract downstream from the tailrace, in which case the reservoir levels are not affected as they would be controlled solely by turbine releases. That option would require adequate storage provision as the turbine water release is not continuous.

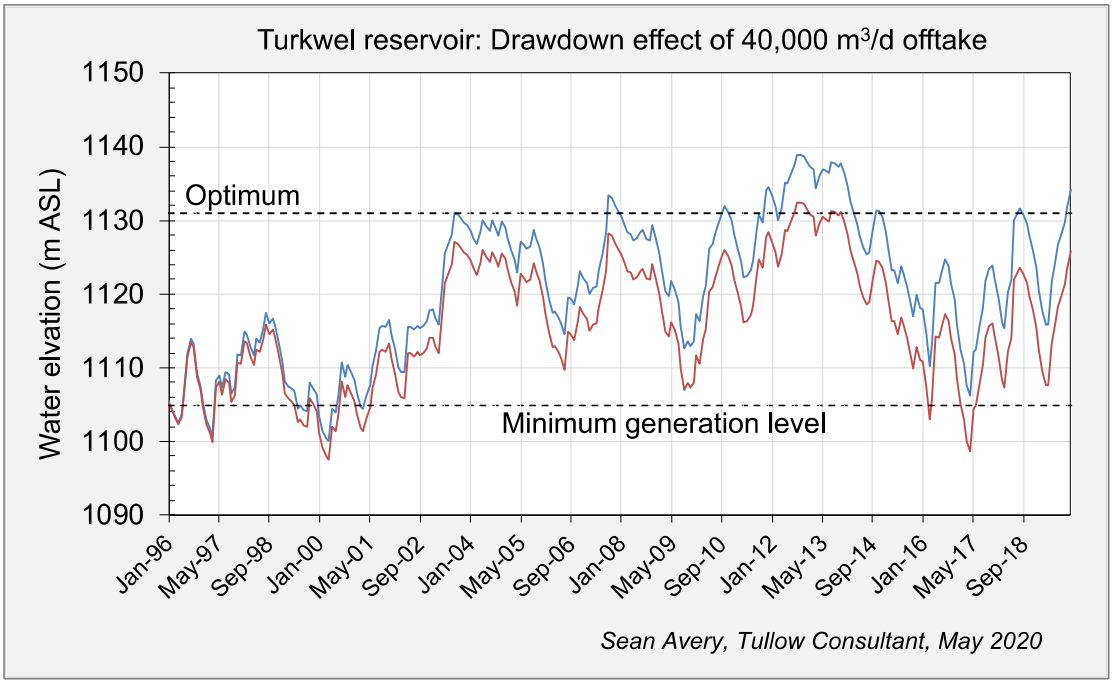


Figure 43: Turkwel reservoir drawdown caused by direct abstraction

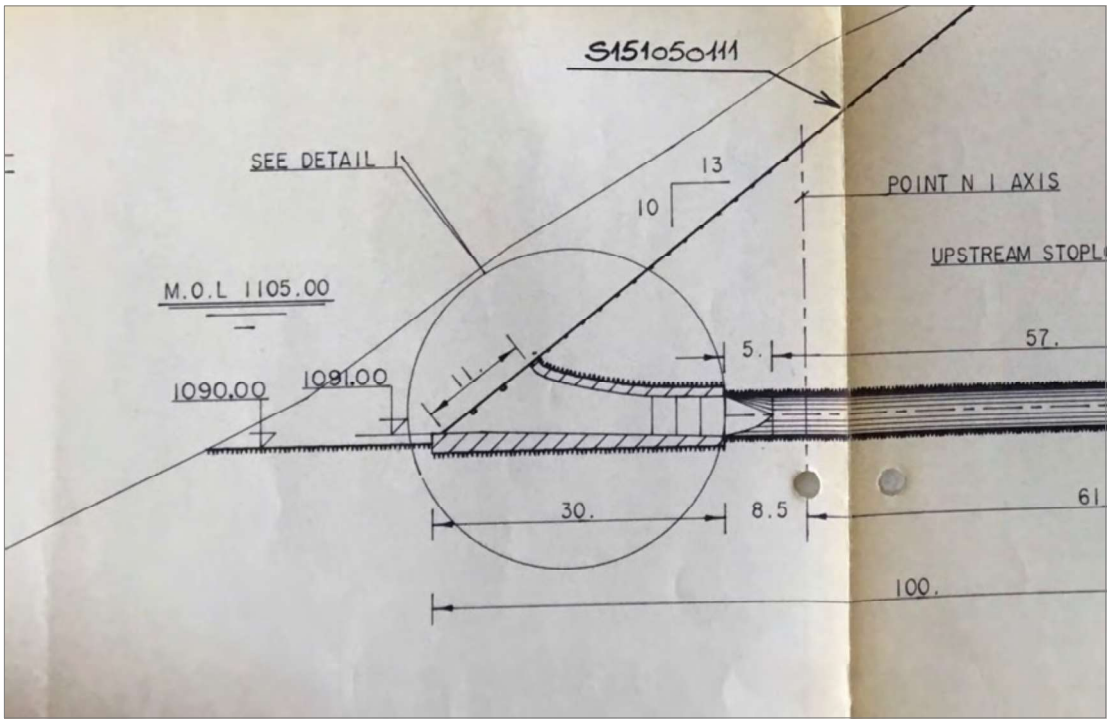


Figure 44: Turkwel power station intake invert level relative to MOL [72]

[72] MOL = Minimum operating level = Minimum generation level = 1105 m ASL, as shown on this extract from a Sogreah design drawing seen at Turkwel dam.

5 RESERVOIR SEDIMENTATION

5.1 Design sedimentation rates

The dam has created a reservoir of gross potential storage capacity 1,641 hm^3 at full supply level 1150 m ASL, zoned as shown in Table 14 below:

Table 14: Storage zones of Turkwel reservoir [73]

Storage zone	Elevation range (m ASL)	Storage volume (hm^3)
Active storage	1105 to 1150	1,478
Inactive storage	1070 to 1105	159
Dead storage	< 1070	4
Gross storage	1150	1,641

The extent of the reservoir's original planned inundated area at elevation 1130 m ASL is illustrated in Figure 45 below.[74] This elevation is very close to the optimum generation water elevation determined in the dam's final design.

In order to adequately size the reservoir dead storage provision over the life of the dam, the Turkwel dam design team carried out extensive reservoir sedimentation studies, including sediment load measurements during floods. These concluded with the adoption of a sedimentation rate of 10 hm^3/y, but with a warning that this could increase (as illustrated in Table 15). At annual rates of increase of 1% and 2%, the gross storage of the reservoir would be filled with sediment in less than 100 and 75 years respectively from 1990 (namely by 2090 and 2065 respectively).

Table 15: Potential sediment yield scenarios presented in the Turkwel designs [75]

Period	Sediment yield annual rate of increase					
	0%		1%		2%	
	Implied rate in final year (hm^3/y)	Total sediment volume (hm^3)	Implied rate in final year (hm^3/y)	Total sediment volume (hm^3)	Implied rate in final year (hm^3/y)	Total sediment volume (hm^3)
By 2017	10	270	13	308	17	353
After 50 yrs	10	500	16	651	27	863
After 75 yrs	10	750	21	1,120	44	1,742 *
After 100 yrs	10	1,000	27	1,722 *	72	3,185 *

*Note: * Gross storage capacity exceeded. Dam closure date 1990. After 75 yrs = 2065.*

The dam design determined that incoming sediments carried principally by the Suam River would be mostly sand and silts.[73] On reaching the impounded water body, the heavier sand bed load of the Suam would form a delta. The delta's leading sand wedge would advance

[73] Turkwel Gorge Multipurpose Project – Dam – Hydropower Plant – Transmission Line, Part 2, Final Design, Volume 2-2, Reservoir Capacity and Allocation, Sogreah Consulting Engineers, 1987.
[74] At the time of the Feasibility Study in 1979, 1130 m ASL was being considered as the top water elevation. During the final design, this top water elevation was increased to 1150 m ASL.
[75] KVDA, Sediment yield at Turkwel dam, WLPU Consultants, 1987.

progressively down the reservoir, eventually reaching the dam's power station intake. Fine sediments would meanwhile distribute throughout the reservoir. Although some fine sediment would be carried from the reservoir through turbine discharges and through regular low-level flushing from the dam, the reservoir design conservatively presumed 100% of the sediment inflow would be caught.[73]

The dam design forecast that fine sediments would settle uniformly in the vicinity of the intake and dam, and the sediment bed elevation would reach the invert of the power station intake after about 30 years (2020). These sediments would comprise fine silts and clays, and provided the turbine operation was continuous, the fine materials would thereafter be drawn into the intake tunnel and would pass through the turbines and on downstream without causing any damage. And in time, the advancing wedge of sands would reach the intake. [73]

The dam design had forecast that the sediment level would reach the minimum operating level 1105 m ASL "after some 50 years", thereby exhausting the inactive storage provision in Table 14 in 2040. And the sediment level would reach 1130 m ASL "after 80 years" (2080). But the design states that the intake and power station would still operate. [73] It was presumed that the dam's low-level outlet would be regularly operated and would sluice fine sediments downstream.

As the reservoir's gross storage capacity would reduce with time, regular bathymetric surveys were included in the dam's operating procedures in order to track changes in storage and to plan sediment management accordingly.[76]

[76] Assistance to Dam Monitoring, Procedure for reservoir siltation monitoring, Sogreah Consulting Engineers, September 1995.

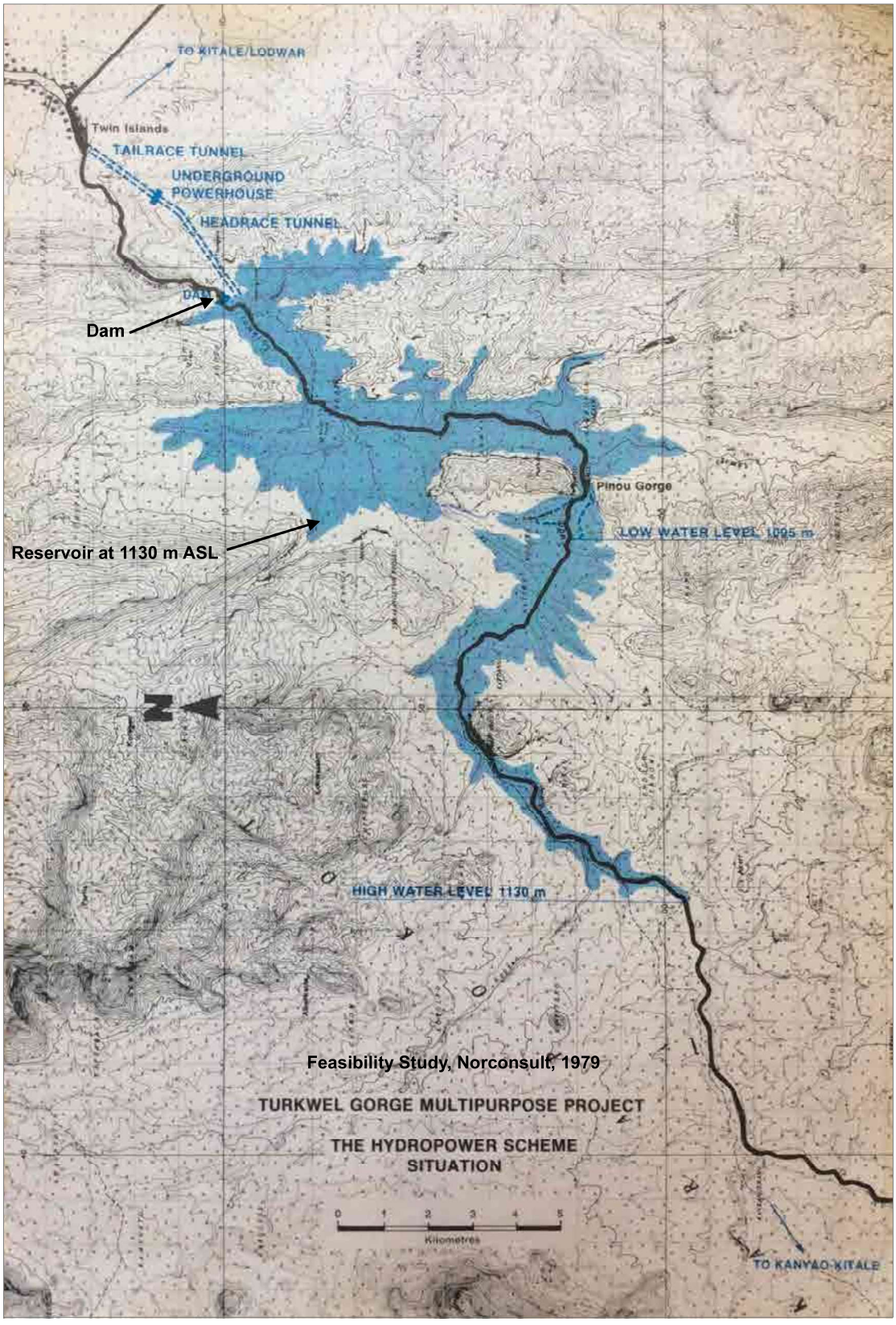


Figure 45: Turkwel reservoir contour map and inundation extent at 1130 m ASL

5.2 Reservoir sedimentation surveys

5.2.1 Bathymetry survey background

Although routine bathymetric surveys of Turkwel dam's reservoir were part of the dam operating procedures,[76] these tasks were not achieved by the dam monitoring team due to technical difficulties with the equipment that had been procured.

The Consultant reviewed KVDA's depth-sounding equipment and the original survey methodology (prepared in 1995), and determined that with the advances in technology, these were now out-dated and redundant.

A bathymetric field survey was planned by the Consultant, and this was undertaken in two stages, as follows:

- A preliminary reconnaissance survey was carried out by boat in September / October 2016 using a Garmin echo-sounder with inbuilt GPS. This survey confirmed that significant sediment deposition had occurred.[77] The high turbidity of incoming water at that time is well-illustrated in Figure 47 at the point where the Suam river was reaching the reservoir.
- More sophisticated sounding and positioning equipment with software were then procured (Figure 48), and the detailed bathymetric field survey was conducted in October 2017. Over several days, the entire inundated reservoir zone was tracked with a survey boat equipped with the modern depth-logging and GPS-positioning equipment (Figure 49).[78] Depth soundings were calibrated in-situ, and readings were corrected for changes in the reservoir water elevation during the survey. Reservoir water level monitoring throughout the survey was achieved through reference to the dam's water level gauges (Figure 25, Figure 26, Figure 27).

As the baseline for the sedimentation study was the original reservoir mapping, the original river centreline on that mapping was adopted by the Consultant as the basis for measuring chainages from the intake to the uppermost limits of the designated reservoir zone (Figure 46).

5.2.2 Water elevation during surveys

It is worth bearing in mind that the Turkwel reservoir was designed with a full supply level (FSL) of 1150 m ASL with sediment eventually accumulating throughout this zone (up to km 35 and 36.4 km in Figure 46). To date, the reservoir water elevation has never reached full supply level. The reservoir's maximum daily water elevation since 1990 was 1139.24 m ASL, and the reservoir has generally operated below the optimum generation elevation of 1131 m ASL (Figure 28). This means that the Suam delta has formed much further downstream than had been expected at the dam design stage.

The water elevation prevailing during the 2017 survey was 1122 m ASL, and the reservoir has operated above this level 45% of the time (Figure 30). Thus, there were significant dry areas upstream which have in the past been inundated and subject to delta sediment depositions not captured by the bathymetric survey (e.g. the non-tracked blue areas in Figure 49).

[77] Strategic Water Supply for Development, Turkwel Dam Option, Field Reconnaissance Report 2, Turkwel Reservoir & Hydrology – Sept/Oct 2016, by Sean Avery, Consultant to Tullow Kenya BV, Oct 2016.
[78] Strategic Water Supply for Development, Turkwel Dam Option, Reservoir Bathymetric Survey 2017, by Sean Avery, Consultant to Tullow Kenya BV, April 2018.

Figure 46: Turkwel reservoir centreline to FSL (distances in km from intake)

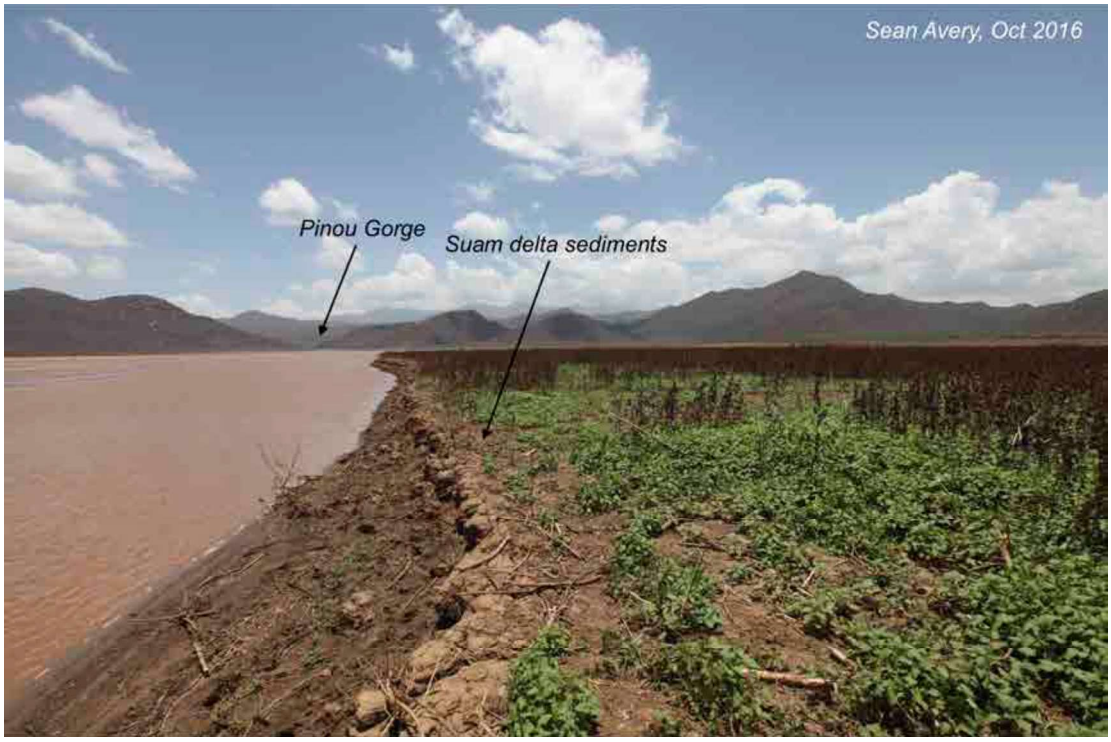


Figure 47: The upper reservoir Suam delta zone upstream of Pinou Gorge [79]

[79] Photo taken looking downstream from the south bank in the vicinity of km 12 in Figure 46. Note turbid incoming water and the large flat area of siltation deposits to the right. This is the flood plain immediately upstream of Pinou Gorge (km 10 in Figure 46).

Figure 48: Boat-clamped transducer / GPS pole, laptop and CEESCOPE Control Unit

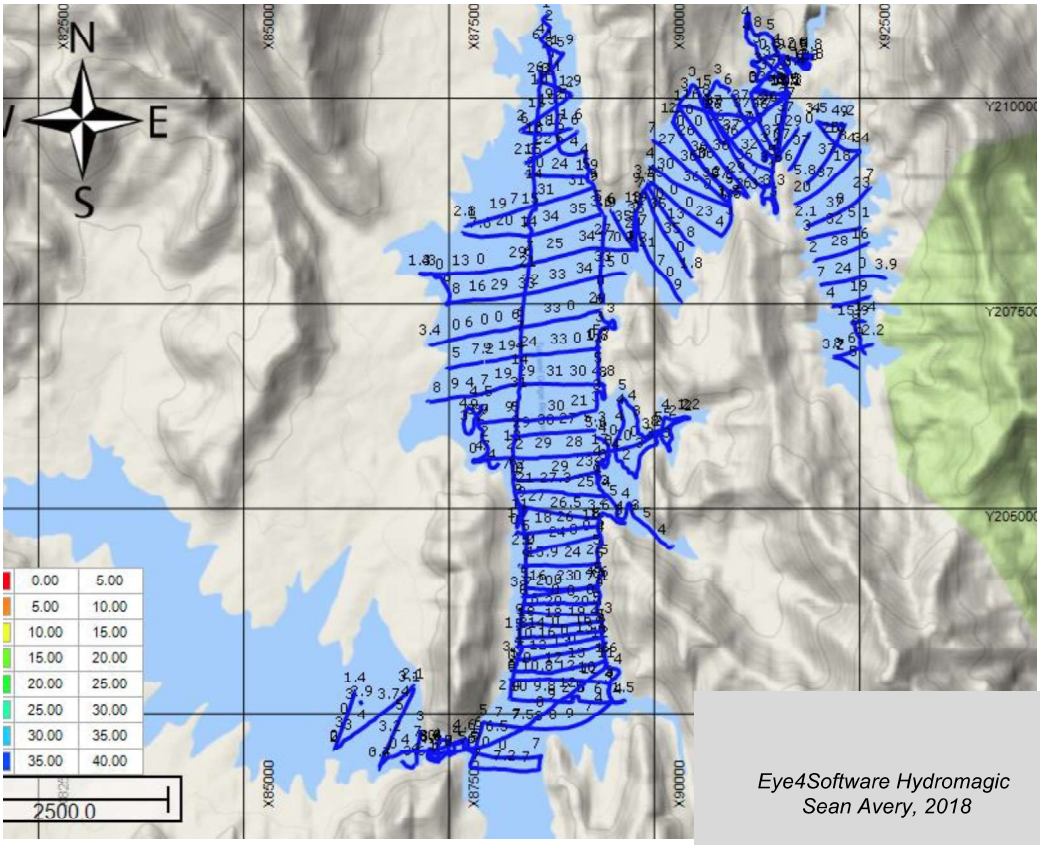


Figure 49: Bathymetric survey tracks and sounding depths in October 2017

5.2.3 Evolution of the Suam delta

Through comparison of available Landsat imagery, the Consultant's 2017 study demonstrated the progressive sediment accumulation within the Suam delta zone since the dam was commissioned.[78] Two examples have been included below in which baseline imagery in 1994/95 was contrasted with recent imagery with a matching water elevation level:

- Figure 50 – Elevation 1114 m ASL: At this water elevation the water was reaching km 16 in 1995, which is well upstream of Pinou Gorge. In contrast, 24 years later in 2019 at the same water elevation, the water did not even reach Pinou Gorge due to sediment that had accumulated since 1995. In this 2019 image, the delta sediment tongue is visible spilling downstream through Pinou Gorge.

- Figure 51 – Elevation 1117 m ASL: The water elevation in these images was three metres higher than above. The same scenario of sediment infilling of the area upstream of Pinou Gorge is illustrated by the comparison of the two images dated 23 years apart.

Areas that would have been submerged in 1994/95 have since accumulated delta sediments that in effect form a dam blocking the extent of reservoir inundation upstream. This sedimentation process is ongoing, and progressive, and could accelerate with increasing catchment pressure.

06 February 1995 (WL 1114.25 m ASL)

20 April 2019 (WL 1114.15 m ASL)

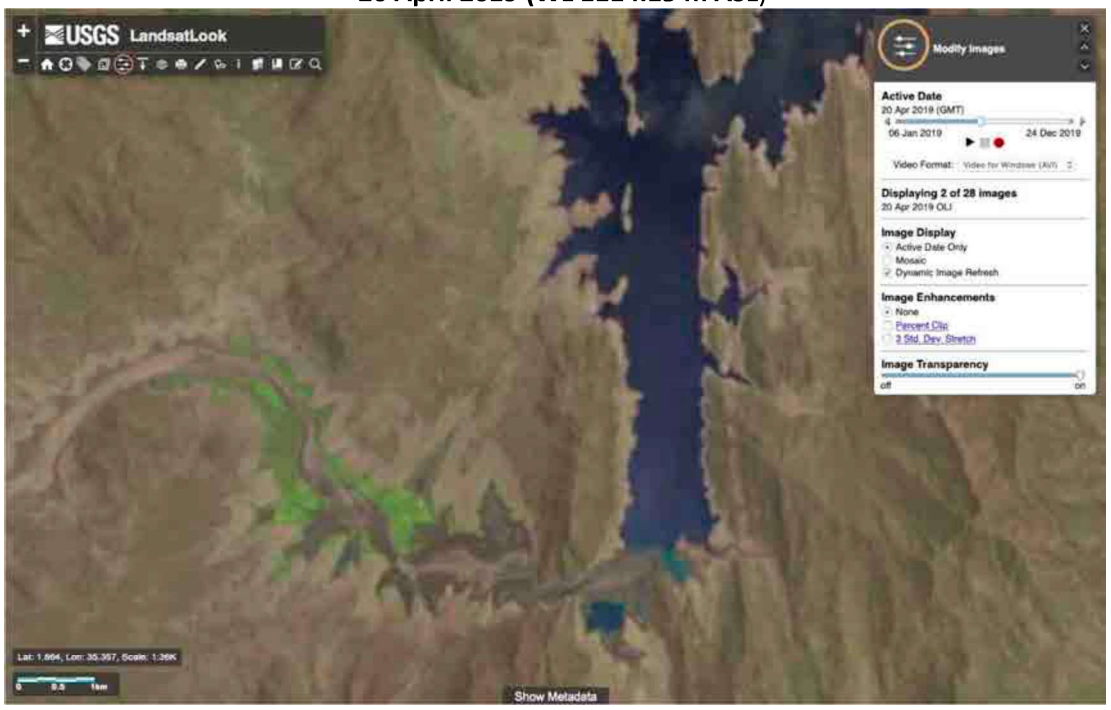
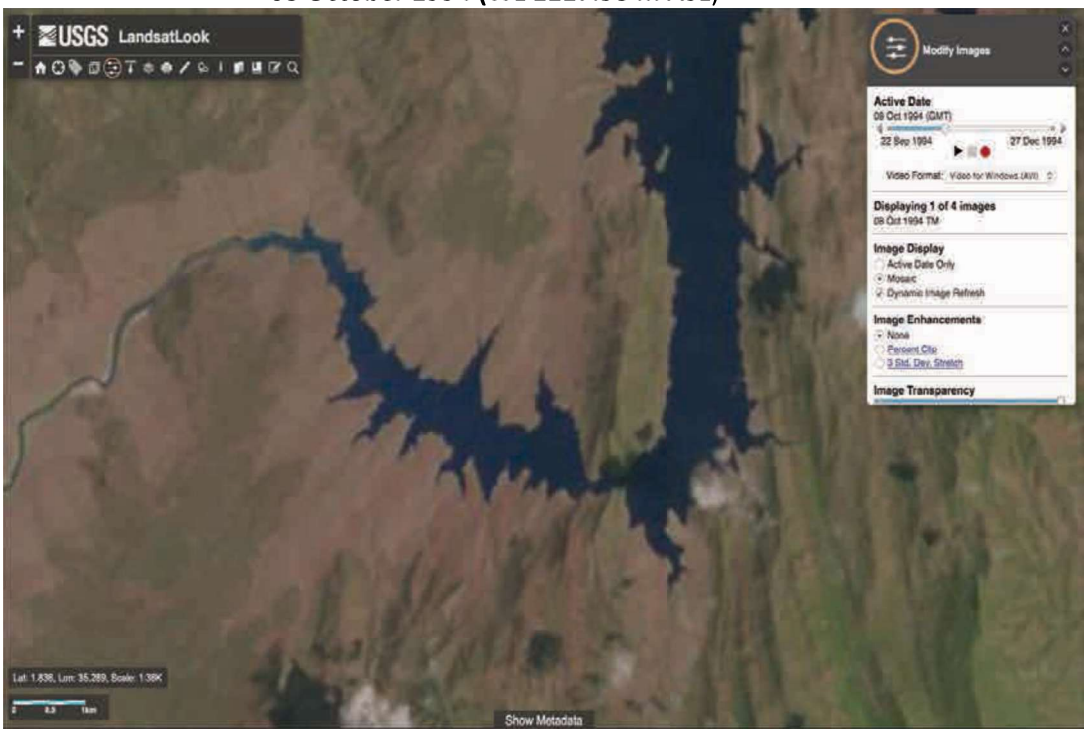


Figure 50: Suam delta deposition from 1994 to 2019 @ WL 1114 m ASL approx. [80]

[80] Imagery sourced from USGS Landsat archive.

08 October 1994 (WL 1117.58 m ASL)



20 Aug 2017 (WL 1117.15 m ASL)

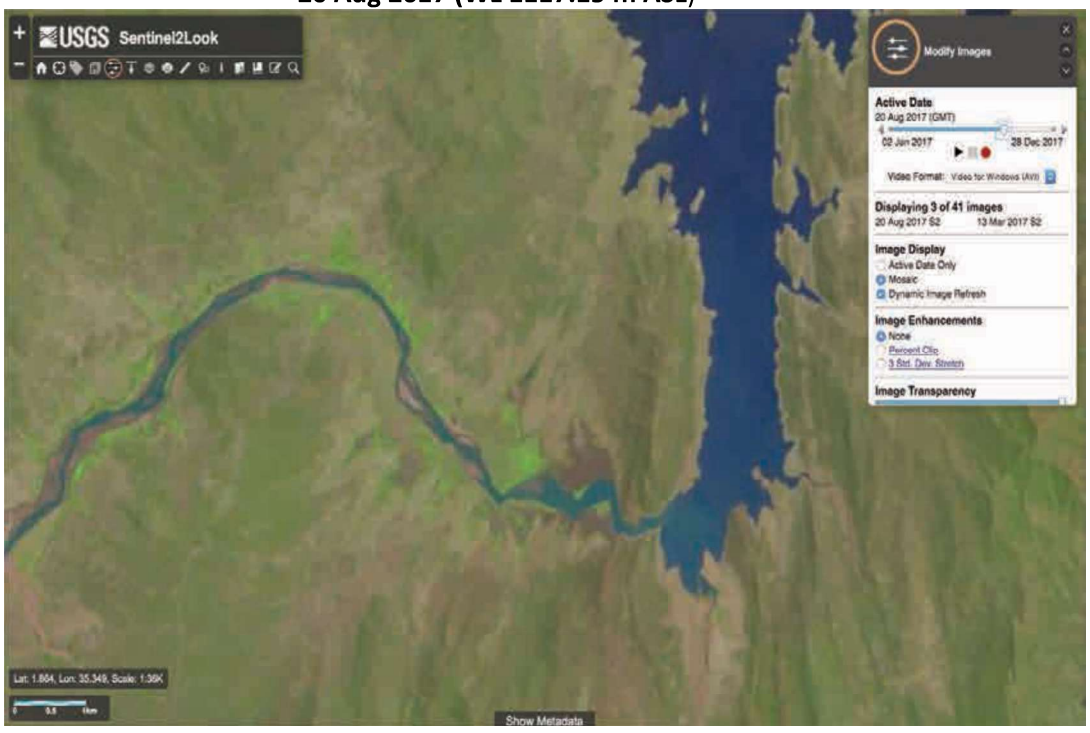


Figure 51: Suam delta evolution from 1994 to 2017 @ WL 1117 m ASL approx. [80]

5.3 Results of reservoir sedimentation survey

5.3.1 Sedimentation within the inundated zone

The Consultant's 2017 bathymetry survey results are presented in Figure 52.[78] The depth zones were coloured at 5-metre intervals up to 35-40 metres deep.

Four baseline valley cross-sections have been marked in Figure 53, and at each of these, the valley cross-sectional profile before the dam was constructed has been contrasted with the 2017 bathymetric survey findings (Figure 54). The extent of sediment deposition within the reservoir was well-illustrated by the infilling of the former river valleys revealed by the survey depth soundings. The sediment infill in the lower reservoir near the dam and intake in 2017 measured 37 metres. At the top end of the inundation zone at Pinou Gorge, the bed elevation had risen 23.5 metres above the baseline.

5.3.2 Sedimentation upstream in the delta zone and beyond to FSL

The delta zone above survey water elevation beyond Pinou Gorge had similarly accumulated sediment. The 2017 survey inundation extended only 0.5 kilometres beyond the gorge, but a study of Landsat imagery enabled the Consultant to map the sediment-affected bed profile further upstream.

The Turkwel reservoir water line in any Landsat image is a known contour line whose elevation above mean sea level is recorded constantly within the Turkwel power station. The Landsat imagery archive is up to date, and depending on cloud conditions, images are archived each month, and these cover the entire reservoir water elevation cycle. Thus, knowing the water elevation of each image, the Consultant was able to map the bed contour elevation changes within the reservoir inundation zone up to 1140 m ASL (Figure 55). And as the baseline maps are also contoured to the same mean sea level datum, the depth of sedimentation can be calculated. The 2017 analysis has been improved by the additional information provided through the very recent high water levels. In May 2020, the reservoir had reached almost 15 kilometres upstream of Pinou Gorge.

The sedimentation in the dry areas upstream of Pinou gorge would preferably be measured by topographical ground or aerial survey, but that task was beyond the scope of the bathymetric survey. Instead sedimentation was estimated from the accurate baseline mapping by means of the geometry logic shown in Figure 56 (this figure is derived directly from Figure 55), as reported earlier by the Consultant, but with updating:[78]

1. The plan surface areas of the reservoir upstream of Pinou Gorge were measured from the baseline 1:10,000 scale mapping for contour intervals 1100 to 1150 m ASL (Table 16). The intermediate contours were very hard to decipher on the paper print maps, but fortunately this did not matter as the contours are evenly spaced and were interpolated. The baseline storage volume was then calculated.
2. The horizontal line of each triangle in Figure 55 represents a measured contour surface area of the reservoir basin upstream of Pinou Gorge.
3. The volume within each triangle has been computed on the basis of the standard cone volume formula amended for the Turkwel topography (standard formula Volume = $^1/_3$ x cone base area x cone height). Because the survey cone base areas are not circular, the factor $^1/_3$ was calibrated from the baseline contour maps whose volumes were computed from areas measured by planimeter. A range of elevation-specific factors was derived.
4. The survey bed profile has been extrapolated upstream through analysis of the upper extent of water inundation derived from Landsat imagery on different dates (Figure 55).

The results show that 9 metres of sediment have accumulated at km 23 (Figure 46). The sediment depth is thus substantial but thinning as one progresses upstream.

5. The 1140 m ASL baseline bed contour is the limit of inundation to date and reaches km 30.1 (Figure 46). Hence this will be the upper limit for delta formation. And with back-up effects further upstream, sediments will have accumulated beyond this point.

6. The reservoir was designed to inundate to full supply level 1150 m ASL, this limit being reached at km 35 in the Suam tributary and at km 36.5 in the Kanyangareng tributary (Figure 46).

7. There are also unmeasured sediment deposits above 1122 m ASL in the deltas of small streams entering the reservoir perimeter downstream of Pinou Gorge. There are eight influx points draining a total catchment of 240 km^2, which is 4% of the total reservoir catchment (two examples in Figure 60 and Figure 61). This sediment deposition beyond the survey water level will be small compared to the Suam river, perhaps 4% of the Suam delta accumulation (on a catchment pro-rata basis).

Table 16: Baseline elevation / area / storage upstream of Pinou Gorge

Elevation (m ASL)	Area (hm^2)	Volume (hm^3)
1100	58.100	5.810
1122	655.000	84.000
1130	1,070.000	157.000
1140	1,873.445	312.819
1145	2,500.000	450.000
1150	3,300.000	625.000

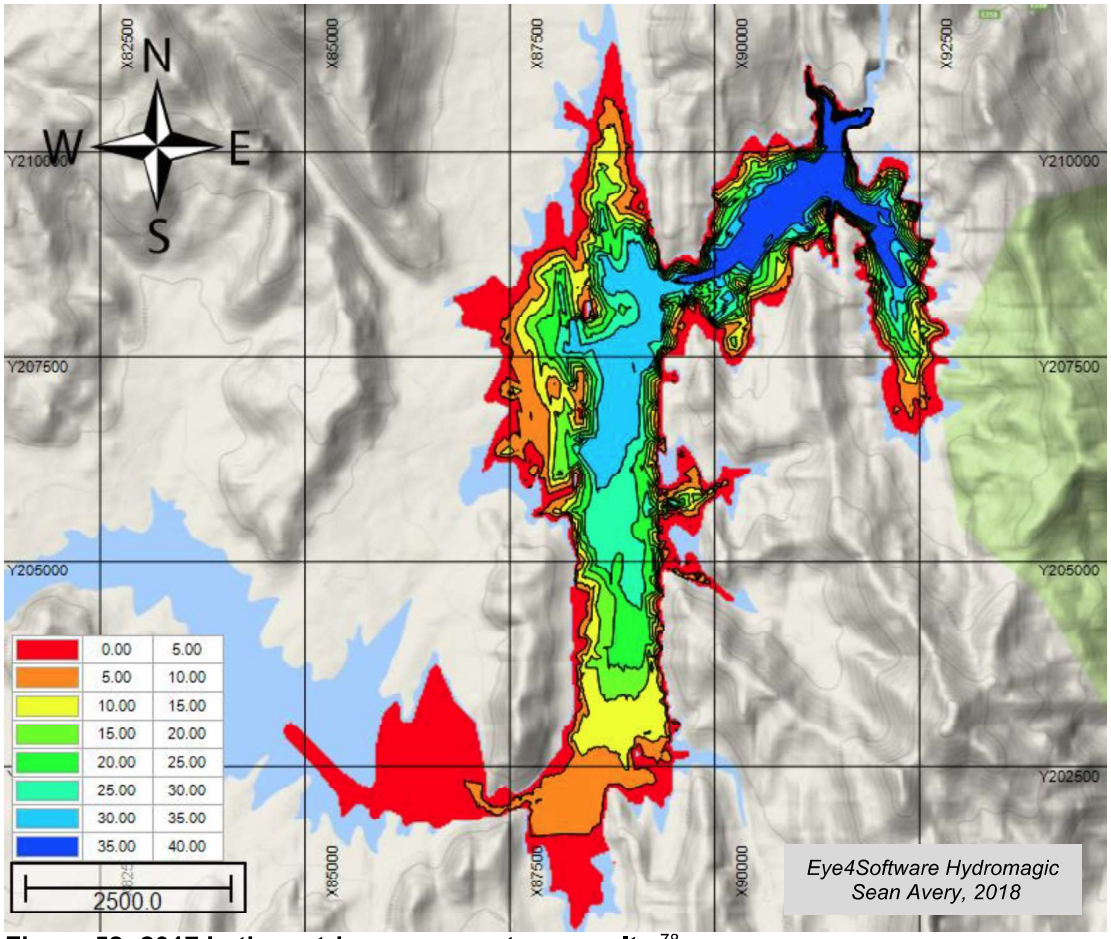


Figure 52: 2017 bathymetric survey contour results [78]

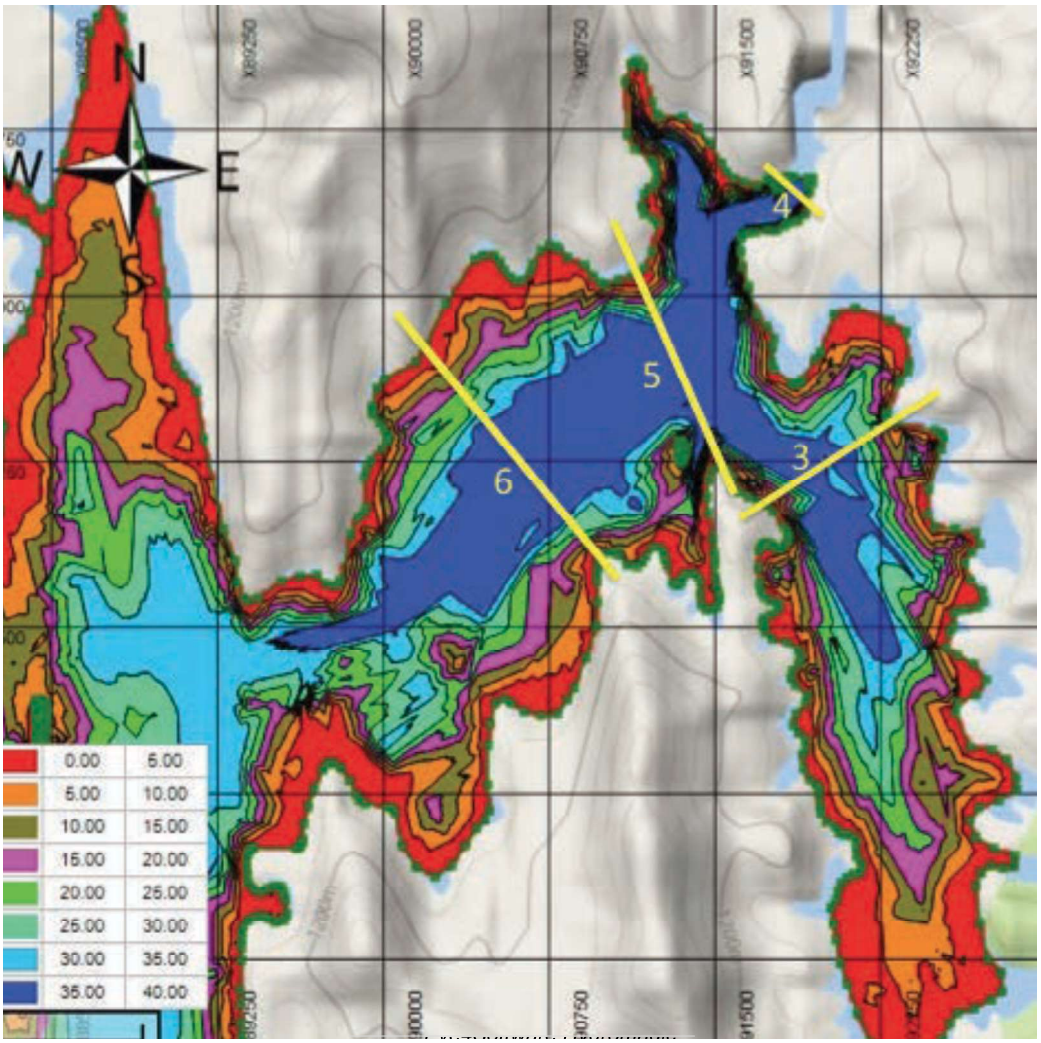


Figure 53: Valley cross-section locations selected near the dam and intake [81]

[81] Section 4 is close to the dam wall.

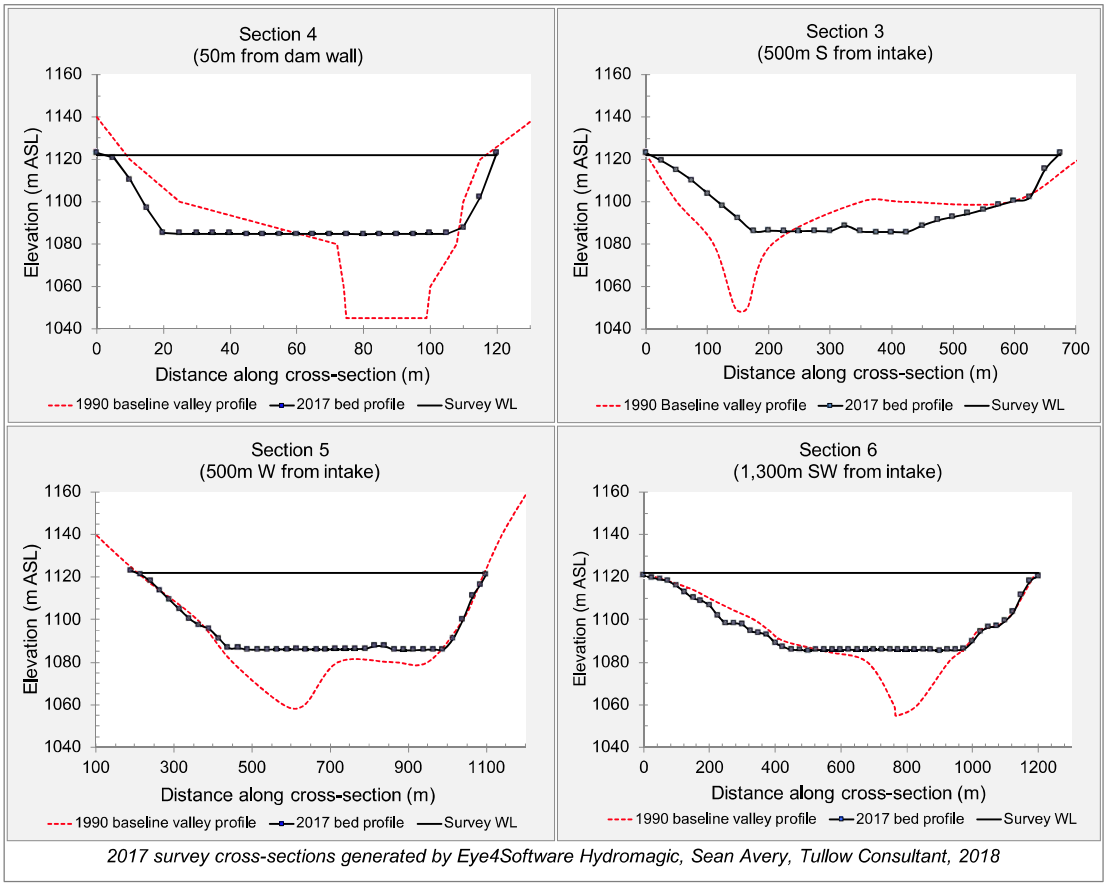


Figure 54: Siltation since 1990 at reservoir cross-sections near the dam

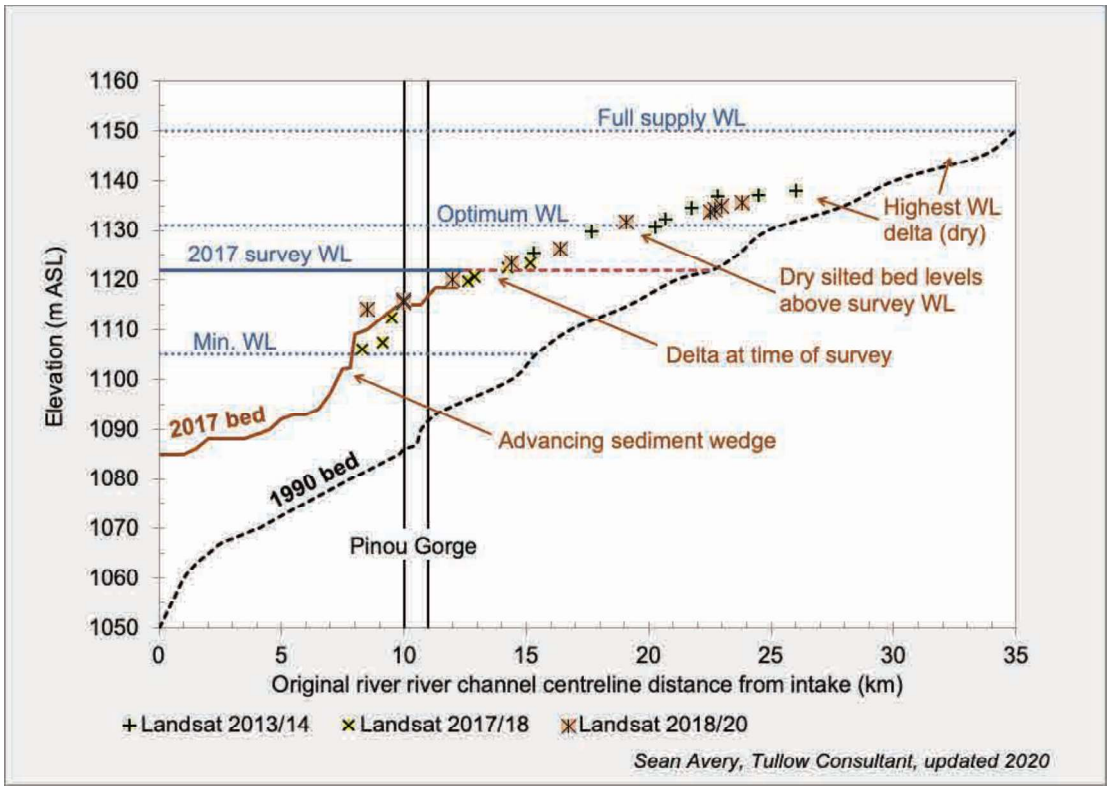


Figure 55: Longitudinal bed profiles through Turkwel reservoir (1990 and 2017)

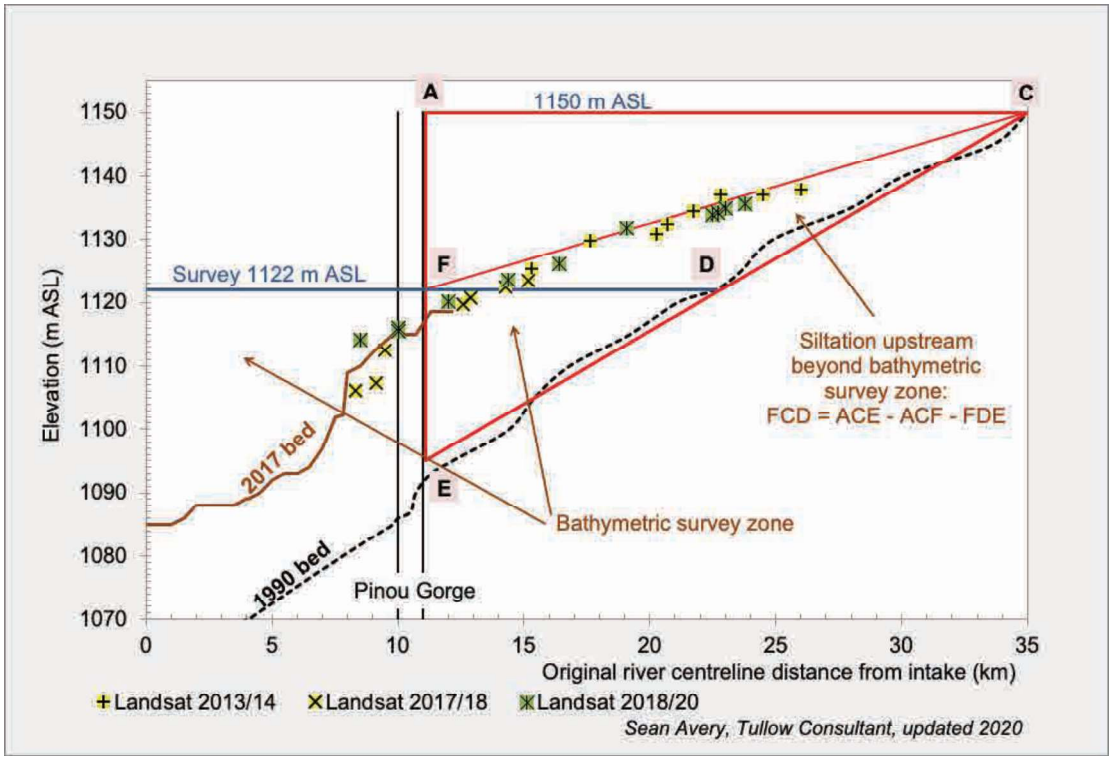


Figure 56: Sediment computation methodology in dry Suam delta zone upstream

5.4 Reservoir elevation / area / storage

5.4.1 Reservoir area shrinkage

The baseline elevation / area / storage data for Turkwel reservoir were abstracted by the Consultant from various design documents prepared by consulting engineers Sogreah and WLPU (Table 8).[78] The baseline reservoir surface areas were checked on hard copies of the contoured maps by means of a planimeter, and the results plotted on Figure 57 validated the baseline exactly.

The reservoir contoured mapping was based on photogrammetric mapping compilations from aerial photography dated 1978.[82] Some reservoir cross-sections may have been re-shaped during construction, notably close to the dam wall (an example being Section 4 in Figure 54). Final "as-made" documents and drawings were sought for the dam project, but were not accessed, so final valley profiles in Figure 54 near the dam could not be checked. Whilst the baseline cross-section profiles may vary, the geo-referenced sounding depths are accurate.

The Consultant's bathymetric survey results show shrinkage of the reservoir area with depths up to the survey water level (Figure 57). This shrinkage is consistent with the sediment build-up in the Suam delta together with the many small deltas on the reservoir perimeter, especially as cultivation to water's edge is being allowed. Note that it was not easy recording the exact shoreline edge from a boat in shallow water, although the plan areas at the lower depths are

[82] Kerio Valley Development Authority, photogrammetric compilation and drawing at 5-metre contour intervals based on aerial photography dated 1978, with elevations based on Survey of Kenya triangulation datum, done by Geosurvey International Limited, dated August 1982.

accurate as these were generated from the geo-referenced soundings by processing through the Eye4Software Hydromagic.

5.4.2 Reservoir volume reduction within survey zone (below 1122 m ASL)

The survey measured a siltation volume of 127.7 hm^3 within the reservoir up to 1122 m ASL, with $^2/_{3rd}$ of this amount (84 hm^3) having accumulated below 1122 m ASL upstream of Pinou Gorge (Table 17). [78]

The bathymetric survey results showed a 28.1% reduction of the storage within the area inundated at the time of the survey.

The inundated area at the time of the survey extended only a short distance upstream of Pinou Gorge (Figure 55).

Table 17: Turkwel elevation / storage / siltation (up to water elevation 1122 m ASL)

Water Surface Elevation (m ASL)	1990 Storage Volume (m^3)	2017 Storage Volume (m^3)	Siltation Volume (m^3)	Siltation as percent 1990 Storage (%)
1122	454,544,000	326,852,856	127,691,144	28.1%
1118	365,089,000	250,683,795	114,405,205	31.3%
1114	289,975,000	190,887,026	99,087,974	34.2%
1110	227,239,000	142,389,095	84,849,905	37.3%
1106	175,247,000	102,656,773	72,590,227	41.4%
1102	132,563,000	69,532,845	63,030,155	47.5%
1098	97,874,000	42,224,773	55,649,227	56.9%
1094	70,077,000	21,563,428	48,513,572	69.2%
1090	48,295,000	7,804,314	40,490,686	83.8%
1086	31,825,000	867,379	30,957,621	97.3%
1084	25,398,000	1,329	25,396,671	100.0%

Notes: Analysis using Eye4Software Hydromagic, Sean Avery 2018

5.4.3 Reservoir volume reduction beyond survey zone (above 1122 m ASL)

Based on Landsat imagery, two estimates of sedimentation volumes upstream of Pinou Gorge beyond the inundated zone have been calculated (Table 18).

These estimates show more sediment deposited upstream within the designated FSL compartment than was measured within the reservoir inundated zone below 1122 m ASL.

5.4.4 Reservoir volume reduction in total within FSL zone

In total, the computed sedimentation amounted to between 19.6 and 23.1% of the gross provision within Turkwel reservoir (Table 18).

These total sedimentation amounts have been converted to annual rates of sediment deposition, and are compared with the design forecast scenarios in Figure 59. The results are within the design scenarios presented earlier in Section 5.1.

Table 18: Summary of Turkwel sediment influx updated in 2020

Survey analysis	Sediment volumes 1145 m ASL Minimum estimate	Sediment volumes 1150 m ASL Higher estimate
Bathymetric survey @ 1122 m ASL (Oct 2017 inundated zone)	127,691,000 m^3	127,691,000 m^3
Add reservoir sediment influx 2018 and 2019	9,458,600 m^3	9,458,600 m^3
Dry sediment upstream of Pinou Gorge above 1122 m ASL	177,818,200 m^3	232,430,180 m^3
Sub-total sediment in 2019 (survey plus upstream of Pinou Gorge)	314,967,900 m^3	369,579,900 m^3
Small reservoir perimeter delta sediments above 1122 m ASL [83]	7,233,280 m^3	9,454,790 m^3
Total sediment deposited within whole reservoir FSL zone in 2019	322,201,200 m^3	379,034,700 m^3
Total sediment in 2019 as % gross storage	19.6%	23.1%
Average annual catchment sediment runoff	10.740 hm^3/y	12.634 hm^3/y

[83] The dry sediment runoff accumulation around the reservoir perimeter above 1122 m ASL was not quantified in the Consultant's 2018 bathymetry report to Tullow.

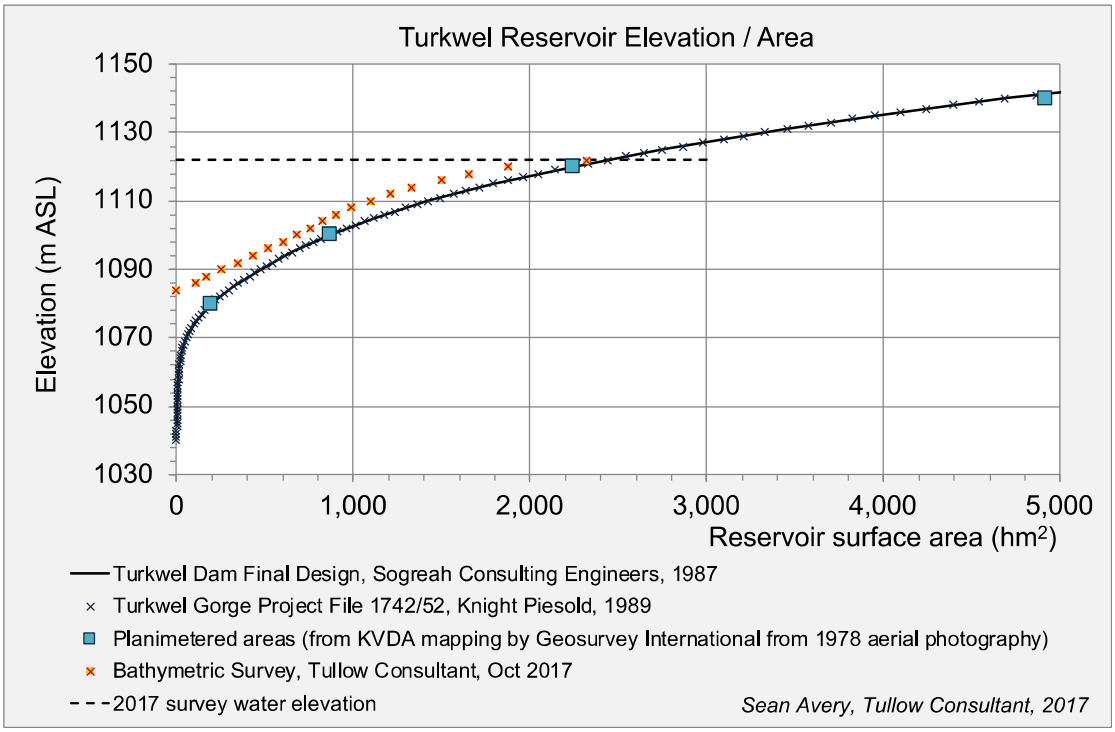


Figure 57: Elevation / area curves for Turkwel reservoir

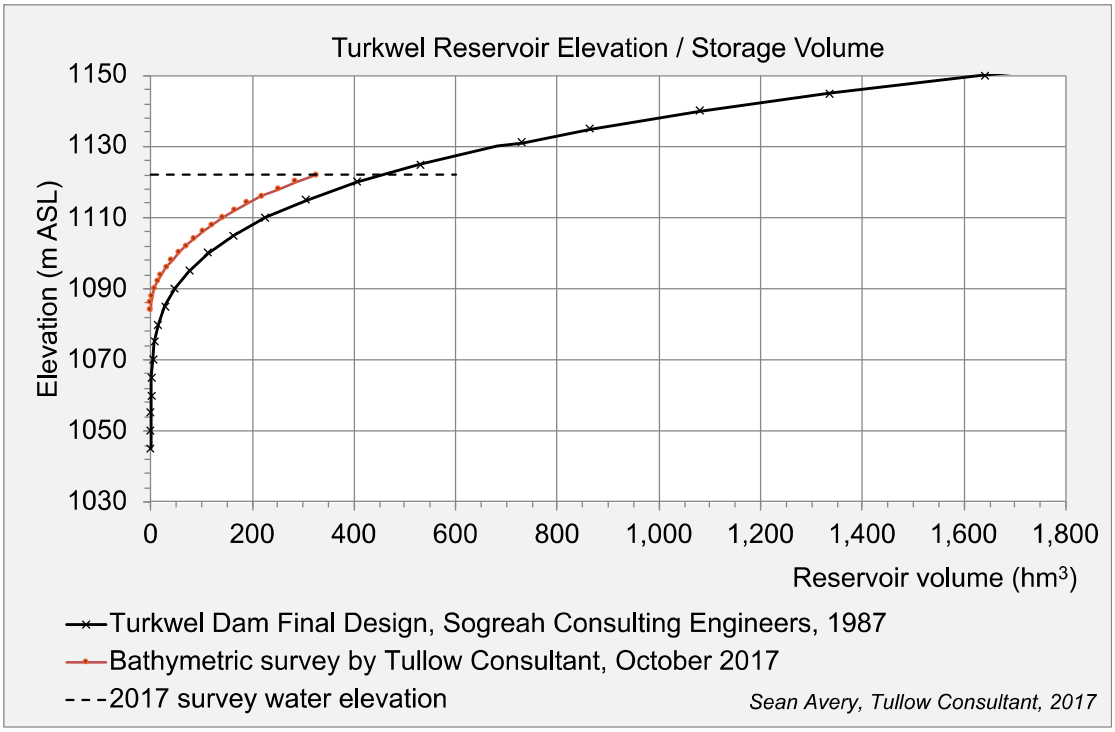


Figure 58: Elevation / storage volume curves for Turkwel reservoir

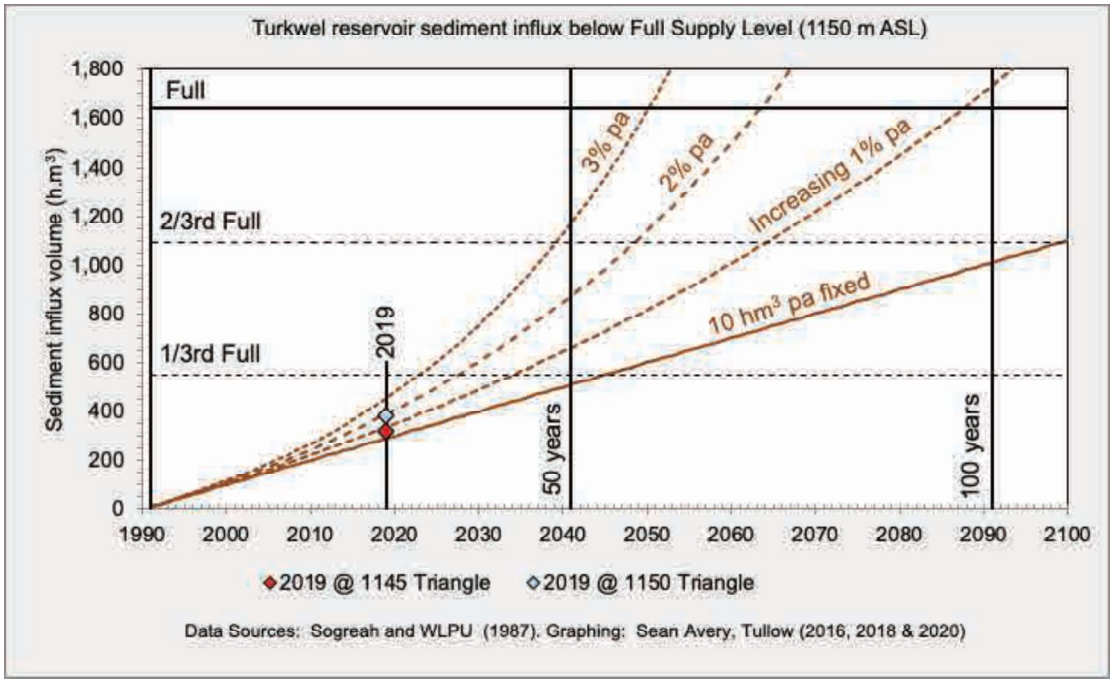


Figure 59: Turkwel design sedimentation scenarios, 2017 survey updated to 2019

5.5 Catchment land use, degradation, and mitigation

The Rift Valley Basin Plan and West Pokot's recent County Integrated Development Plan acknowledge that soil erosion and land degradation within the County remain a major challenge.[84]

Examples of land use practices that exacerbate soil wash into the reservoir are to be seen along the shores of Turkwel's reservoir itself, where cultivation is allowed far below the full supply level set aside for the reservoir, and usually right up to water's edge, as illustrated below:

- Figure 60 and Figure 61: These aerial views of the reservoir shore show demarcated farming areas around the small incoming streams and their deltas.
- Figure 62 and Figure 63: These reservoir-level views show farming following the water level closely and then becoming inundated when reservoir levels rise. This traditional flood-recession farming understandably exploits the proximity of the water table and new soil deposits.
- Figure 64: This image is on the Suam river channel within the designated reservoir zone (km 24 in Figure 46 and Figure 55). The sandy riverbed is over 300 m wide, which is 3-times what it was when the reservoir was commissioned.

An inspection of Google Earth imagery shows riparian flood recession cultivation being practised beyond the reservoir zone upstream. This is particularly evident along the Suam river, some examples being as follows:

[84] Rift Valley Basin Plan, Kenya Water Security and Climate Resilience Project, Second Draft, November 2019, p.116, citing West Pokot CIDP, 2018.

- Figure 65, and Figure 66: These aerial images in the lower Suam illustrate the understandable preference of farmers in dry areas to farm adjacent to the river channel. The small tributaries are full of sand.

- Figure 67: This aerial image in the lower Suam illustrates the degradation and consequent flood runoff erosion that can result from farming (note degraded area to the left of the main channel).

- Figure 68: This aerial image of the upper Suam river shows the boundary between the protected area of Mount Elgon and the intensive contoured cultivation below. The contrast is striking. During a site visit by the Consultant in 2016, a local farmer near Suam Bridge complained of progressive encroachment and tree removal from the riverine areas.

Although the flood recession / riparian zone practices are traditional and understandable in dry areas, they disturb the soils within the flood contributing area and exacerbate soil runoff. These are zones within which indigenous vegetation cover might otherwise flourish and protect soils from erosion. Uncontrolled access of livestock similarly generates riverbank erosion passages.

The Turkwel reservoir's lifetime will depend on the dam owner and the county government's policy in catchment protection measures, especially within the vital riparian zones, not only adjacent to the defined reservoir zone, but along the rivers too.

5.6 Future sedimentation risk forecast

The Consultant's bathymetric survey has provided an accurate assessment of the sediment accumulation within the inundated reservoir area at the time of the survey. Upstream of Pinou Gorge, an indirect method was applied, the study of Landsat imagery having provided a visible perspective into the reservoir physical changes with sedimentation over time.

In the absence of the final design hydrology report for Turkwel dam, it was not possible to check the detailed sediment yield methodology adopted at that time. The design review in 1987 by WLPU Consultants was non-committal, having described the proposed design sediment yield as "high, but neither improbable nor incapable of a substantial increase".[75]

The Consultant's 2017 survey analysis is consistent with the design scenarios reproduced in Figure 59. These show the original design sediment yield scenarios to have been realistic, as were the warnings at that time of possible increases. The erosion of the Kongelai river gauging station is clear evidence of increasing flood severity in recent years (illustrated earlier in Figure 15). This observation is critical as floods carry the bulk of the sediments transported by the river. Likewise, the extent of cultivation within the reservoir zone and along the Suam river upstream is liable to persist and increase, and these activities will exacerbate sediment discharge risks, as discussed above in Section 5.5.

The reservoir has operated at lower water elevation than intended, and the Suam delta has formed lower down the designated reservoir zone. The sand wedge will reach the dam earlier than had been expected. The measured rate of sediment influx to Turkwel is intermediate between the constant design rate and the 2% annual increase line, but the estimate would need to be refined by further survey planned by the Consultant. For the time being, the original design curves reproduced in Figure 59 remain applicable guidelines. The sediment build-up in the vicinity of the dam and intake is not helped by the failure to regularly operate the low-level outlet as this function was specifically designed to constantly evacuate fine silts. Instead of being discharged downstream, these fine silts are accumulating.

Figure 60: Farming activities below reservoir FSL (western shore)

Figure 61: Farming activities below reservoir FSL (southern shore near Pinou Gorge)

Figure 62: Shoreline cultivation (water elevation is 28 metres below FSL)

Figure 63: Shoreline cultivation inundated (water elevation is 28 metres below FSL)

Figure 64: Riverbank farming below FSL at km 24

Figure 65: Lower Suam riverbank subsistence cultivation

Figure 66: Lower Suam riverbank cultivation

Figure 67: Lower Suam riverbank farming and erosion

Figure 68: Upper Suam forest reserve boundary with intensive farming area

6 RESERVOIR WATER QUALITY

6.1 Regional water quality

A regional study done for KVDA many years ago reported good general water quality from rivers and streams in the Suam-Turkwel drainage system.[85] The Suam, Kanyangareng and Turkwel were fresh, non-saline, and low in fluorides, but most of the waters were found to be bacteriologically contaminated. That study identified water quality risks from a range of domestic and also industrial pollutants.[86]

6.2 Water chemistry at Turkwel dam

The Tullow field team collected 44 water samples at Turkwel dam during the period 2015 to 2019, either from near the power station intake on Turkwel reservoir itself, or from the turbine discharge tailrace downstream of the power station.

Water samples were sent to Nairobi for full chemical analysis by the accredited laboratory appointed at the time by Tullow (see Annex 7 to Annex 15). The laboratory test results include comparison with the appropriate limits set by the Kenya Standard for potable drinking water, KS 459-1. Some additional parameters were tested to suit other Tullow requirements.

There is no significant difference in water chemistry between the two sampling locations at the dam, as would be expected (see Piper chart in Figure 69). The major cation / ion balance across eleven samples dated 2018 was checked by the Consultant, and varied from -15% to +8%. It should be within 5%. Notwithstanding this, the water test results provide the water chemistry basis.

Some test results are highlighted in red font in the tables, either because they exceed the KS limit, or are out-of-character with other test results in the series. A summary of all test results is provided in Table 19. The results dated December 2015 were excluded by the Consultant from the summary due to certain out-of-character readings.

The water test results are outside limits set in KS 459-1 in the following cases:

- Aluminium: Detected in 12 out of 43 samples, 8 of which exceeded the KS limit of 0.1 mg/L, the mean being 0.8 mg/L and the maximum being 4.1 mg/L
- Iron as Fe^{++}: Detected in 23 out of 43 samples, 7 of which exceeded the KS limit of 0.3 mg/L, the mean being 0.4 mg/L and the maximum being 2.6 mg/L
- Arsenic as As: Detected in 2 out of 43 samples, both of which exceeded the KS limit of 0.01 mg/L, the mean being 0.07 mg/L and the highest being 0.09 mg/L
- Cadmium as Cd: Detected in only 1 out of 43 samples, exceeding the KS limit of 0.003 mg/L by orders of magnitude, and hence likely to be a spurious result
- Lead as Pb: Detected in only 2 out of 43 samples, both exceeding the KS limit of 0.01 mg/L, the mean being 0.03 mg/L and the highest being 0.04 mg/L
- Selenium as Se: Detected in 4 out of 43 samples, all of which by far exceeded the KS limit of 0.01 mg/L, the mean being 0.45 mg/L and the highest being 0.86 mg/L
- Ammonia as N: Detected in 29 out of 43 samples, 10 of which exceeded the KS limit of 0.5 mg/L, the mean being 1.6 mg/L and the highest being 12.4 mg/L

[85] Studies of Water Quality and Primary Production in the Kerio Valley Basin, Final Report to KVDA, AGTO Technical Consultants, May 1985.
[86] Ibid, Appendix IV.

- Nickel as Ni: Detected in 2 out of 43 samples, both of which exceeded the KS limit of 0.02 mg/L, the mean being 0.11 mg/L and the highest being 0.12 mg/L
- Boron as Boric acid: Detected in 34 out of 43 samples, 12 of which exceeded the KS limit of 0.3 mg/L, the mean being 1.6 mg/L and the highest being 14.1 mg/L
- Nitrite: Detected in 10 out of 43 samples, 6 of which exceeded the KS limit of 0.003 mg/L, the mean being 0.388 mg/L and the highest being 3.41 mg/L
- Phosphates: Detected in 27 out of 43 samples, 4 of which exceeded the KS limit of 2.2 mg/L, the mean being 0.8 mg/L and the highest being 5.6 mg/L

Interestingly, some of the above chemical constituents are among trace elements listed within a past regional study [85] as "possible and identified industrial pollutants in the KVDA waters".[87]

The water chemistry will be elaborated through further data collection for the water treatment process design (beyond the scope of the Consultant's assignment).

Table 19: Water chemistry results summary

Sample ID	Test Parameter	KS 459-1	Units	Number of detectable values (Maximum 43)	Percentage of values that are "detectable"	Number of values exceeding KS Limit	Percent detectable values exceeding KS Limit	Highest detectable value	Mean detectable value	Lowest detectable value
Table 1	pH	6.5 to 8.5 **	pH units	42	98%	0	0%	8.4	7.5	6.7
	Electrical conductivity	1,500	µS/cm	42	98%	0	0%	342	225	93
Table 2 from KS 459-1:2007 *	Suspended matter	nd ***	***	39	91%	0	0%	d	d	0.00
	Total dissolved solids	1,000	mg/L	43	100%	0	0%	222	139	54
	Total Hardness as $CaCO_3$	300	mg/L	42	98%	0	0%	115.2	60.3	12.5
	Aluminium as Al^{+++}	0.1	mg/L	12	28%	8	67%	4.1	0.8	0.05
	Chloride as Cl^-	250	mg/L	43	100%	0	0%	31	8.7	0.9
	Iron as Fe^{++}	0.3	mg/L	23	53%	7	30%	2.6	0.4	0.03
	Sodium as Na^+	200	mg/L	43	100%	0	0%	70	9.7	3.2
	Sulphate	400	mg/L	43	100%	0	0%	55	4.3	1.0
	Zinc as Zn^{++}	5	mg/L	4	9%	0	0%	0.1	0.0	0.01
	Magnesium as Mg^{++}	100	mg/L	42	98%	0	0%	10.6	4.9	0.1
	Calcium as Ca^{++}	150	mg/L	43	100%	0	0%	28.7	15.9	0.1
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	2	5%	2	100%	0.09	0.07	0.05
	Cadmium as Cd	0.003	mg/L	1	2%	1	100%	12.7	12.7	12.7
	Lead as Pb	0.01	mg/L	2	5%	2	100%	0.04	0.03	0.01
	Copper as Cu	1	mg/L	1	2%	0	0%	0.11	0.11	0.11
	Mercury as Hg	0.001	mg/L	0	0%	0	None	nd	nd	nd
	Manganese as Mn	0.5	mg/L	7	16%	0	0%	0.2	0.1	0.01
	Selenium as Se	0.01	mg/L	4	9%	4	100%	0.86	0.45	0.04
	Ammonia as N	0.5	mg/L	29	67%	10	34%	12.4	1.6	0.00
	Chromium as Cr	0.05	mg/L	2	5%	0	0%	0.04	0.00	0.03
	Nickel as Ni	0.02	mg/L	2	5%	2	100%	0.12	0.11	0.09
	Cyanide as CN	0.07	mg/L	9	21%	0	0%	< 0.001	< 0.001	< 0.001
	Barium as Ba	0.7	mg/L	30	70%	0	0%	0.09	0.06	0.03
	Nitrate as NO_3	50	mg/L	35	81%	0	0%	29.1	4.8	0.00
	Boron as boric acid	0.3	mg/L	34	79%	12	35%	14.1	1.6	0.00
	Fluoride as F	1.5	mg/L	43	100%	0	0%	1.3	0.6	0.00
	Bromate as BrO_3	0.01	mg/L	2	5%	0	0%	0.007	0.004	0.001
	Nitrite	0.003	mg/L	10	23%	6	60%	3.410	0.388	0.000
	Phosphates as PO_4^{3-}	2.2	mg/L	27	63%	4	15%	5.6	0.8	0.00
Additional Tullow parameters	Potassium		mg/L	43	100%	0	0%	4.8	3.2	1.2
	Strontium		mg/L	35	81%	0	0%	0.2	0.2	0.09
	Boron as B		mg/L	1	2%	0	0%	0.05	0.05	0.05
	SiO_2 as Si		mg/L	42	98%	0	0%	14.8	3.6	0.65
	Lithium		mg/L	0	0%	0	None	< 0.004	< 0.004	< 0.004
	Bicarbonate as $CaCO_3$		mg/L	42	98%	0	0%	282	90	19
	Total Alkalinity		mg/L	43	100%	0	0%	375	125	54

Notes on table:

* Residual chlorine test excluded from results as raw water sampled

** Carbonated water minimum pH 4.0

*** Turbidity max 5 NTU (Table 1 KS 459-1)

"d" = "detectable"; "nd" = "not detected"

Red numeral = "Value > KS Limit"; Green highlight = "Out of character" value

[87] The AGTO study dated 1985 listed the following trace elements as "possible and identified pollutants in the KVDA waters": Iron, Manganese, Lead, Copper, Chromium, Cobalt, Cadmium, Barium, Arsenic, Thallium, Zinc, Selenium, Silver, Antimony. Note the Turkwel dam catchment was only a portion of AGTO's full study area of the entire Rift Valley Basin.

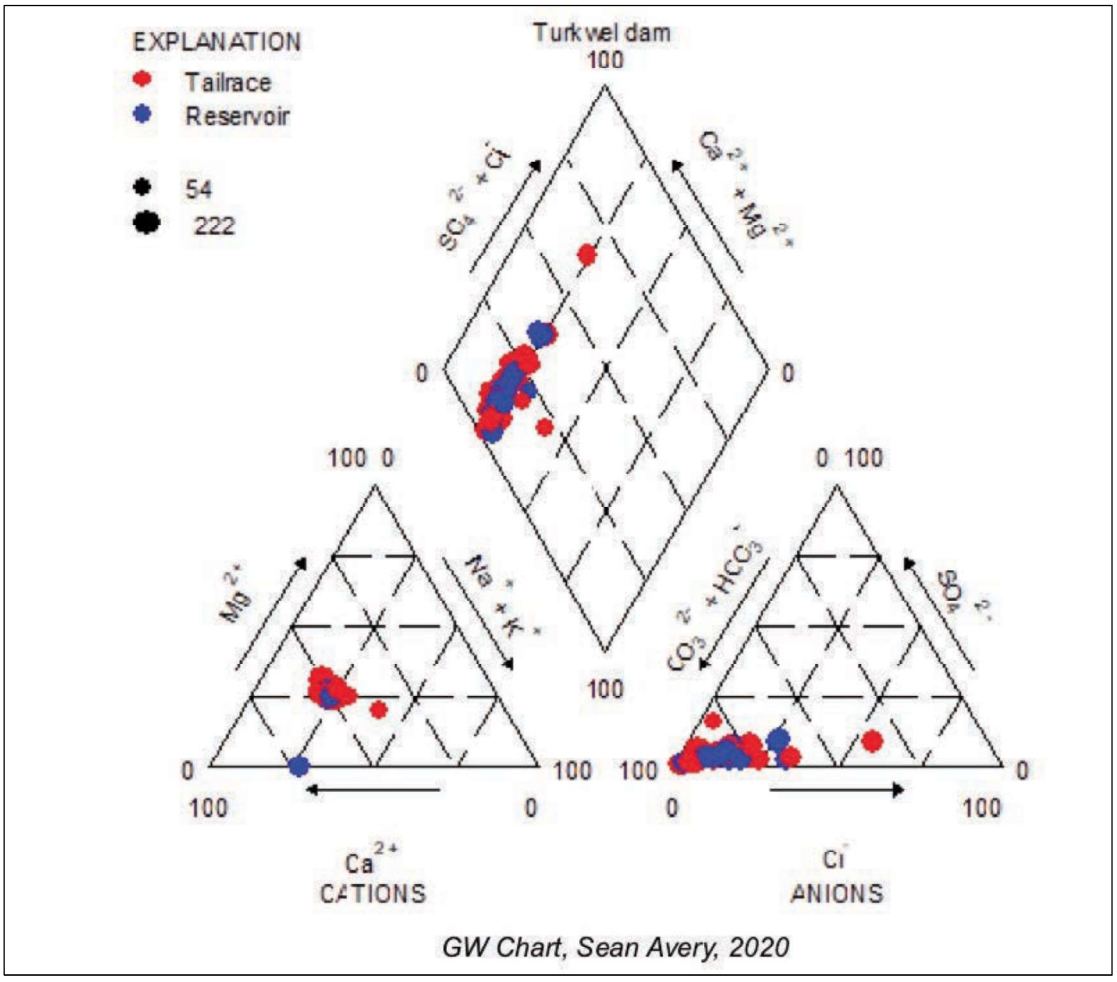


Figure 69: Piper chart of major ions detected in water samples

6.3 Historic water quality data comparisons

The Tullow test results have been averaged and compared with the limited historic data gleaned from reports for the Turkwel catchment upstream of the dam (Table 20).

The Turkwel reservoir water chemistry is of course characteristic of the river water inflows, these being fresh non-saline water principally from the Suam River. The water chemistry results are comparable to historic data from long before the dam was built. The total dissolved solids are slightly higher in the reservoir water, as are some of the chemical constituents such as chloride (Table 20).

The retention time within the reservoir is 3.4 months at minimum operating level (1105 m ASL), and 15.4 months at optimum operating level (1131 m ASL). The retention period determines the extent to which chemical constituents may concentrate with evaporation, or through ecological uptake and deposition. There has never been any spill from Turkwel reservoir, and aside from suspended sediment carried downstream through the turbines, all sediment has been captured.

Table 20: Historic water chemistry comparisons

Dates and data sources	pH	EC @ 25 °C (µS/cm)	TDS (mg/L)	Ca^{++} (mg/L)	Mg^{++} (mg/L)	Na^{++} (mg/L)	K^{++} (mg/L)
KS Limit [1]	6.5 - 8.5	1,500	1,000	150	100	200	-
1973 - 75 [2]	7.9	172	nm	17.3	4.2	11.5	3.3
1978 [3]	7.8	149	109.2	16.8	5.3	5.4	2.8
1983 [4]	8.0	145	87.0	18.0	3.5	nm	nm
1988 [5]	7.4	260	nm	31.0	9.7	8.4	5.2
2015 - 19 [6]	7.5	225	138.6	15.9	4.9	9.7	3.2

Dates and data sources	Fe^{++} (mg/L)	Mn (mg/L)	SO_4^- (mg/L)	F^- (mg/L)	Cl^- (mg/L)	HCO_3^- (mg/L)	Hardness as $CaCo_3$ (mg/L)
KS Limit [1]	0.4	0.5		1.5	250		300
1973 - 75 [2]	0.6	0.2	2.5	0.4	5.0	104.7	62.7
1978 [3]	nm	nm	1.1	1.1	2.0	44.7	nm
1983 [4]	10.5	nm	nm	0.4	3.5	90.5	nm
1988 [5]	0.4	0.1	1.1	0.45	9.0	nm	116.0
2015 - 19 [6]	0.4	0.1	4.3	0.6	8.7	109.3	60.3

Notes on tables above:

1. KS Limit = Kenya Standard KS 459-1:2007, maximum limits are tabulated
2. MoWD files for Suam River @ RGS 2B07 at Kongelai upstream from Turkwel reservoir
3. Measurements at Twin Islands (former RGS 2B27 just downstream from the dam tailrace), AGTO Technical Consultants Ltd, water quality report to KVDA dated May 1985
4. MoWD files for Suam River (the location on the river was not stated)
5. Water Analysis No 793, River Turkwel, sample collected by the dam contractor Spie Batignolles on 20/8/88 for concrete production purposes (on file in KVDA office at Turkwel)
6. Mean of Tullow water chemistry results in Annex 7 to Annex 15
7. " nm " signifies "not measured"

6.4 Reservoir water quality profiling

Reservoir water quality profiling surveys were done by the Consultant in 2016 [89] and 2017.[88] A summary of findings is included in the sub-sections below.

The electrical conductivity (EC) of water is a measure of total dissolved salts, and hydrogen ion concentration (pH) is the measure of acidity / alkalinity. Both these important water quality characteristics are amongst the laboratory test results, but were also measured in-situ within the reservoir itself by the Consultant.[89] [88] This was achieved through vertical reservoir profiling with an EXO Sonde multi-parameter water quality instrument.[90] The range of parameters measured also included water temperature, turbidity, chlorophyll, total algae, and fluorescent organic matter, the results of which have previously been reported by the Consultant to Tullow.

6.4.1 Specific conductivity at 25°C

An earlier study by others from 1992 to 1995 revealed seasonal changes occurring with average monthly specific conductivity (SPC) varying within the range 140 to 200 µS/cm (Kotut et al., 1998 [91]). During the 2016 survey, SPC ranged from 180 to 190 µS/cm. Throughout the 2017 survey, SPC was in the range 170 to 180 µS/cm, with little variability through the vertical reservoir depth profile.

6.4.2 Hydrogen ion concentration, pH

The previous published study mentioned above reported "median pH" values in Turkwel reservoir ranging from 7.1 to 8.7.[91] Tullow's 2015 to 2018 laboratory-tested pH values ranged from 6.7 to 8.4 (Table 19). The Tullow results are comparable to the historic data (pH 7.4 to 8.0, Table 20), and are also comparable to results from the Consultant's in-situ profiling in the reservoir (Figure 70).[88]

Note however that the Tullow laboratory samples were either derived from surface layers of the reservoir, or from turbine releases downstream that would have drawn water well below the reservoir surface. The Consultant's in-situ profiling showed pH declining from 8.7 at the reservoir surface to 7.4 at the reservoir bed (Figure 70).[88]

And also note that pH concentration in reservoirs varies with photosynthetic activity, and hence varies with depth of light penetration as shown in the results above, and will also vary at the surface with the time of day.

6.4.3 Water temperature

During the Consultant's 2017 survey, there was a near uniform temperature gradient from 28°C at the reservoir surface to 24°C at the bed (Figure 71). That temperature gradient occurred throughout the reservoir.

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[88] Strategic Water Supply for Development, Turkwel Dam Option, Turkwel Reservoir Water Quality, by Sean Avery, Tullow Consultant, October 2018.

[89] Strategic Water Supply for Development, Turkwel Dam Option, Field Reconnaissance Report 2, Turkwel Reservoir & Hydrology, by Sean Avery, Tullow Consultant, Sept/Oct 2016.

[90] YSI (2014), EXO User Manual, Advanced Water Quality Monitoring Platform, August 2014.

[91] Kiplagat Kotut, Lothar Krienitz, Francis Muthuri, Temporal changes in phytoplankton structure and composition at the Turkwel Gorge Reservoir, Kenya, *Hydrobiologia* 368: 41-59, 1998, field studies done from 1992-95.

6.4.4 Dissolved oxygen concentration

Throughout the reservoir during both of the Consultant's surveys, the reservoir surface waters were saturated with dissolved oxygen. The dissolved oxygen always declined through the vertical profile, reaching 20% saturation at roughly 20 metres depth, and reaching zero at the bed (Figure 72). At 20% saturation the dissolved oxygen concentration is approximately 2 mg/L, the limit below which fish will not thrive. The bathymetric survey had confirmed the significant sediment accumulation throughout the reservoir. This deposition is an ongoing process, and the sediment includes organic matter whose decomposition would be exerting a high oxygen demand.

6.4.5 Chlorophyll, total algae and macrophytes

The EIA for Turkwel had reported a lack of nutrients in the Turkwel water and concluded that eutrophication was improbable.[16] The Consultant's surveys observed minimal vegetation growth along the reservoir fringes,[89] and low chlorophyll and total algae levels were measured.[89] [88] The reservoir operations are not at present affected by undesirable alien aquatic species like water hyacinth. However, nutrient inflows may change in the future depending on activities upstream.

6.4.6 Turbidity

Of particular significance for the raw water supply quality is the improvement in the turbidity of the incoming river water through sediment deposition along the length of the reservoir body.[89] The test results of water samples taken by Tullow from the dam only "detected" suspended sediments (Annex 7 to Annex 15). The water naturally tends to be clearest in the lowest part of the reservoir near the dam and power station intake.

The effect of sediment deposition on raw water clarity is well illustrated by the results from the reservoir water quality profiling survey done by the Consultant in October 2016 along the length of the reservoir.[89] The incoming river water turbidity of over 600 FNU at the head of the reservoir had reduced to 2.4 FNU in relatively still water in the lower reservoir offshore from the power station intake (Figure 73).

Not surprisingly, there are slight increases in turbidity in areas of turbulence due to higher water velocities, notably through the narrowing of Pinou gorge, and also as the turbine intake is approached.

By way of comparison, potable water's turbidity would typically not exceed 1.5 FNU, and clear river water would typically have turbidity 10 FNU. Thus, during the Consultant's 2016 survey, Turkwel's water clarity at the power station intake was equivalent to "clear river water". However, the clarity will vary according to season and water level (i.e. storage), and long-term the storage capacity is being displaced as the reservoir is filling with sediment, so the reservoir will keep changing.

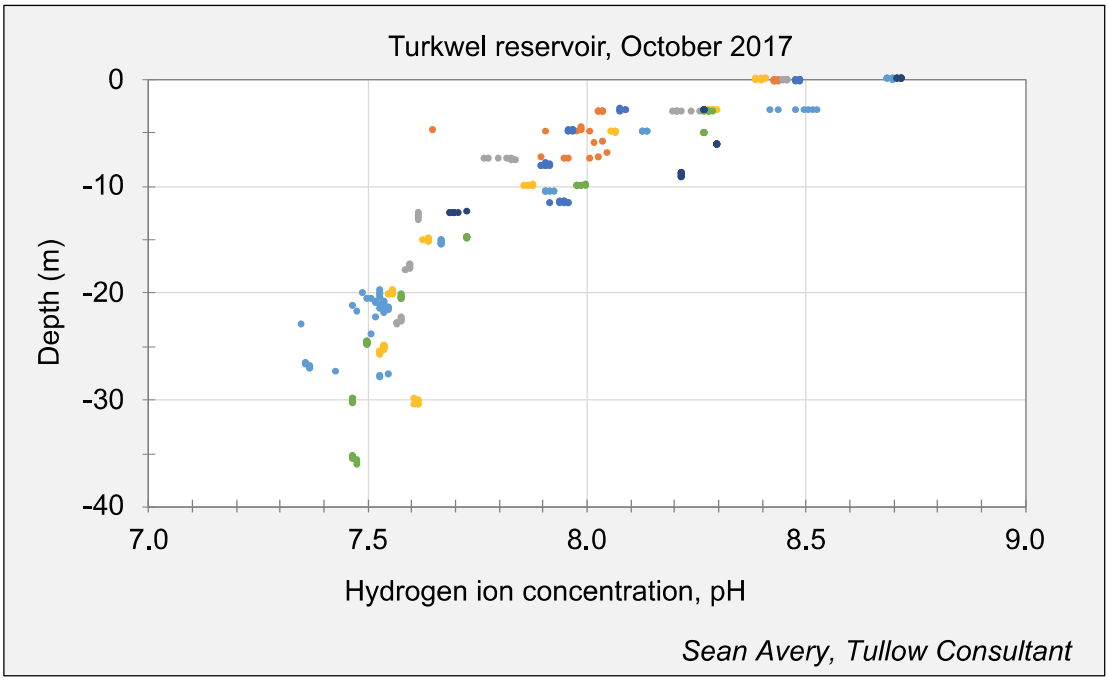

Figure 70: Vertical reservoir pH profiles

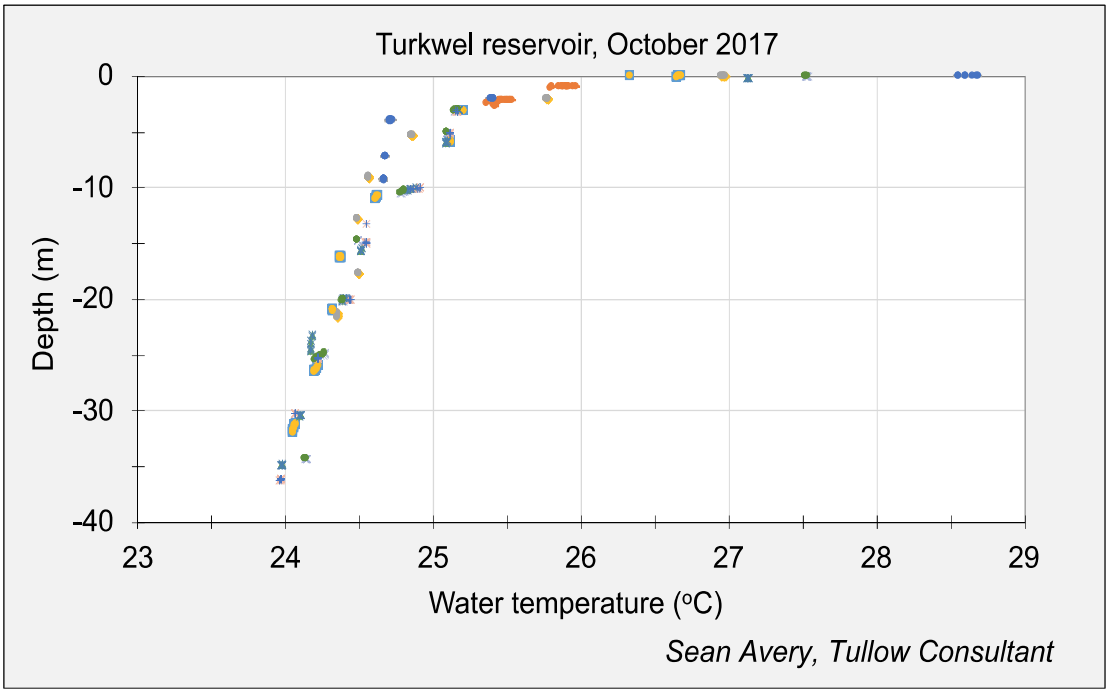

Figure 71: Vertical water temperature profiles

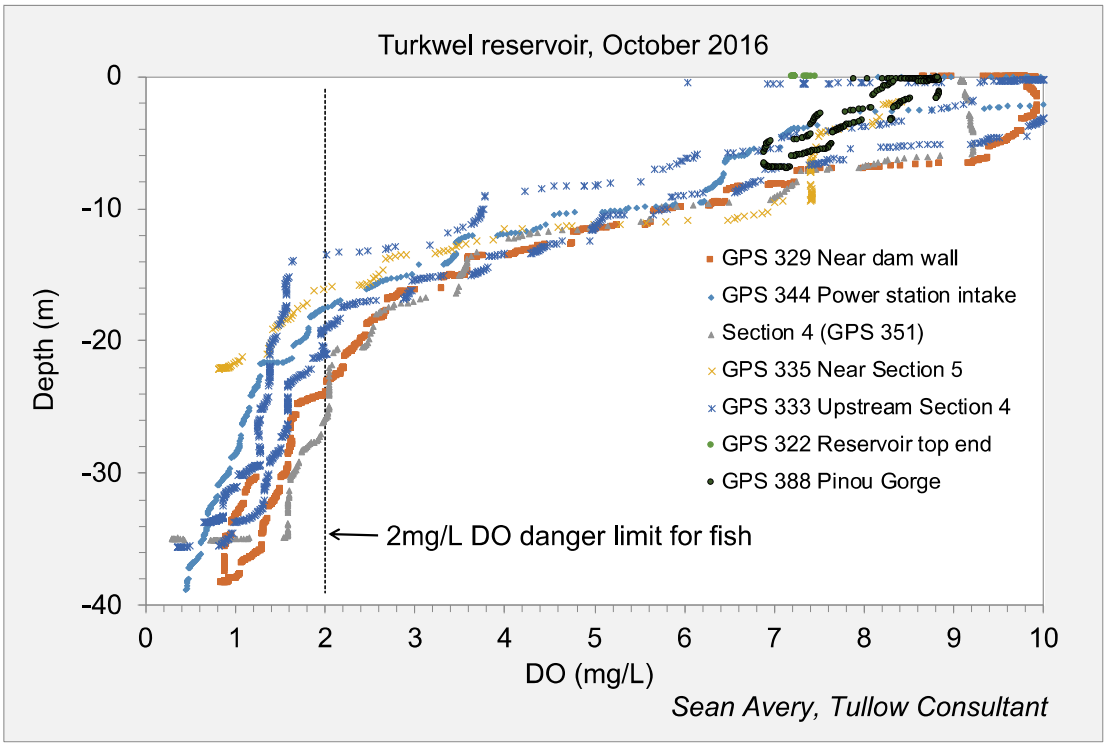

Figure 72: Vertical dissolved oxygen profiles

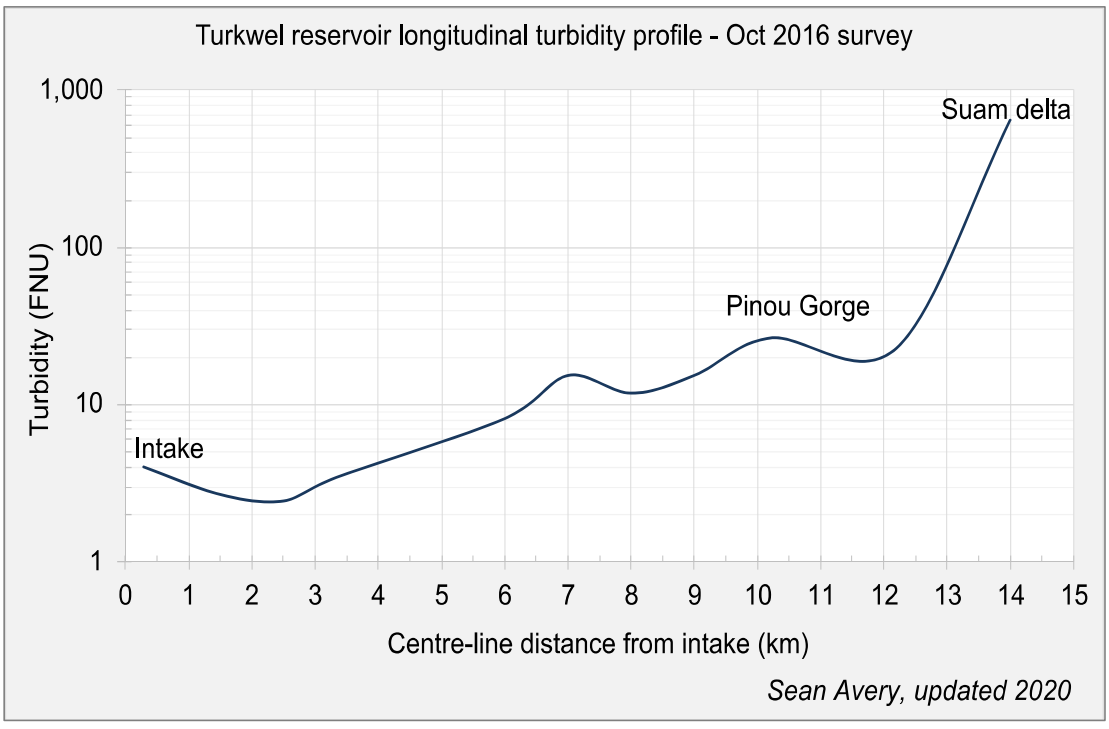

Figure 73: Longitudinal turbidity profile along the reservoir

7 FLOOD HYDROLOGY

7.1 Historic flood measurements at Turkwel Gorge

Flood water levels in the River Turkwel were recorded not far from the dam site at RGS 2B27 (Twin Islands) from 1978 to 1988.[92] Earlier flood data from as early as 1975 were obtained through levelling of high water marks.[92] With gorge closure by the dam in January 1990, river water level data collection at RGS 2B27 ceased.[92]

Flood peaks between 1977 and 1987 ranged from 370 to 1,293 m^3/s. A possible flood trash mark equivalent to 1,990 m^3/s was once located high up on a rock ledge, but this was treated by the dam design consultants with caution as it might have been a result of what they termed "flood water surging".[92]

7.2 Recent flood measurements

The Turkwel dam spillway has never been put to the test as the reservoir has never come anywhere near spillway level. This was anticipated by the design team as they had noted that "in the early decades of the dam's life, the reservoir is unlikely to fill because the total storage capacity is very large in relation to the dam's yield".[92] Hence, in terms of ongoing peak flood monitoring, the operation of the river gauging stations upstream remains vital to the dam monitoring.

It is unfortunate that since the Turkwel gorge was closed by the dam in 1990, no flood data have been collected upstream. The most important gauging station is RGS 2B33 on the Suam River at Kongelai. This station had been equipped in 1987 with a cableway in order to capture the all-important medium and high-flow rating of the station. Prior to 1987, the station had only been rated to 27 m^3/s, whereas mean annual floods of up to 670 m^3/s were occurring.[44] In effect, no meaningful high-flow data were available. Unfortunately, the cableway has been washed away twice since the dam was built, and it is visually apparent that a contributing factor has been increasing flood magnitudes with increasing anthropogenic pressure on the catchment, evident from the associated channel and riverbank erosion consequences (Figure 15).[93] These catchment risks existed at the time the dam was built, and will have become worse.

The cableway for RGS 2B33 has recently been restored by a contractor engaged by the Water Resources Authority with Tullow support. The new cableway design has not been seen by the Consultant, but it will be apparent from past experience that the cableway at its lowest point needs to be well above the highest flood water level allowing for floating debris including trees and logs.

7.3 Turkwel dam spillway discharge design

The preliminary design of the dam recommended that the spillway design should be based on the peak 1,000 year return period flood of 6,600 m^3/s.[9] The extreme flood estimates in the later final design were summarised by KVDA's review team (reproduced in Table 21). The Francou-

[92] Annex J, Turkwel River Basin Hydrology, Flood Magnitude and Frequency Relationships of Suam and Turkwel Rivers, August 1987, WLPU Consultants.

[93] An annotated photographic record is included in the following report: Lower Turkwel and Kerio Basin Status Review Report, river gauging station review prepared by Sean Avery, Consultant to Tullow Kenya, July 2017.

Rodier Envelope Curve adopted a K-value = 4.5. For comparison today, various hydropower dam projects in the Omo Basin adopted K-values in the range 3.79 to 5.01.[94]

The Francou-Rodier K-value is calculated from the maximum observed flood in the river.

Table 21: Turkwel extreme flood estimates [44]

Method	Return period (years)	Discharge (m^3/s)	Note
Gumbel	1,000	5,000	
Gumbel	10,000	6,500	
Gradex	1,000	6,000	Maximum envelope
Gradex	10,000	8,500	Maximum envelope
Envelope curve	-	5,000	Francou-Rodier K = 4.5
PMF	-	10,000	Hershfield

In accordance with standard engineering practise, the dam design team carried out flood routing trials with extreme antecedent conditions where the reservoir was assumed full. They demonstrated that the design floods would pass safely without the dam overtopping.[44]

The Turkwel PMF (probable maximum flood) is directly comparable with PMF values computed for a range of major dams in Kenya and Ethiopia (plotted in Figure 74). Three Creager flood curves are included. The Creager Formula was published in 1945, and the C=100 curve was formulated from worldwide historic flood peak maxima (mainly in the USA). The Creager C=100 flood has no return period but has commonly been applied for spillway designs.[95] In Kenya, a Creager C=45 was found applicable to PMF values computed for various dams on Aberdare rivers.[96]

7.4 Turkwel dam flood risk and dam inspection recommendations

The dam has a very low flood risk, but this situation will change with the increasing flood and sediment runoff risk in the catchment. The ongoing sediment deposition within the reservoir is in turn reducing the storage that buffers incoming floods.

The last KVDA dam inspection report seen by the Consultant is dated 2002. Dam inspections are mandatory under Kenya's Water Act, and they not only inspect the structural integrity of the dam and ancillary structures, but they also review the evolving dam hydrology database, including floods and associated risks, as well as the risks of a dam break. The Third Schedule of the Water Resources Management Rules 2007 requires a dam in the high risk category to be inspected every two years by an expert duly licensed under the Water Act.

It is vital that the high-flow measurements resume at RGS 2B33. And it is equally important to resume water level monitoring at the other gauging stations in the catchment, notably the two main seasonal sand river tributaries (RGS 2B20 and 2B23 in Figure 5). Routine visits to all river gauging stations are vital, even if the rivers are seasonal, not only to monitor rating changes, but also to observe peak flood water levels evident from recent visible flood debris lines. The flows during these peak flood events are readily quantified from channel slope and geometry

[94] Extreme Flood Report, Studio Pietrangeli, Rome, Gibe III dam, Level 1 Design, June 2007.
[95] FAO Irrigation and Drainage Paper 37, Arid Zone Hydrology, Rome, 1981.
[96] Probable Maximum Flood estimates, Third Nairobi Water Supply Project, Howard Humphreys, Consulting Engineers, November 1985.

and by applying indirect methods of river discharge measurement, for instance slope-area discharge computation methods.[97]

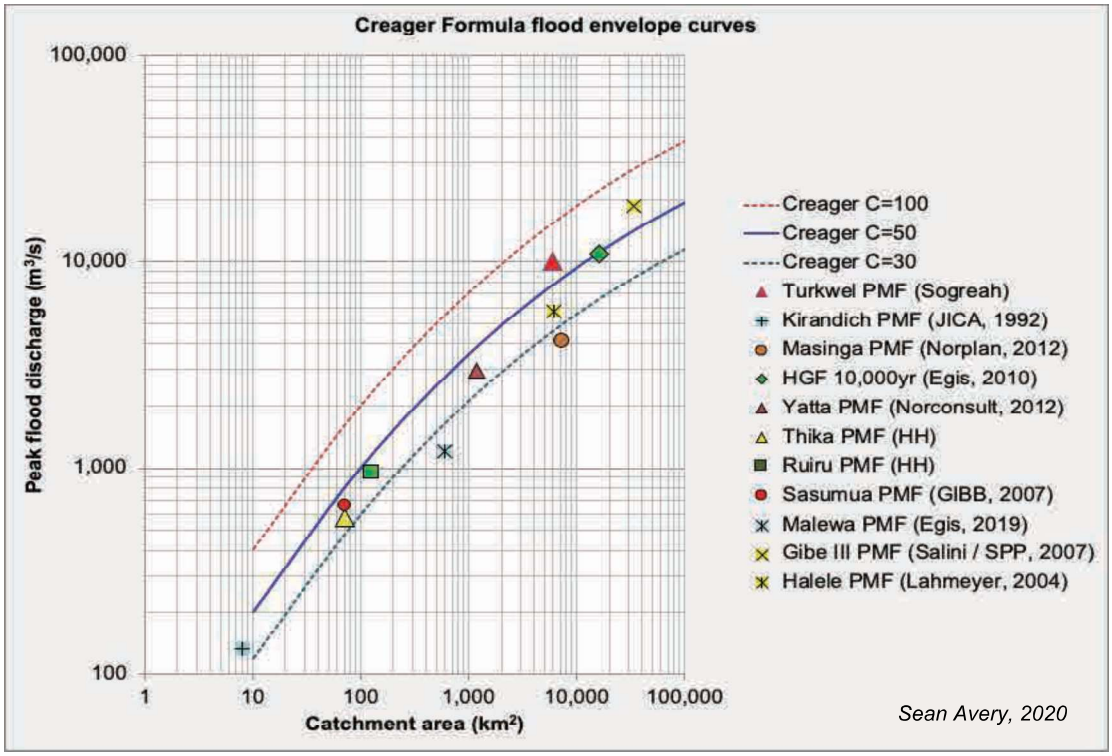

Figure 74: Probable maximum floods compared [98]

[97] WMO - No.168, Guide to Hydrological Practices, Volume I, Data Acquisition and Processing, World Meteorological Organisation, 1981, Section 2.5.6.4.

[98] Note that HGF = High Grands Falls Dam (note that in the case of this particular dam, floods may be attenuated by upstream dams); Note also that Gibe III and Halele hydropower dams are in the Omo / Turkana Basin in Ethiopia, and all other dams are within Kenya.

8 WATER ALLOCATION DOWNSTREAM OF TURKWEL DAM

8.1 History of flow release from the dam

8.1.1 Compensation flow release from the dam's low-level outlet

The Water Act 2016 defines a compensation flow as "the flow released from a dam or weir which is required for downstream uses and Reserve".

In anticipation of the plugging of Turkwel dam's diversion tunnels in January 1990, a report was prepared by KVDA on compensation flow releases from the dam.[99]

Historically, there was water flow in the Turkwel river at Katilu[100] for half the year, and for only a few days at Lodwar. But with the dam operational, the expectation published in government documents was that flows would increase significantly with 20 m^3/s being released.[101] Those same government documents understood the dam to be designed with flood gate release capacity 500 m^3/s, but did not expect this sort of high flow release to occur.[101]

The KVDA compensation flow analysis considered flow characteristics in both the Malmalte and Turkwel rivers as these combine to form the Turkwel river that flows through Turkana County to distant Lake Turkana. In a field exercise dated 21st April 1989, KVDA measured flows on the Turkwel river at Twin Islands, on the Malmalte river, and on the Turkwel river Katilu, and based on these, the riverbed infiltration and evaporation losses on that occasion were computed as follows:

R.Turkwel flow at Twin Islands	2.3 m^3/s
R. Malmalte flow	5.2 m^3/s
R.Turkwel flow at Katilu	3.2 m^3/s
Infiltration and evaporation	2.3 + 5.2 - 3.2 = 4.3 m^3/s

The evaporation losses are very significant as the lower Turkwel river channel is wide, but infiltration serves to recharge the riparian aquifers, a vital ecological role.

The KVDA analysis abstracted the lowest flow recorded in each month at Twin Islands (RGS 2B27 from 1980 to 1988), and this averaged 2.675 m^3/s. KVDA thereby determined that the compensation release from Turkwel "… should be minimal in the order of 2.5 m^3/s to 3.0 m^3/s." KVDA later instructed that a constant flow of 1.5 m^3/s be released through the dam's low-level outlet until further notice (equivalent to the flow exceeded 78% of the time on the Turkwel river at Twin Islands).[102]

The flow release from the dam's low-level outlet was discontinued long ago, and the outlet is currently inoperable. This inoperable state is very likely due to sediment as the bathymetric survey undertaken by the Consultant established that the low-level outlet was buried beneath 14 metres of sediment.[77] [78] The dam design had anticipated that sediment deposition would reach the low-level outlet within 12 years (by 2002), but provided constant releases were ensured, natural flushing was planned to keep the inlet zone of the low-level outlet clear.[103]

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[99] Compensation Water Releases from Turkwel Gorge Reservoir, report by J.M. Mutuaruchiu, Hydrologist (letter dated 15th May 1989, Ref. KVDA/WD/WR/VOL.I(14), seen on KVDA files at Turkwel dam).

[100] Katilu is the location of a large government irrigation project, on the east bank of the Turkwel river about 52 km downstream from the Turkwel dam tailrace (Figure 2).

[101] Range Management Handbook of Kenya, Turkana District, Ministry of Agriculture, Livestock Development and Marketing, 1994.

[102] Letter Ref. KVDA/MD/04/VOL.II dated 19th April 1989 from Managing Director KVDA to Resident Engineer Sogreah Consultant (on file in KVDA office at Turkwel dam).

[103] Turkwel Gorge Multipurpose Project, Dam-Hydropower Plant-Transmission Line, Part 2 Final Design, Volume 2-2, Reservoir Capacity and Allocation, Sogreah, April 1987.

The dam design considered the low-level outlet as playing a role in the long-term management of sediment build-up. After monitoring deposits, it was envisaged that sluicing through the low-level outlet would be planned to get rid of fine sand and discourage accumulation against the dam wall.

A short 5.3 kilometre reach of the river through the Turkwel gorge to the dam tailrace was affected by the discontinuation of the low-level outlet compensation flow releases. Once the turbine tailrace location is reached, the river channel receives the full discharge from the turbine tailrace, and the volumes discharged are far in excess of the above compensation flow, albeit only during the hours that power is being generated.

8.1.2 Flow stoppage during periods of turbine shutdown

(a) Flow-duration patterns, past and present, and impacts

The pre-dam natural Turkwel river flow pattern has been contrasted against reservoir inflow and turbine release patterns since the dam was fully operational. The analysis is presented in Figure 75, and is based on monthly flows, so short term peaks and lows are ironed out. The pattern of past and recent natural inflows is unchanged, and the regulated release pattern from the dam is a complete contrast. The turbine release volume is less than reservoir inflows as there have been evaporation losses and changes in storage in the reservoir.

Power is generated according to the demand from the national electricity grid, and is governed by the water level status in the reservoir. Since 1996, Turkwel's two turbines have operated 12.5 hours per day on average, namely 52% of the time. On occasions, the turbines have operated for as little as 1.2 hrs/day, and at other times up to 24 hrs/day.[104]

A single turbine discharges at the rate 17 m^3/s, and when both turbines are running the flow doubles to 34 m^3/s. Intermediate daily flow magnitudes vary according to how long individual turbines are operated. For 48% of the time, there was no discharge to the river, the shutdown period generally being from late evening to dawn, so the no-flow period is generally predictable.

In terms of hydrological diversity, during the river's pre-dam natural seasonal period, monthly flows in the river ranged from zero up to 100 m^3/s, with daily peak floods of over 1,000 m^3/s occurring.[105] With the dam operational, the river flow has become totally regulated, and diurnal up to the Malmalte river confluence, with the diurnal influence extending beyond. And obviously, the release flow will never exceed the combined hydraulic capacity of the turbines, namely about 34 m^3/s, and flow will only be continuous for periods less than a day.

If both turbines are shut down for maintenance purposes, there is no water release to the river, potentially for several days. The entire 16.8 kilometres of river channel down to the Turkwel river's Malmalte river confluence is then affected, and flows thereafter downstream from the confluence are significantly reduced. These no-flow periods are rare, although they have occurred. If they are timed to coincide with high flows in the Malmalte, or periods when crops are not being irrigated, impacts can be reduced.

Although the flow release volumes are regulated, they can vary from day to day, plus there will be occasional local stormwater runoff influx from the catchment between the dam tailrace and the Malmalte confluence (unmeasured and not included in the graph above).

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[104] Data on monthly generating hours provided by Kengen to Richard Boak of Tullow.
[105] See Section 7.1 of this report.

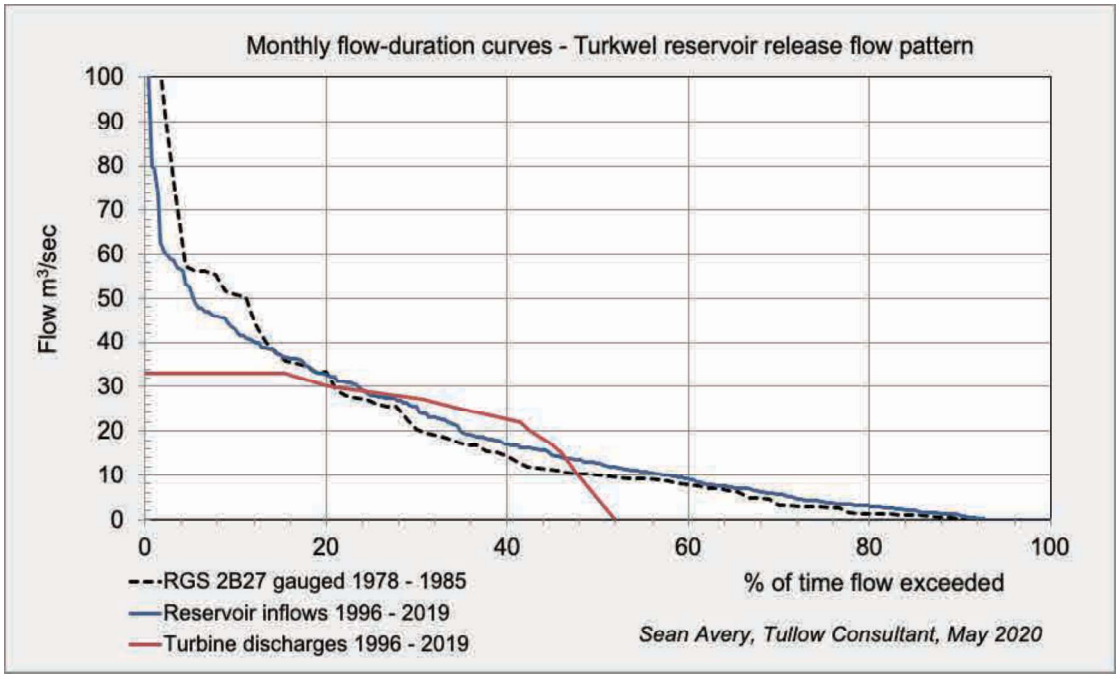

Figure 75: Flow-duration curves

(b) Other impacts

Before the dam was built, the river from the dam to the confluence was a seasonal channel subject to periods of zero flow, medium flows and short periods of flood inundation. The nature of the riparian vegetation will of course have since been changing to suit the regulated flow environment now prevailing. The Malmalte river however continues to flow naturally, albeit with its low flows exacerbated by upstream irrigation abstractions, and its floods may well be more violent today than they used to be, as the catchment is subject to anthropogenic pressure and change.

There are many community irrigation intakes taking water from the Turkwel river downstream of the Turkwel / Malmalte confluence, as well as from the Malmalte upstream of the confluence. Some of these intakes closest to the confluence were observed by the Consultant to be subject to diurnal flows too, with water offtake only possible when the full combined turbine discharge was passing. These intakes have also been affected by the river channel downcutting as a consequence of dam closure, in cases leaving intakes stranded (discussed below).

8.1.3 Channel degradation and aggradation

The environmental impact assessment of Turkwel dam in 1991 had correctly reported that as a consequence of all coarse sediment movement being arrested within Turkwel's impoundment, the river downstream of the dam would be deprived of this flow of bed material.[106] And as there were no natural fixed hydraulic controls in the form of rock bars in the river until near Lodwar, the riverbed would degrade, with its bed elevation becoming lower.[107] To stop this happening, a series of check weirs were proposed downstream of the dam to ensure channel bed degradation did not exceed 1.5 metres, but those proposals were never implemented.

[106] KVDA, Turkwel Environmental Impact Study, Final Report, Sogreah Consulting Engineers, May 1991.
[107] Ibid., the underlying rock level was measured to be ten metres below riverbed level, so there is significant degradation potential before hard rock is reached.

The channel degradation process started as soon as the dam was closed. An early photo shows the extent of channel degradation in 1998, seven years after dam commissioning, with reported relic tree trunks having been exposed (Figure 77). KVDA staff at that time reported that degradation had not yet occurred beyond the Malmalte confluence.[108] KVDA were reported to have carried out topographical survey of the river bed at that time,[108] but their staff today are unaware of that work, and were unable to locate the survey documents.

In 2016, the Consultant visited the site of the former Twin Islands gauging station RGS 2B27, and local people claimed that whereas they once were able to simply step into the river and walk across, they must now first clamber some distance down the bank (Figure 76). Downstream the river was inspected by the Consultant during a walk to the Malmalte confluence, and lowering of the channel bed was not as dramatic as upstream at Twin Islands (Figure 78). Later in the same field visit, channel degradation was seen at Nakwamoru where normal river water levels no longer reach the irrigation intake invert level. Nakwamoru is just over 3 km downstream of the confluence. There were major excavation works in progress to re-position the irrigation intake much further upriver.

Further downstream from Nakwamoru, a reversal from channel degradation to aggradation was expected by the Turkwel design team.[109] And in the lower Turkwel, no dam-consequential changes in bed level had been expected.

A current status study of the extent of the degradation / aggradation of the Turkwel river channel from the dam was one of the follow-up tasks that had been planned by the Consultant (as part of a lower Turkwel concept modelling assignment for Tullow).

Figure 76: Former site of RGS 2B27 at Twin Islands in 2016

[108] Assistance to Turkwel Dam Monitoring, Periodical Inspection No.4, Sogreah Consulting Engineers, Oct 1999.
[109] KVDA, Turkwel Environmental Impact Study, Final Report, Sogreah Consulting Engineers, May 1991, p.116-118.

Figure 77: Channel degradation at Twin Islands in November 1997 [110]

Figure 78: River Turkwel downstream in 2016

[110] Photo from Dam Periodical Inspection No.2 carried out in November 1997, Sogreah Ingenierie, Feb 1998.

8.2 The Water Act – Guidelines for Water Allocation

8.2.1 Category of water resource use activities

Tullow is seeking a permit to abstract 40,000 m^3/d of water from Turkwel dam (Section 3.5).

Part B in the Fifth Schedule of the Water Resource Management Rules lists four water use activity categories that determine the levels of approval required before a permit to abstract water can be issued.[111] The Categories are named A to D according to the risk to the water resource, Category D being the most stringent.

The Turkwel river flows from West Pokot into Turkana County and is the most important surface water resource in both counties. This river contributes 29% of the runoff in the whole of Rift Valley Basin.[112] Being mindful of its critical value within a semi-arid to arid area, coupled with the history of conflict in the region where the dam is situated, the Tullow abstraction permit application should be determined in Category D.

8.2.2 The water allocation process

Government water allocation processes have existed in Kenya for over 100 years. However, abstractions from a remote seasonal river like the lower Turkwel were not a priority, and the numerous irrigation offtakes had not yet been formalised with permits when the Consultant visited the Lodwar office of the Water Resources Authority in 2016. The Water Act recognises that many informal Class A offtake farmers are unable to apply for permits as they don't possess the legal documents required for a permit application.

The water legislation in Kenya has undergone many changes in recent years. All water allocations today are subject to compliance with Kenya's Water Act 2016 under which the Water Resources Management Rules 2007 were issued. Guidelines for Water Allocation have also been developed by the Authority.[113]

The first step in water allocation is determining the availability of the water resource (the main subject of this report). And the first priority in the subsequent water allocation process is meeting the "Reserve", this being defined in the Water Act as the quantity and quality of water required to meet the following needs:

a. Satisfy basic human needs for all people who are or may be supplied from the water resource [114]
b. Protect aquatic ecosystems in order to secure ecologically sustainable development and use of the water resource

In the case of Turkwel dam, the Consultant is not aware of the Reserve having been set, with the dam's discharge operational rules currently governed solely by national power demands and balancing generation output depending on water elevations in the Turkwel reservoir. There is

[111] Water Resources Management Rules 2007, Legal Notice No.171, The Water Act (No.8 of 2002).
[112] Rift Valley Basin Plan, Water Resources Authority, Aurecon, April 2020, p.vi.
[113] Guidelines for Water Allocation in Kenya, prepared for Water Resources Authority by Rural Focus, and commissioned by GIZ-WSRP, Third Version, April 2019.
[114] The basic human need is quantified in the Water Resources Management Rules 2007 as 25 Litres per person per day. This is required to meet the needs of drinking, food preparation, clothes washing, bathing, and basic sanitation.

currently no functional mechanism to release compensation flows from the dam when the turbines are not running.

8.2.3 Prioritisation

The Guidelines have emphasised that the first priority on the water resource is always the Reserve, as the basic human need requirements are embodied within this. The Guidelines further observed that the next consideration is that under Section 43 of the Water Act, domestic water needs take priority over other water uses. The Guidelines note that the Water Act is silent with respect to the priority attached to all other water demands, and the Guidelines list the various considerations that are required by Section 43 of the Water Act.

The Guidelines finally list the prioritisation adopted in the National Water Master Plan 2030 in which it was stated that the Reserve and existing water uses for domestic, industrial, irrigation, hydropower and inter-basin transfers are prioritised ahead of any new applications.

Furthermore, the Water Resources Authority has established that water for irrigation and other commercial purposes should be allocated from flood flow. This has implications for all irrigation offtakes both upstream and downstream of Turkwel dam. It is recognised that the majority of riparian farmers are non-compliant, and the Guidelines talk of incentives to develop flood water storage facilities, although this is beyond the resources of most riparian farmers.

8.2.4 The Reserve

(a) Unregulated river

In an unregulated river, the "Reserve" is defined in the Guidelines in two parts, as follows: [113]

i. A portion of the low flow for which a minimum flow requirement is specified
ii. A portion of the high flow for which an upper limit on the allocable yield is specified

The "minimum" in an unregulated river is the flow that is exceeded 95% of the time (Q_{95} being determined by flow-duration analysis of naturalised daily flows). This is the flow limit below which the river should not drop.

The amount of water that can be allocated in an unregulated river is capped at the flow that is exceeded 50% of the time, Q_{50}. This means that flows above Q_{50} are by default reserved for ecological needs.

(b) Regulated river

The river downstream of Turkwel falls within this "regulated" category. The final EIA for Turkwel dam dated 1991 had identified the possible consequences of downstream flow regulation by the dam, mainly related to the potential for more water to be taken from the river through increasing irrigation developments, but also changes in the riparian water table that could affect the natural riparian forests. Mitigation measures and monitoring were proposed in that EIA, notably to prevent the drop in the water table, but none were implemented.[16]

The Guidelines state that in a regulated river "a more sophisticated environmental flow regime" is required as "without this, the river may not be able to sustain ecosystems dependant on hydrological variability".[113] The Guidelines have cited the Brisbane Declaration 2007 of environmental flows (e-flows) that takes into account that each part of natural river flow has a role in sustaining a riverine ecosystem. In the case of a major dam like Turkwel, the Water Resources Authority requires "an holistic methodology with public consultations".[113] The multi-disciplinary expertise needed to achieve this is listed in the Guidelines as follows:

- Social scientists
- Hydrologist
- Hydraulic engineer
- Fluvial geomorphologist
- Water quality specialist
- Riparian vegetation specialist
- Fish specialist
- Macroinvertebrate specialist

The above assessment and public consultations are beyond the scope of the Consultant's present assignment. The required assessment would need to cover both the Malmalte and Turkwel rivers that together form the Turkwel river flowing downstream to Lake Turkana. Baseline work for Tullow's water pipeline abstraction ESIA is being undertaken for Tullow by Golder Associates, and their team included the above specialist expertise.

8.2.5 Turkwel dam and the "Reserve"

It is recommended that the requirements of the recent Guidelines applicable to regulated rivers be addressed in regard to Turkwel dam's turbine releases. This assessment is a pre-requisite before the Water Resources Authority can determine a water allocation from this river.

9 CONCLUSIONS AND RECOMMENDATIONS

The power generation at Turkwel and water levels in the reservoir are inter-related and the reservoir has been operated generally between the minimum and optimum generation levels. These levels are lower than had been designed, as the hydrological yield had originally been over-estimated due to the paucity of hydrological data at the time of project inception in the 1970s.

The Turkwel turbines have on average been operated 12.5 hours per day, and contrary to expectations expressed in the Rift Valley Basin Plan, there is insufficient water to allow any increase to this power generation period.

The abstraction direct from the reservoir sought by Tullow's Client is feasible. An adjustment by Kengen to the generation levels may be necessary at times as the upper limit of the abstraction alone is equivalent to an additional 30% net evaporation loss that will draw reservoir levels down.

Note that expectations have been expressed in the very recent Rift Valley Basin Plan to also supply the Resort City on Lake Turkana from this same source, but the feasibility of that expectation has not been studied.

The annual inflow to Turkwel reservoir has averaged 18 m^3/s since commissioning, slightly higher than KVDA's 17 m^3/s water permit, and slightly lower than the 19.2 m^3/s allowed in Kengen's water permit. The Consultant's 18 m^3/s assessment confirms the hydrological yield expectation at the time the reservoir filling commenced in 1990.

The proposed abstraction requested by Tullow's client will double the current abstractions licensed to this point of the Turkwel river. The abstraction amounts to 2.5% of the average annual Turkwel reservoir inflow. To put this into perspective, the net evaporation loss alone from the reservoir amounts to 6.9% of the average annual inflow (Table 13).

Under current catchment conditions, the reservoir's naturalised inflow yield is not expected to decline. In the future, some increase is expected with the increasing rainfall trend, but on the other hand, reservoir evaporation will tend to increase. Upstream water demands on the Suam river are expected to increase too, and at present these are indeterminate. A Water Allocation Plan as laid down in the Water Act is needed for the basin. Some water demand estimates are included in this report, perhaps 1.2 m^3/s in 2030 (Table 5).

There are no obvious water quality constraints, and the reservoir operations are not presently affected by water hyacinth, but this can change with upstream activities. There is significant sediment deposition taking place within the reservoir zone. The deposition rate is very high by Kenyan standards, but is in line with design expectations. A sand wedge is progressing down the reservoir, perhaps closer to the dam than had been expected at this time.

The original forecast dam-life scenarios in regard to sediment deposition were realistic, but ongoing monitoring is necessary as originally laid down in the dam operation procedures. This monitoring includes climate and bathymetry, as well as restoration of good quality measurements at the principal gauging stations upstream, especially for monitoring floods and sediment. In addition, cultivation activities within the reservoir's riparian zone should be addressed together with the widespread farming practises along the Suam river itself. Cultivation within riparian zones exacerbates soil loss and "tillage" is listed in the Water Act as a "proscribed activity" (in the Sixth Schedule of the Water Resources Management Rules 2007).

The dam has a low flood risk, but this is a major dam with catastrophic consequences in the event of a dam-break failure. The Fourth Schedule of the Water Resources Management Rules 2007 requires this dam to be inspected every two years by an expert duly licensed under the Water Act. An inspection would amongst other considerations recommend steps needed to restore the low-level outlet to full functionality as the outlet's sluicing capacity was designed to

clear fine sediments from accumulation against the dam. These sluicing releases would of course reduce the water available for power generation.

The Water Allocation Guidelines issued under the Water Act have been updated and these have potential implications for the water releases from Turkwel dam. The Guidelines require determination of the Reserve by adopting the holistic multi-disciplinary methodology and public consultations required by the Water Resources Authority. If these requirements are to be met, the dam's operation rules in terms of releases will need to be adjusted, and this may also impact on the water available for generation.

10 ANNEXES

Annex 1: Abstraction permits in Suam catchment (upper Turkwel)

#	File No		WRA Category	WRA Q.O.W. m^3/day	QOW converted to m^3/s (STA Calcs)	Suam permits (m^3/s)	Name of Water Body
1	WRMA/20/KAP/2BA/10028/S	KAMASIAN WATER PROJECT	B	61	0.0007		KAMASIAN STREAM OF MURUNY RIVER
2	WRMA/20/KAP/2BA/10033/S	RIFT VALLEY WATER SERVICE BOARD	C	500	0.0058		KERELWA STREAM OF MURUNY RIVER
3	WRMA/20/KAP/2BA/10034/S	RIFT VALLEY WATER SERVICE BOARD	C	200	0.0023		KOSULOL TRIOFIYON STREAM OF MURUNY RIVER
4	WRMA/20/KAP/2BA/10071/S	CEMTECH LIMITED	B	300	0.0035		MURUNY RIVER
5	WRMA/20/KAP/2BA/10134/S	NATIONAL WATER CONSERVATION & PIPELINE CORPORATION - MURUNY	D	38,880	0.4500		MURUNY RIVER
6	WRMA/20/KAP/2BB/10015/S	KERIO VALLEY DEVELOPMENT	D	0	0.0000		WEIWEI RIVER
7	WRMA/20/KAP/2BB/10044/S	KERIO VALLEY DEVELOPMENT	D	1,000	0.0116		WEIWEI RIVER
8	WRMA/20/KAP/2BC/1/S	ADC SUAM ORCHARDS	D	715	0.0083	0.0083	KAPTEGA RIVER -TRIBUTARY OF SUAM
9	WRMA/20/KAP/2BC/10001/S	KERIO VALLEY DEVELOPMENT AUTHORITY *	D	1,468,000	17.0		TURKWEL RIVER (Turkwel dam)
10	WRMA/20/KAP/2BC/10012/S	MT ELGON ORCHARDS LTD	C	519	0.0060	0.0060	KAPTEGA RIVER-TRIBUTARY OF SUAM
11	WRMA/20/KAP/2BC/10013/S	MT ELGON ORCHARDS LTD	B	109	0.0013	0.0013	KAPTEGA RIVER -TRIBUTARY OF SUAM
12	WRMA/20/KAP/2BC/10032/S	RIFT VALLEY WATER SERVICE BOARD	C	900	0.0104	0.0104	KOTORUK RIVER - TRIBUTARY OF SUAM
13	WRMA/20/KAP/2BC/10037/S	ST THERESAS TARTAR GIRLS SCHOOL	B	46	0.0005	0.0005	KOTORUK STREAM -TRIBUTARY OF SUAM
14	WRMA/20/KAP/2BC/10043/S	ADC SUAM ORCHARDS	D	1,095	0.0127	0.0127	KAPTEGA RIVER -TRIBUTARY OF SUAM
16	WRMA/20/KAP/2BC/10099/S	KENYA ELECTRICITY GENERATING COMPANY LTD **	D	1,657,681	19.2		RIVER TURKWEL (Turkwel dam)
17	WRMA/20/KAP/2BC/10109/S	MT ELGON ORCHARDS LTD	D	25,920	0.3000	0.3000	KAPTEGA RIVER-TRIBUTARY OF SUAM
18	WRMA/20/KAP/2BC/10144/S	PETER DAVID KAIME	B	20	0.0002	0.0002	KAPTEGA RIVER -TRIBUTARY OF SUAM
19	WRMA/20/KAP/2BC/10164/S	LIMAKI CLEMENT (KESOT-CHERU SELF HELP GROUP)	B	11	0.0001	0.0001	KWOK STREAM-TRIBUTARY OF SUAM
20	WRMA/20/KAP/2BC/10189/S	JIANGXI YOUSE CONSTRUCTION GROUP CO LTD	B	20	0.0002	0.0002	SUAM RIVER
22	WRMA/20/KAP/2BC/10198/S	COUNTY GOVERNMENT OF TRANS NZOIA	D	11,376	0.1317	0.1317	KAPTEGA RIVER -TRIBUTARY OF SUAM
						0.4714	SUB-TOTAL SUAM RIVER

STA Notes on permits:
Data provided by Water Resource Authority to Tullow in April 2020
QOW = Quantity of Water allowed by permit
* KVDA permit for Turkwel dam power generation superseded by Kengen permit
** Kengen permit for Turkwel dam (superssedes KVDA permit and 100% returnable except small offtake to supply water to Kengen camp at Turkwel)
STA = Tullow Consultant, Eng Sean Avery

Annex 2: Andersen Orchards Rainfall

Andersen Orchards, Mount Elgon - CHIRPS monthly rainfall download (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total RF mm
1981	9.2	19.3	209.3	162.7	94.6	59.4	165.0	163.5	143.3	83.6	34.0	26.4	1,170
1982	18.7	44.5	45.2	188.1	215.4	76.4	98.1	99.8	65.0	114.8	203.0	37.0	1,206
1983	24.1	36.5	50.6	147.2	187.5	126.5	122.7	175.3	112.1	117.9	52.4	23.8	1,177
1984	15.2	19.9	19.7	139.5	79.5	99.8	115.1	99.7	68.1	35.9	93.8	38.7	825
1985	38.0	37.4	105.5	212.3	164.7	110.0	151.7	147.9	89.0	54.7	116.7	7.0	1,235
1986	10.6	16.6	85.1	209.6	134.9	86.0	115.5	93.8	72.7	77.9	26.1	13.7	943
1987	19.0	53.0	103.6	100.4	150.0	117.0	55.0	139.8	60.6	77.6	101.9	25.7	1,004
1988	22.8	36.5	72.8	255.0	88.3	93.2	245.8	186.7	192.8	123.5	63.5	13.2	1,394
1989	10.4	47.4	138.1	107.4	159.9	89.1	133.1	124.0	112.2	95.3	72.9	91.0	1,181
1990	43.5	112.4	127.7	149.0	118.0	73.5	153.3	131.7	79.9	81.3	45.4	39.7	1,155
1991	56.7	21.4	92.3	127.9	257.3	128.9	180.8	214.4	55.6	142.1	49.7	13.4	1,341
1992	11.6	22.6	44.2	143.2	82.5	192.1	156.5	107.7	89.7	133.0	48.8	27.1	1,059
1993	65.0	101.0	21.6	105.8	177.2	131.2	129.3	97.6	81.1	59.8	35.5	12.0	1,017
1994	10.8	19.0	87.8	163.0	166.9	136.9	170.5	171.6	53.1	66.8	149.8	25.8	1,222
1995	14.2	59.8	69.5	138.1	136.7	111.7	171.8	100.6	114.7	147.1	68.6	42.3	1,175
1996	46.9	64.0	139.1	150.8	126.7	120.4	127.6	155.3	111.2	65.6	68.1	20.9	1,197
1997	34.1	8.9	104.2	228.4	101.0	105.2	152.5	98.7	25.5	121.2	134.8	41.8	1,156
1998	70.1	64.9	28.8	121.2	136.0	98.1	137.8	115.4	92.9	140.2	64.8	9.2	1,079
1999	21.8	12.7	103.2	138.1	120.4	120.5	118.0	110.6	95.5	186.6	43.8	47.7	1,119
2000	17.7	11.5	21.0	113.3	132.6	72.2	145.2	186.7	85.0	160.1	56.8	29.6	1,032
2001	66.2	23.6	107.1	113.2	148.6	166.8	134.2	115.1	96.4	142.7	116.3	12.7	1,243
2002	22.5	27.7	97.8	118.5	118.7	97.0	85.3	113.2	48.3	123.0	37.5	120.2	1,010
2003	30.7	22.8	65.1	198.8	161.6	148.0	164.1	178.9	64.8	49.5	61.3	42.6	1,188
2004	49.9	34.8	60.4	174.4	115.1	68.8	90.0	140.3	81.7	108.8	101.4	53.7	1,079
2005	45.4	35.0	58.3	107.5	165.0	94.4	101.6	118.4	125.4	114.2	30.0	13.4	1,009
2006	18.9	52.6	95.7	200.1	112.2	82.6	74.6	139.6	183.4	152.2	165.0	80.9	1,358
2007	43.0	97.4	59.9	160.7	150.4	143.1	196.9	194.1	236.1	70.9	34.3	26.0	1,413
2008	16.8	37.7	66.9	92.6	146.9	110.9	176.1	187.0	98.9	159.7	91.5	0.0	1,185
2009	36.1	13.0	32.6	177.8	146.2	65.9	93.5	114.2	88.0	95.7	45.3	132.6	1,041
2010	35.6	145.6	119.6	133.3	216.4	116.1	154.1	125.1	129.5	135.3	30.6	55.2	1,396
2011	13.2	24.0	124.2	90.7	121.5	152.6	168.7	196.9	130.2	87.1	218.1	18.6	1,346
2012	8.2	19.8	32.6	246.2	238.4	131.0	187.1	185.2	256.4	160.7	101.6	87.7	1,655
2013	44.2	19.0	126.3	236.2	149.1	109.0	160.3	157.6	198.7	156.1	103.5	65.3	1,525
2014	22.9	21.7	79.9	50.8	162.5	117.6	139.7	163.7	90.8	223.4	69.9	16.5	1,159
2015	8.0	17.0	27.8	167.4	132.2	177.0	125.5	65.8	99.9	156.3	110.5	64.7	1,152
2016	43.8	17.8	56.9	249.4	198.5	130.2	136.3	79.6	78.8	92.5	33.3	8.9	1,126
2017	35.8	91.2	53.8	79.0	230.8	102.1	339.5	166.3	150.9	178.1	85.1	11.5	1,524
2018	12.5	20.4	136.2	267.6	249.0	191.3	184.7	135.4	65.1	108.1	23.7	55.8	1,450
2019	17.0	22.5	63.6	126.0	140.8	177.5	173.3	199.0	154.8	207.5	116.5	87.6	1,486
Min	8.0	8.9	19.7	50.8	79.5	59.4	55.0	65.8	25.5	35.9	23.7	0.0	825
Mean	29.0	39.8	80.4	156.2	152.2	116.2	146.9	140.9	107.1	118.1	79.6	39.5	1,206
Max	70.1	145.6	209.3	267.6	257.3	192.1	339.5	214.4	256.4	223.4	218.1	132.6	1,655

Annex 3: Turkwel catchment rainfall

Turkwel dam catchment - CHIRPS monthly rainfall download (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total RF mm
1981	6.7	11.7	168.1	117.2	64.7	53.9	111.1	132.0	86.4	63.4	27.1	21.8	864
1982	10.1	25.6	48.1	135.4	157.2	51.6	95.6	75.7	46.8	74.8	173.4	25.6	920
1983	10.9	25.7	28.6	101.9	124.2	77.1	85.0	185.7	64.0	79.4	52.8	17.3	853
1984	8.2	13.6	26.6	100.6	52.0	63.5	80.3	63.2	75.8	29.8	78.7	28.2	620
1985	22.0	28.1	97.3	171.5	123.1	82.2	109.9	95.1	51.9	32.9	80.6	7.8	902
1986	5.8	12.0	75.8	199.4	81.4	71.7	85.2	74.2	47.4	67.2	19.7	15.6	755
1987	10.8	24.7	83.7	109.3	135.7	100.7	57.5	102.8	41.3	63.2	89.4	17.4	837
1988	14.7	29.2	54.0	219.7	91.1	89.0	178.9	131.5	112.7	100.3	36.6	13.4	1,071
1989	3.0	34.1	111.9	114.8	141.1	55.7	125.2	93.9	81.7	79.1	53.2	64.3	958
1990	19.2	63.3	102.9	119.3	102.7	53.0	109.4	100.5	54.6	75.8	37.1	26.4	864
1991	31.0	11.8	85.7	86.9	173.7	96.9	114.1	156.8	58.0	117.6	40.2	12.9	986
1992	5.0	13.9	43.1	127.0	75.6	95.7	116.4	92.7	54.2	108.9	29.7	14.8	777
1993	29.9	70.5	20.0	69.5	183.1	97.8	86.4	77.3	47.0	51.8	46.6	12.5	792
1994	8.2	12.7	55.6	123.5	136.5	93.2	138.3	156.9	38.2	56.1	100.7	15.9	936
1995	8.1	31.6	68.6	100.8	89.6	86.1	141.7	69.9	73.1	96.7	51.5	28.6	846
1996	24.0	32.6	110.0	122.6	94.4	121.7	102.1	132.3	75.9	65.6	52.3	17.9	951
1997	13.3	6.3	82.3	199.0	89.8	95.5	127.0	95.8	26.0	132.9	116.3	33.6	1,018
1998	37.2	38.6	24.1	94.7	129.1	113.9	109.8	103.2	59.5	103.7	48.5	11.0	873
1999	9.7	8.3	94.9	128.6	70.3	69.1	88.5	80.7	46.5	118.1	38.4	28.6	782
2000	9.1	6.8	17.8	83.4	101.1	61.1	109.2	130.4	62.5	124.7	44.9	17.3	768
2001	32.3	14.2	106.6	111.7	117.4	146.8	106.6	101.0	60.7	107.9	87.7	8.4	1,001
2002	9.4	15.6	87.1	99.6	126.0	78.8	66.6	77.6	33.1	119.8	31.0	76.7	821
2003	12.7	10.7	61.4	204.1	149.5	96.2	111.7	165.8	47.5	33.1	49.6	37.0	979
2004	23.5	17.0	59.1	141.7	96.3	47.7	83.2	95.8	54.3	71.6	107.8	42.7	841
2005	24.2	19.8	44.1	78.7	185.7	70.5	83.0	87.7	100.5	66.2	29.6	12.4	802
2006	9.1	31.4	91.6	152.8	93.0	56.4	62.7	150.9	92.3	119.9	164.1	70.5	1,095
2007	22.9	59.4	53.9	135.7	152.8	154.2	165.4	145.5	170.9	38.3	26.6	24.9	1,150
2008	7.7	17.2	63.0	69.1	88.1	86.1	119.3	110.0	72.8	125.0	92.3	3.6	854
2009	18.3	6.3	27.5	132.4	136.4	44.6	85.8	71.3	61.5	76.4	46.7	108.7	816
2010	23.2	82.0	125.1	120.3	187.7	85.8	126.4	98.4	87.0	92.2	23.9	33.1	1,085
2011	6.8	12.8	88.7	70.9	93.9	117.4	125.0	155.0	84.7	68.7	218.7	15.6	1,058
2012	2.2	12.8	22.9	213.1	215.9	85.3	146.2	140.8	137.5	135.8	88.8	62.0	1,263
2013	28.8	10.7	107.1	217.4	123.1	78.6	122.7	131.7	115.0	116.5	68.0	28.4	1,148
2014	7.9	10.3	66.3	31.2	109.6	66.1	106.6	157.0	53.8	163.6	56.2	19.2	848
2015	1.5	10.2	19.8	167.0	116.0	111.8	80.7	49.2	50.3	99.8	108.5	43.2	858
2016	21.4	9.6	47.4	256.3	136.2	92.9	95.6	66.2	50.9	77.1	24.8	4.3	883
2017	23.6	51.8	38.1	54.6	144.1	60.4	257.4	146.6	125.8	169.8	68.0	9.8	1,150
2018	3.7	12.1	128.0	287.9	229.5	154.6	111.9	121.9	37.2	69.3	18.1	46.4	1,221
2019	6.5	12.6	53.2	75.8	99.8	145.5	160.3	161.1	97.3	179.5	91.3	73.1	1,156
Min	1.5	6.3	17.8	31.2	52.0	44.6	57.5	49.2	26.0	29.8	18.1	3.6	620
Mean	14.7	23.5	69.0	131.9	123.5	87.4	112.5	112.4	70.2	91.6	67.2	29.5	933
Max	37.2	82.0	168.1	287.9	229.5	154.6	257.4	185.7	170.9	179.5	218.7	108.7	1,263

Annex 4: Turkwel reservoir rainfall

Turkwel reservoir water surface area - CHIRPS monthly rainfall download (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total RF mm
1981	5.6	11.1	156.4	98.0	41.9	53.0	68.6	89.5	42.2	63.0	23.7	18.6	672
1982	7.5	29.0	56.0	117.1	110.3	30.7	71.5	47.6	24.2	87.0	209.3	21.8	812
1983	5.9	23.4	27.5	107.6	58.7	47.2	94.7	177.0	28.5	109.7	57.7	17.5	755
1984	5.6	11.2	46.1	60.1	29.9	53.4	61.9	41.4	48.7	47.0	69.5	32.6	507
1985	14.7	28.3	84.2	208.5	93.0	58.0	87.4	60.5	21.8	29.1	62.6	7.3	755
1986	6.4	8.9	96.4	218.2	52.2	55.6	57.0	66.9	24.9	79.2	20.8	11.9	698
1987	6.6	15.4	75.4	99.2	118.0	101.5	51.1	64.7	16.4	73.1	87.5	13.3	722
1988	9.1	26.3	45.3	235.5	71.9	88.7	145.3	84.4	68.9	105.4	34.6	12.4	928
1989	0.0	28.2	87.4	128.0	116.6	41.9	84.3	90.6	53.4	82.8	58.7	49.6	821
1990	9.9	46.9	94.6	102.6	75.0	35.0	65.2	50.3	30.6	77.4	34.7	20.2	642
1991	26.8	7.4	91.0	38.8	132.9	64.3	80.8	84.4	41.0	144.9	41.5	10.7	765
1992	0.0	11.9	54.3	105.7	80.2	49.4	86.1	52.6	20.1	101.8	21.3	10.3	594
1993	21.6	78.5	16.7	60.8	183.0	93.5	40.6	49.8	20.7	47.3	75.0	12.0	699
1994	0.0	12.3	47.5	82.7	130.2	68.1	156.4	105.3	18.3	64.9	83.4	13.0	782
1995	5.8	26.2	70.2	80.7	61.5	49.2	109.5	38.5	41.7	82.9	30.8	13.7	611
1996	23.6	12.5	92.8	78.3	61.6	136.4	57.6	104.8	26.4	65.1	50.1	11.1	720
1997	0.0	0.0	63.6	225.4	68.2	63.4	127.9	83.0	16.3	153.6	143.3	26.4	971
1998	21.7	30.7	18.1	72.1	111.4	100.9	71.5	41.3	30.7	60.7	43.8	11.2	614
1999	5.8	5.5	92.8	114.3	49.4	41.5	38.5	48.7	20.1	70.8	35.2	20.4	543
2000	6.3	0.0	13.5	53.2	66.7	45.3	64.6	98.4	26.9	90.0	40.0	11.8	517
2001	28.6	8.5	125.3	94.0	76.0	121.9	68.7	44.5	26.0	93.7	67.1	8.9	763
2002	4.5	8.1	86.6	119.9	134.8	60.3	45.0	45.3	16.7	117.0	20.1	59.5	718
2003	8.5	5.0	69.4	240.0	144.2	58.4	66.7	134.1	30.3	35.0	40.7	37.0	869
2004	16.5	6.6	64.4	164.0	73.9	36.0	70.0	64.7	39.4	71.3	111.2	33.5	752
2005	21.1	14.0	44.4	64.1	185.1	70.0	60.3	48.6	60.1	58.0	32.8	10.0	669
2006	6.2	19.8	81.1	128.1	72.5	26.1	45.5	140.3	35.6	116.3	183.9	68.4	924
2007	17.5	52.8	36.4	133.8	138.6	159.0	139.2	147.1	121.1	34.4	17.9	26.4	1,024
2008	7.3	11.2	66.5	56.6	52.4	63.4	80.5	51.8	41.1	135.0	100.4	6.3	673
2009	11.9	0.0	20.6	126.7	89.3	38.0	70.1	36.5	28.9	83.8	47.0	86.7	639
2010	17.3	58.9	139.2	98.7	124.8	73.2	103.7	77.0	53.2	71.7	23.7	20.1	861
2011	6.6	6.8	73.8	47.6	54.9	109.1	88.2	120.3	55.1	68.4	257.0	14.5	902
2012	0.0	8.5	14.8	231.1	207.9	61.0	117.1	119.6	47.0	156.5	69.7	43.8	1,077
2013	20.2	7.0	88.3	238.1	96.2	53.4	85.3	76.2	45.2	73.4	64.3	15.2	863
2014	0.0	8.8	54.2	9.1	48.7	42.0	75.9	98.8	27.1	135.5	43.6	11.8	555
2015	0.0	5.6	17.2	167.1	82.1	74.9	38.7	30.6	19.1	61.6	114.7	24.1	636
2016	12.9	7.5	40.8	219.8	92.9	65.6	62.9	52.2	17.4	53.4	19.3	0.0	645
2017	15.3	35.0	33.4	31.6	92.6	28.4	185.1	105.2	73.2	170.6	77.2	8.1	856
2018	0.0	7.7	133.3	313.2	202.6	125.6	53.2	81.6	14.6	50.2	16.4	42.0	1,040
2019	0.0	11.3	46.7	56.7	55.8	115.5	110.8	74.3	50.7	191.9	76.3	64.4	854
Min	0.0	0.0	13.5	9.1	29.9	26.1	38.5	30.6	14.6	29.1	16.4	0.0	507
Mean	9.7	17.9	65.8	123.8	95.8	68.2	81.7	77.6	36.5	87.5	66.8	23.7	755
Max	28.6	78.5	156.4	313.2	207.9	159.0	185.1	177.0	121.1	191.9	257.0	86.7	1,077

Annex 5: Turkwel evaporation

Turkwel pan evaporation (mm)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1983		209.9											
1984	253.2	209.1	206.0	250.0	247.0	251.0	252.4	242.0	224.0	235.5	232.6	211.4	2,814
1985	214.7	194.3	163.7	177.7	162.6	234.2	263.7	169.5	165.6	170.5	153.9	185.6	2,256
1986	269.7	250.2	265.0	172.0	197.8	138.6	186.7	182.3	206.6	207.9	204.9	223.5	2,505
1987	241.7	267.4	271.3	245.4	195.2	119.5	229.0	292.7	311.9	310.6	240.6	286.0	3,011
1988	285.0	342.0	327.0	214.8	224.6	233.2	186.8	207.3	205.9	246.0	212.6	250.8	2,936
1989	278.4	261.2	310.7	225.4	221.0	227.5	214.5	245.9		231.0	235.0	232.6	
1990	242.9	213.3	186.1	197.1	228.3	245.6	235.5	247.3	278.0	251.3	220.6	212.5	2,759
1991			287.3		185.3			197.8	180.3				
1992	208.8		156.4										
1993	132.9	176.5	243.2	201.3		211.5		175.6					
1994													
1995						278.7	213.4		315.7	265.3		195.3	
1996	240.1	232.1	234.3	239.4	236.2	174.2	113.8						
1997	258.5	272.5	291.8	223.9	201.8		221.6	234.9		239.5	243.5		
1998	231.7	227.7	278.6	213.2	220.1	231.8	193.5	242.3	277.1	249.9	211.2	230.6	2,808
1999	249.7												
2000													

Note: Data provided by KVDA, gaps are missing data

Annex 6: Turkwel reservoir water balance

Turkwel reservoir water balance						
Date	Water Elevation at month end	Reservoir inflow	Net evaporation Loss	Spiil	Direct abstraction	Turbine discharge
mmm-yy	m ASL	h.m^3	h.m^3	h.m^3	h.m^3	h.m^3
Jan-96	1106.25	9.019	2.288	0.000	0.000	26.297
Feb-96	1104.90	14.050	2.062	0.000	0.000	26.404
Mar-96	1103.97	19.952	1.602	0.000	0.000	26.479
Apr-96	1103.09	23.119	0.718	0.000	0.000	34.476
May-96	1103.06	41.991	0.846	0.000	0.000	29.767
Jun-96	1105.14	80.909	1.285	0.000	0.000	40.768
Jul-96	1109.33	119.856	1.415	0.000	0.000	42.454
Aug-96	1112.93	81.948	1.925	0.000	0.000	47.314
Sep-96	1113.59	55.102	2.899	0.000	0.000	63.296
Oct-96	1111.29	6.313	1.829	0.000	0.000	66.259
Nov-96	1108.41	26.741	1.630	0.000	0.000	50.296
Dec-96	1106.46	5.673	2.026	0.000	0.000	31.027
Jan-97	1104.19	0.419	2.047	0.000	0.000	27.088
Feb-97	1102.36	0.000	1.787	0.000	0.000	11.523
Mar-97	1101.20	2.017	1.364	0.000	0.000	12.565
Apr-97	1104.44	118.066	0.774	0.000	0.000	26.247
May-97	1108.62	52.938	1.138	0.000	0.000	40.518
Jun-97	1108.20	13.929	1.507	0.000	0.000	35.316
Jul-97	1108.44	73.987	1.353	0.000	0.000	42.801
Aug-97	1109.28	40.858	1.618	0.000	0.000	45.748
Sep-97	1107.78	6.760	2.195	0.000	0.000	39.257
Oct-97	1106.90	47.387	1.472	0.000	0.000	35.620
Nov-97	1109.56	105.122	1.725	0.000	0.000	37.091
Dec-97	1111.77	36.702	2.635	0.000	0.000	35.658
Jan-98	1113.31	96.201	3.231	0.000	0.000	39.414
Feb-98	1114.77	35.023	3.344	0.000	0.000	35.965
Mar-98	1113.70	7.035	2.607	0.000	0.000	37.170
Apr-98	1112.21	29.869	1.146	0.000	0.000	45.885
May-98	1112.80	86.005	1.390	0.000	0.000	47.681
Jun-98	1113.70	43.490	1.960	0.000	0.000	48.730
Jul-98	1114.40	92.664	1.794	0.000	0.000	58.816
Aug-98	1116.36	96.719	2.243	0.000	0.000	54.803
Sep-98	1116.71	34.093	3.329	0.000	0.000	57.313
Oct-98	1116.37	72.419	2.302	0.000	0.000	56.825
Nov-98	1116.20	42.514	2.343	0.000	0.000	59.793
Dec-98	1114.53	9.379	2.989	0.000	0.000	47.273
Jan-99	1112.03	3.404	3.046	0.000	0.000	43.619
Feb-99	1109.42	0.000	2.605	0.000	0.000	31.143
Mar-99	1107.85	23.460	1.970	0.000	0.000	32.893
Apr-99	1107.38	32.178	0.905	0.000	0.000	35.708
May-99	1107.01	32.058	1.049	0.000	0.000	36.376
Jun-99	1105.64	8.764	1.320	0.000	0.000	36.804
Jul-99	1104.68	45.245	1.111	0.000	0.000	39.169
Aug-99	1104.55	28.683	1.266	0.000	0.000	35.371
Sep-99	1104.14	29.576	1.808	0.000	0.000	29.784
Oct-99	1106.05	78.208	1.408	0.000	0.000	25.712
Nov-99	1107.63	18.631	1.567	0.000	0.000	28.421
Dec-99	1106.79	19.007	2.062	0.000	0.000	27.920
Jan-00	1104.91	0.000	2.129	0.000	0.000	32.739
Feb-00	1102.42	0.000	1.793	0.000	0.000	18.532
Mar-00	1100.88	0.000	1.338	0.000	0.000	7.431
Apr-00	1100.20	0.000	0.603	0.000	0.000	3.789
May-00	1102.28	60.171	0.808	0.000	0.000	15.414
Jun-00	1104.20	15.048	1.220	0.000	0.000	21.200
Jul-00	1104.97	45.940	1.129	0.000	0.000	18.345
Aug-00	1108.42	88.800	1.551	0.000	0.000	20.829
Sep-00	1109.77	17.403	2.423	0.000	0.000	45.057
Oct-00	1109.59	72.994	1.685	0.000	0.000	46.862
Nov-00	1109.91	22.950	1.755	0.000	0.000	36.312
Dec-00	1108.82	9.741	2.286	0.000	0.000	23.942
Jan-01	1107.38	1.833	2.427	0.000	0.000	22.533
Feb-01	1105.62	0.000	2.144	0.000	0.000	20.118
Mar-01	1104.57	14.994	1.657	0.000	0.000	17.228
Apr-01	1105.31	41.770	0.812	0.000	0.000	18.941
May-01	1106.93	47.600	1.044	0.000	0.000	27.262
Jun-01	1108.98	57.947	1.568	0.000	0.000	18.614
Jul-01	1111.33	60.702	1.558	0.000	0.000	26.894
Aug-01	1113.91	88.904	2.013	0.000	0.000	33.290
Sep-01	1115.62	25.990	3.174	0.000	0.000	17.097
Oct-01	1115.63	35.767	2.229	0.000	0.000	38.890
Nov-01	1116.01	61.823	2.323	0.000	0.000	39.647
Dec-01	1115.59	11.273	3.133	0.000	0.000	43.341
Jan-02	1113.68	8.517	3.286	0.000	0.000	39.445
Feb-02	1111.42	0.000	2.868	0.000	0.000	35.140

Turkwel reservoir water balance						
Date	Water Elevation at month end	Reservoir inflow	Net evaporation Loss	Spill	Direct abstraction	Turbine discharge
mmm-yy	m ASL	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$
Mar-02	1109.79	4.018	2.170	0.000	0.000	14.429
Apr-02	1109.43	12.622	1.004	0.000	0.000	12.491
May-02	1112.49	113.951	1.370	0.000	0.000	11.400
Jun-02	1115.55	14.496	2.128	0.000	0.000	13.288
Jul-02	1115.35	2.992	1.872	0.000	0.000	7.329
Aug-02	1115.48	21.224	2.159	0.000	0.000	8.240
Sep-02	1115.55	6.733	3.165	0.000	0.000	11.848
Oct-02	1115.53	19.857	2.219	0.000	0.000	10.101
Nov-02	1116.05	23.837	2.328	0.000	0.000	9.410
Dec-02	1117.12	42.418	3.349	0.000	0.000	10.051
Jan-03	1117.87	15.713	3.949	0.000	0.000	11.362
Feb-03	1117.36	1.151	3.744	0.000	0.000	17.918
Mar-03	1116.36	3.340	2.934	0.000	0.000	18.628
Apr-03	1118.84	144.970	1.535	0.000	0.000	19.762
May-03	1123.64	114.403	2.201	0.000	0.000	19.817
Jun-03	1126.12	67.487	3.280	0.000	0.000	28.970
Jul-03	1127.41	67.820	3.056	0.000	0.000	27.184
Aug-03	1129.55	126.125	3.798	0.000	0.000	28.875
Sep-03	1130.90	25.758	5.833	0.000	0.000	29.161
Oct-03	1130.45	10.278	4.027	0.000	0.000	26.358
Nov-03	1129.93	12.035	4.048	0.000	0.000	21.657
Dec-03	1129.53	12.846	5.480	0.000	0.000	18.952
Jan-04	1128.99	10.073	6.135	0.000	0.000	25.419
Feb-04	1128.17	3.635	5.764	0.000	0.000	26.129
Mar-04	1127.23	5.350	4.552	0.000	0.000	27.211
Apr-04	1127.58	75.519	2.171	0.000	0.000	26.211
May-04	1129.24	80.199	2.727	0.000	0.000	24.800
Jun-04	1129.67	17.714	3.749	0.000	0.000	40.725
Jul-04	1128.91	20.480	3.232	0.000	0.000	37.742
Aug-04	1129.26	82.857	3.757	0.000	0.000	36.313
Sep-04	1129.46	28.564	5.531	0.000	0.000	53.954
Oct-04	1128.48	28.691	3.743	0.000	0.000	53.846
Nov-04	1128.92	112.113	3.900	0.000	0.000	51.887
Dec-04	1129.48	19.669	5.471	0.000	0.000	36.706
Jan-05	1128.40	5.422	6.000	0.000	0.000	42.933
Feb-05	1126.82	6.569	5.477	0.000	0.000	49.427
Mar-05	1125.36	26.498	4.237	0.000	0.000	54.618
Apr-05	1123.83	20.198	1.878	0.000	0.000	65.004
May-05	1125.03	167.487	2.324	0.000	0.000	52.817
Jun-05	1126.88	46.805	3.377	0.000	0.000	58.728
Jul-05	1126.38	52.159	2.938	0.000	0.000	62.008
Aug-05	1126.30	68.761	3.360	0.000	0.000	57.086
Sep-05	1127.57	127.403	5.154	0.000	0.000	57.088
Oct-05	1128.18	28.450	3.700	0.000	0.000	55.399
Nov-05	1127.01	20.083	3.629	0.000	0.000	53.748
Dec-05	1125.24	4.450	4.659	0.000	0.000	58.910
Jan-06	1122.89	4.391	4.853	0.000	0.000	59.945
Feb-06	1120.45	3.411	4.261	0.000	0.000	52.422
Mar-06	1118.37	20.210	3.198	0.000	0.000	53.092
Apr-06	1117.57	49.043	1.454	0.000	0.000	44.608
May-06	1117.21	27.719	1.691	0.000	0.000	42.891
Jun-06	1116.43	36.994	2.212	0.000	0.000	48.292
Jul-06	1115.30	26.831	1.867	0.000	0.000	53.036
Aug-06	1117.08	152.124	2.315	0.000	0.000	50.152
Sep-06	1119.49	42.112	3.744	0.000	0.000	44.570
Oct-06	1118.99	38.191	2.574	0.000	0.000	50.308
Nov-06	1119.82	95.579	2.731	0.000	0.000	41.708
Dec-06	1122.09	82.453	4.115	0.000	0.000	26.834
Jan-07	1122.70	18.441	4.815	0.000	0.000	37.071
Feb-07	1121.88	20.044	4.516	0.000	0.000	30.993
Mar-07	1120.78	0.429	3.533	0.000	0.000	31.722
Apr-07	1120.47	48.440	1.642	0.000	0.000	26.150
May-07	1120.99	41.288	1.980	0.000	0.000	36.817
Jun-07	1122.16	94.205	2.808	0.000	0.000	38.581
Jul-07	1124.40	101.667	2.722	0.000	0.000	40.649
Aug-07	1126.98	125.991	3.448	0.000	0.000	40.331
Sep-07	1130.89	208.156	5.831	0.000	0.000	39.215
Oct-07	1133.19	34.662	4.447	0.000	0.000	42.798
Nov-07	1132.51	6.964	4.448	0.000	0.000	37.911
Dec-07	1131.68	9.772	5.931	0.000	0.000	25.917
Jan-08	1130.91	7.391	6.585	0.000	0.000	30.169
Feb-08	1129.86	5.082	6.139	0.000	0.000	37.312
Mar-08	1128.80	9.626	4.829	0.000	0.000	32.218
Apr-08	1128.23	23.997	2.225	0.000	0.000	28.929

Turkwel reservoir water balance						
Date	Water Elevation at month end	Reservoir inflow	Net evaporation Loss	Spill	Direct abstraction	Turbine discharge
mmm-yy	m ASL	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$
May-08	1127.70	7.443	2.574	0.000	0.000	29.122
Jun-08	1127.42	43.375	3.446	0.000	0.000	31.832
Jul-08	1127.98	61.584	3.122	0.000	0.000	33.650
Aug-08	1128.53	72.966	3.656	0.000	0.000	61.469
Sep-08	1128.06	43.154	5.250	0.000	0.000	73.458
Oct-08	1127.37	72.681	3.590	0.000	0.000	74.287
Nov-08	1128.32	122.738	3.813	0.000	0.000	56.678
Dec-08	1128.45	7.565	5.265	0.000	0.000	57.032
Jan-09	1126.52	7.730	5.588	0.000	0.000	59.436
Feb-09	1124.35	4.135	4.980	0.000	0.000	57.855
Mar-09	1121.80	0.000	3.682	0.000	0.000	58.263
Apr-09	1120.06	24.104	1.614	0.000	0.000	40.663
May-09	1120.76	76.380	1.961	0.000	0.000	28.838
Jun-09	1121.23	10.408	2.704	0.000	0.000	32.616
Jul-09	1119.78	18.102	2.260	0.000	0.000	54.990
Aug-09	1117.21	0.000	2.328	0.000	0.000	62.251
Sep-09	1114.08	1.472	2.964	0.000	0.000	50.398
Oct-09	1113.09	49.263	1.989	0.000	0.000	30.862
Nov-09	1113.31	10.663	2.059	0.000	0.000	17.890
Dec-09	1113.33	30.668	2.832	0.000	0.000	17.866
Jan-10	1115.50	109.940	3.565	0.000	0.000	37.285
Feb-10	1116.87	16.760	3.666	0.000	0.000	32.812
Mar-10	1118.08	106.076	3.159	0.000	0.000	33.138
Apr-10	1120.41	55.885	1.638	0.000	0.000	27.230
May-10	1123.60	156.311	2.198	0.000	0.000	24.543
Jun-10	1126.53	48.055	3.332	0.000	0.000	25.711
Jul-10	1127.48	74.651	3.064	0.000	0.000	36.226
Aug-10	1128.94	87.940	3.712	0.000	0.000	32.466
Sep-10	1130.50	95.595	5.749	0.000	0.000	42.883
Oct-10	1131.62	70.436	4.202	0.000	0.000	39.813
Nov-10	1131.62	16.514	4.307	0.000	0.000	38.466
Dec-10	1130.60	11.921	5.702	0.000	0.000	47.294
Jan-11	1129.01	3.621	6.140	0.000	0.000	56.477
Feb-11	1127.13	4.252	5.542	0.000	0.000	51.622
Mar-11	1125.28	16.427	4.224	0.000	0.000	61.530
Apr-11	1123.35	9.859	1.844	0.000	0.000	57.583
May-11	1122.39	49.348	2.095	0.000	0.000	45.582
Jun-11	1122.83	61.228	2.885	0.000	0.000	38.422
Jul-11	1123.90	74.764	2.668	0.000	0.000	38.953
Aug-11	1126.59	160.373	3.398	0.000	0.000	42.386
Sep-11	1129.77	137.259	5.596	0.000	0.000	59.732
Oct-11	1130.34	30.735	4.010	0.000	0.000	63.859
Nov-11	1131.88	204.198	4.349	0.000	0.000	54.577
Dec-11	1134.30	71.606	6.517	0.000	0.000	42.798
Jan-12	1133.97	8.613	7.357	0.000	0.000	47.352
Feb-12	1132.62	4.212	6.791	0.000	0.000	48.812
Mar-12	1130.95	2.837	5.229	0.000	0.000	59.747
Apr-12	1130.84	116.476	2.450	0.000	0.000	59.727
May-12	1133.38	156.320	3.172	0.000	0.000	28.471
Jun-12	1135.04	35.177	4.553	0.000	0.000	35.250
Jul-12	1135.65	103.959	4.126	0.000	0.000	47.370
Aug-12	1136.93	122.706	4.951	0.000	0.000	66.423
Sep-12	1138.18	101.085	7.556	0.000	0.000	39.307
Oct-12	1138.82	45.567	5.421	0.000	0.000	38.368
Nov-12	1138.77	54.247	5.547	0.000	0.000	55.352
Dec-12	1138.36	36.628	7.514	0.000	0.000	58.373
Jan-13	1137.66	33.778	8.377	0.000	0.000	56.033
Feb-13	1137.12	52.399	7.964	0.000	0.000	59.858
Mar-13	1135.69	0.000	6.198	0.000	0.000	66.890
Apr-13	1135.22	81.402	2.869	0.000	0.000	43.276
May-13	1136.51	101.676	3.544	0.000	0.000	56.569
Jun-13	1136.90	48.256	4.861	0.000	0.000	53.318
Jul-13	1136.59	48.137	4.265	0.000	0.000	59.401
Aug-13	1137.13	128.005	4.985	0.000	0.000	62.123
Sep-13	1137.79	60.892	7.455	0.000	0.000	59.421
Oct-13	1137.51	59.914	5.181	0.000	0.000	72.501
Nov-13	1137.50	95.201	5.309	0.000	0.000	72.976
Dec-13	1137.08	26.494	7.189	0.000	0.000	70.928
Jan-14	1135.51	10.765	7.768	0.000	0.000	77.950
Feb-14	1133.55	7.451	7.022	0.000	0.000	73.348
Mar-14	1131.76	30.983	5.386	0.000	0.000	79.363
Apr-14	1130.21	27.471	2.395	0.000	0.000	74.146
May-14	1128.66	32.504	2.669	0.000	0.000	77.651
Jun-14	1127.10	32.979	3.405	0.000	0.000	73.205

Turkwel reservoir water balance						
Date	Water Elevation at month end	Reservoir inflow	Net evaporation Loss	Spiil	Direct abstraction	Turbine discharge
mmm-yy	m ASL	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$	$h.m^3$
Jul-14	1125.82	49.154	2.876	0.000	0.000	74.609
Aug-14	1125.50	86.078	3.258	0.000	0.000	72.336
Sep-14	1127.25	138.956	5.091	0.000	0.000	44.479
Oct-14	1130.05	122.865	3.968	0.000	0.000	39.014
Nov-14	1131.27	40.270	4.253	0.000	0.000	38.023
Dec-14	1130.84	27.492	5.753	0.000	0.000	47.885
Jan-15	1129.42	9.512	6.235	0.000	0.000	67.102
Feb-15	1127.35	2.453	5.588	0.000	0.000	57.721
Mar-15	1124.78	0.000	4.144	0.000	0.000	72.689
Apr-15	1123.30	59.945	1.840	0.000	0.000	59.087
May-15	1122.42	6.466	2.097	0.000	0.000	47.660
Jun-15	1122.64	104.259	2.862	0.000	0.000	47.125
Jul-15	1123.29	28.658	2.606	0.000	0.000	49.285
Aug-15	1121.95	12.333	2.833	0.000	0.000	50.280
Sep-15	1119.84	0.939	3.799	0.000	0.000	51.243
Oct-15	1117.81	30.305	2.449	0.000	0.000	59.353
Nov-15	1118.46	93.866	2.580	0.000	0.000	32.024
Dec-15	1119.01	0.000	3.628	0.000	0.000	22.243
Jan-16	1118.07	23.907	3.982	0.000	0.000	33.606
Feb-16	1116.37	0.000	3.587	0.000	0.000	56.066
Mar-16	1112.47	0.000	2.464	0.000	0.000	67.560
Apr-16	1111.72	79.606	1.120	0.000	0.000	37.361
May-16	1117.37	197.369	1.702	0.000	0.000	31.484
Jun-16	1121.49	40.141	2.733	0.000	0.000	38.446
Jul-16	1122.21	74.168	2.496	0.000	0.000	36.437
Aug-16	1123.83	92.489	3.052	0.000	0.000	45.276
Sep-16	1124.19	35.799	4.525	0.000	0.000	57.494
Oct-16	1122.61	8.226	2.984	0.000	0.000	56.454
Nov-16	1120.38	7.470	2.795	0.000	0.000	58.332
Dec-16	1117.54	0.000	3.409	0.000	0.000	61.286
Jan-17	1114.21	0.000	3.365	0.000	0.000	46.927
Feb-17	1111.55	0.000	2.886	0.000	0.000	30.328
Mar-17	1109.09	0.000	2.097	0.000	0.000	35.617
Apr-17	1106.94	15.631	0.885	0.000	0.000	32.724
May-17	1109.18	89.994	1.170	0.000	0.000	14.831
Jun-17	1112.33	33.127	1.840	0.000	0.000	23.969
Jul-17	1114.01	89.428	1.763	0.000	0.000	37.078
Aug-17	1116.78	97.180	2.285	0.000	0.000	44.045
Sep-17	1119.95	130.635	3.817	0.000	0.000	46.204
Oct-17	1122.64	96.393	2.987	0.000	0.000	53.130
Nov-17	1123.69	65.095	3.191	0.000	0.000	51.112
Dec-17	1122.98	3.825	4.263	0.000	0.000	44.955
Jan-18	1120.71	0.000	4.444	0.000	0.000	55.660
Feb-18	1117.75	0.000	3.807	0.000	0.000	53.643
Mar-18	1115.73	36.997	2.855	0.000	0.000	56.663
Apr-18	1117.77	147.030	1.467	0.000	0.000	47.066
May-18	1121.14	82.991	1.992	0.000	0.000	39.421
Jun-18	1126.07	261.500	3.273	0.000	0.000	36.819
Jul-18	1130.56	75.551	3.437	0.000	0.000	40.686
Aug-18	1131.34	70.558	4.056	0.000	0.000	46.885
Sep-18	1131.22	34.825	5.902	0.000	0.000	56.299
Oct-18	1130.21	29.227	3.990	0.000	0.000	64.116
Nov-18	1128.75	17.603	3.875	0.000	0.000	65.728
Dec-18	1126.97	18.106	4.979	0.000	0.000	65.445
Jan-19	1124.78	8.302	5.227	0.000	0.000	69.551
Feb-19	1121.98	0.000	4.534	0.000	0.000	61.426
Mar-19	1119.04	8.579	3.289	0.000	0.000	70.666
Apr-19	1116.78	15.060	1.406	0.000	0.000	46.636
May-19	1115.92	42.791	1.599	0.000	0.000	41.192
Jun-19	1118.77	156.599	2.444	0.000	0.000	35.301
Jul-19	1123.01	106.687	2.577	0.000	0.000	36.080
Aug-19	1125.54	111.321	3.263	0.000	0.000	46.644
Sep-19	1127.39	101.510	5.119	0.000	0.000	55.371
Oct-19	1128.92	110.172	3.804	0.000	0.000	56.483
Nov-19	1130.76	117.218	4.175	0.000	0.000	45.438
Dec-19	1133.00	134.029	6.222	0.000	0.000	41.376

Annex 7: Turkwel water chemistry - Samples 1 to 5

WATER QUALITY RESULTS				1	2	3	4	5
				Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal
	Parameter	KS459 Limit	Units	TD1 Tailrace	TD2Tailrace	17		08-Oct-15
Date				16/6/15	16/6/15	5/8/15	20/9/15	28/10/15
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	150	150	133	209	128
	Total Hardness as $CaCO_3$	300	mg/L	78.4	78.1	78.7		82.1
	Aluminium as Al^{+++}	0.1	mg/L	<0.04	<0.04	<0.04	<0.04	<0.04
	Chloride as Cl^-	250	mg/L	5.98	4.79	7.13	14.46	10.56
	Iron as Fe^{++}	0.3	mg/L	<0.007	<0.007	0.04	<0.007	0.06
	Sodium as Na^+	200	mg/L	10.97	10.97	8.32	8.65	7.31
	Sulphate	400	mg/L	2.47	2.06	2.68	2.9	1.8
	Zinc as Zn^{++}	5	mg/L	0.01	<0.002	<0.002	<0.002	<0.002
	Magnesium as Mg^{++}	100	mg/L	6.32	6.27	6.62	6.49	6.81
	Calcium as Ca^{++}	150	mg/L	20.98	20.94	20.59	20.44	21.65
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	nd	nd	d	nd	nd
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	nd	nd	nd	nd	nd
	Copper as Cu	1	mg/L	<0.006	<0.006	<0.006	<0.006	<0.006
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Ammonia as N	0.5	mg/L	0.11	0.11	0.05	0.1	0.08
	Chromium as Cr	0.05	mg/L	<0.007	<0.007	<0.007	<0.007	<0.007
	Nickel as Ni	0.02	mg/L	nd	nd	<0.015	<0.015	<0.015
	Cyanide as CN	0.07	mg/L	Nil	Nil	Nil	Nil	Nil
	Barium as Ba	0.7	mg/L	0.09	0.09	0.08	0.07	0.09
	Nitrate as NO_3	50	mg/L	2.1	1.8	6.1	Nil	10.7
	Boron as boric acid	0.3	mg/L	<0.005	<0.005	<0.005	<0.002	
	Boron as B		mg/L					
	Fluoride as F	1.5	mg/L	0.84	0.96	0.96	0.53	0.27
	Bromate as BrO_3	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	
	Nitrite	0.003	mg/L	nd	nd	Nil	Nil	Nil
	Phosphates as PO_4^{3-}	2.2	mg/L	0.04	Nil	Nil	nd	Nil
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	6.65	6.94	7.54	6.75	7.24
	Electrical conductivity	1,500	µS/cm	231	230	204	322	196
	Potassium		mg/L	4.2	4.19	3.93	3.82	3.73
	Strontium		mg/L	<0.0005	<0.0005	0.23	0.22	0.23
	SiO_2 as Si		mg/L	4.28	4.11	3.45	3.38	4.73
	Lithium		mg/L			<0.004	<0.002	<0.004
	Bicarbonate as $CaCO_3$		mg/L	100	95	140		58
	Total Alkalinity		mg/L	100	95	140	210	106

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 8: Turkwel water chemistry - Samples 6 to 10

WATER QUALITY RESULTS				6	7	8	9	10
				Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal	Tailrace canal
	Parameter	KS459 Limit	Units	11-Nov-15	7-DEC-15	AQ 47599b	AQ 48994	AQ 49745
Date				2/12/15	30/12/2015	30/03/2016	30/08/2016	16/10/201
Table 2 from KS 459-1:2007	Suspended matter	nd		nd	nd	Nil	2	Nil
	Total dissolved solids	1,000	mg/L	120	666 ???	110	85	85
	Total Hardness as $CaCO_3$	300	mg/L	76.6	226.9	74.0	50.0	12.5
	Aluminium as Al^{+++}	0.1	mg/L	<0.04	<0.04	<0.001	<0.001	0.05
	Chloride as Cl^-	250	mg/L	11.32	4.43	4.42	11.80	14.75
	Iron as Fe^{++}	0.3	mg/L	0.62	0.34	<0.001	0.05	0.09
	Sodium as Na^+	200	mg/L	7.31	217.13	70.19	13.6	47.1
	Sulphate	400	mg/L	2.06	20.6	1.08	54.5	7.92
	Zinc as Zn^{++}	5	mg/L	<0.002	0.13	0.12	<0.001	0.01
	Magnesium as Mg^{++}	100	mg/L	6.69	33.53	4.56	4.11	0.07
	Calcium as Ca^{++}	150	mg/L	19.64	35.58	15.75	13.13	0.09
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	nd	nd	<0.001	<0.001	<0.001
	Cadmium as Cd	0.003	mg/L	nd	nd	<0.001	<0.001	<0.001
	Lead as Pb	0.01	mg/L	nd	nd	<0.001	<0.001	<0.001
	Copper as Cu	1	mg/L	<0.006	<0.006	0.11	<0.001	<0.001
	Mercury as Hg	0.001	mg/L	nd	nd	<0.001	<0.001	<0.001
	Manganese as Mn	0.5	mg/L	0.01	0.01	0.04	0.18	0.02
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.001	<0.001	<0.001
	Ammonia as N	0.5	mg/L	0.31	0.01	0.19	0.001	<0.001
	Chromium as Cr	0.05	mg/L	<0.007	<0.007	<0.001	<0.001	<0.001
	Nickel as Ni	0.02	mg/L	<0.015	<0.015	<0.001	<0.001	<0.001
	Cyanide as CN	0.07	mg/L	Nil	Nil	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	0.09	<0.002	<0.001	<0.001	<0.001
	Nitrate as NO_3	50	mg/L	0.8	0.57	0.16	12.63	29.11
	Boron as boric acid	0.3	mg/L	0.02	0.18	<0.001	<0.001	<0.001
	Boron as B		mg/L					
	Fluoride as F	1.5	mg/L	0.69	1.8	1.25	0.12	0
	Bromate as BrO_3	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	0.007
	Nitrite	0.003	mg/L	nd	nd	<0.001	<0.001	<0.001
	Phosphates as PO_4^{3-}	2.2	mg/L	Nil	Nil	0.33	4.89	0.83
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.27	7.33	8.02	7.66	7.64
	Electrical conductivity	1,500	µS/cm	185	1,024 ????	220	170	170
	Potassium		mg/L	3.83	1.61	3.9	4.61	1.18
	Strontium		mg/L	<0.005	1.23	<0.001	<0.001	<0.001
	SiO_2 as Si		mg/L	5.93	5.44	4.57	<0.001	3.5
	Lithium		mg/L	<0.004	<0.004	<0.001	<0.001	<0.001
	Bicarbonate as $CaCO_3$		mg/L	80	590	181	282	271
	Total Alkalinity		mg/L	80	590	181	375	187

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 9: Turkwel water chemistry - Samples 11 to 15

WATER QUALITY RESULTS				11	12	13	14	15
				Tailrace canal	Tailrace canal	Tailrace canal	Turkwel Dam reservoir	Turkwel Dam reservoir
	Parameter	KS459 Limit	Units	SGS	MA17-05350.001	TURK 1 (SGS MA18-02852.003)		TURKWEL DAM (SGS MA18-00633.004)
Date				Aug-17	Nov-17	Feb-18	May-18	Jun-18
Table 2 from KS 459-1:2007	Suspended matter	nd		d	nd	d	d	d
	Total dissolved solids	1,000	mg/L	118	142	148	136	136
	Total Hardness as $CaCO_3$	300	mg/L	69.1	61.0	61.7	77.6	58.9
	Aluminium as Al^{+++}	0.1	mg/L	2.08	<0.05	0.07	0.39	0.14
	Chloride as Cl^-	250	mg/L	8.26	0.87	2.89	3.28	28.45
	Iron as Fe^{++}	0.3	mg/L	1.22	0.93	0.03	0.19	0.07
	Sodium as Na^+	200	mg/L	8.54	7.17	6.17	7.07	6.51
	Sulphate	400	mg/L	1.65	1.03	2.26	2.40	2.88
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	5.77	4.68	4.99	<0.01	4.51
	Calcium as Ca^{++}	150	mg/L	18.17	16.71	16.48	21.23	16.15
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.01	<0.01	<0.01	<0.001	<0.01
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	nd	nd	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	nd	<0.01	<0.01	0.04	<0.02
	Ammonia as N	0.5	mg/L	0.02	Nil	0.03	0.02	12.44
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	Nil	Nil	<0.001	Nil	<0.001
	Barium as Ba	0.7	mg/L	0.07	0.05	0.05	0.08	<0.004
	Nitrate as NO_3	50	mg/L	1.24	1.06	9.12	3.41	6.07
	Boron as boric acid	0.3	mg/L	2.4	<0.005	0.31	Nil	Nil
	Boron as B		mg/L			0.05		
	Fluoride as F	1.5	mg/L	0.66	0.36	0.49	0	0.67
	Bromate as BrO_3	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	pending
	Nitrite	0.003	mg/L	0.12	Nil	nd	3.41	nd
	Phosphates as PO_4^{3-}	2.2	mg/L	0.02	Nil	0.09	3	5.61
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.44	7.09	7.91	8.4	7.74
	Electrical conductivity	1,500	µS/cm	210	219	228	228	241
	Potassium		mg/L	3.84	3.47	2.93	3.43	3.38
	Strontium		mg/L	0.19	0.18	0.18	0.1	0.17
	SiO_2 as Si		mg/L	4.22	6.58	4.23	3.68	2.85
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	40	92	82	151	79
	Total Alkalinity		mg/L	119	92	103	183	131

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 10: Turkwel water chemistry - Samples 16 to 20

WATER QUALITY RESULTS				16	17	18	19	20
				Tailrace Canal	Turkwel Dam reservoir	Tailrace Canal	Tailrace Canal	Tailrace Canal
	Parameter	KS459 Limit	Units	MA18-02852.007	MA18-04598.005. Sample 05	(SGS MA18-04598.006)	MA18-05094.001	MA18-05739.012
Date				Jun-18	Sep-18	Sep-18	Oct-18	Nov-18
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	97	151	157	107	132
	Total Hardness as $CaCO_3$	300	mg/L	47.1	51.6	49.7	56.8	49.5
	Aluminium as Al^{+++}	0.1	mg/L	4.08	<0.05	<0.05	<0.05	<0.05
	Chloride as Cl^-	250	mg/L	30.86	9.36	9.78	4.25	12.76
	Iron as Fe^{++}	0.3	mg/L	2.56	<0.02	0.12	<0.02	<0.02
	Sodium as Na^+	200	mg/L	5.98	6.04	6.18	6.19	5.3
	Sulphate	400	mg/L	4.12	1.65	2.06	2.26	1.65
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	3.76	4.37	4.12	4.76	4.13
	Calcium as Ca^{++}	150	mg/L	12.67	13.45	13.11	14.88	13.01
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.004	<0.01	<0.01		<0.01
	Cadmium as Cd	0.003	mg/L	12.67	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Ammonia as N	0.5	mg/L	12.39	0.65	0.38	1.06	2.1
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	<0,02	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	<0,001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	<0.004	<0.004	<0.004	0.05	<0.004
	Nitrate as NO_3	50	mg/L	7.17	2.03	3.55	6.69	1.96
	Boron as boric acid	0.3	mg/L	Nil	Nil	Nil	Nil	Nil
	Boron as B		mg/L					
	Fluoride as F	1.5	mg/L	0.56	0.93	0.93	0.89	0.47
	Bromate as BrO_3	0.01	mg/L	0.001	<0.001	<0.001		
	Nitrite	0.003	mg/L	nd	nd	nd	nd	0.148
	Phosphates as PO_4^{3-}	2.2	mg/L	2.02	0.09	0.34	2.54	0.11
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.45	8.05	7.61	7.55	7.54
	Electrical conductivity	1,500	µS/cm	171	262	270	184	231
	Potassium		mg/L	2.96	2.9	2.8	2.91	2.48
	Strontium		mg/L	0.14	0.17	0.17	0.18	0.16
	SiO_2 as Si		mg/L	8.83	2.71	4.18	3.46	2.20
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	79	66	61	71	52
	Total Alkalinity		mg/L	131	106	101	132	76

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 11: Turkwel water chemistry - Samples 21 to 25

WATER QUALITY RESULTS				21	22	23	24	25
				Turkwel Dam reservoir	Tailrace Canal	Turkwel Dam reservoir	Tailrace Canal	Tailrace Canal
	Parameter	KS459 Limit	Units	MA18-05739.013	MA19-00061.001	MA19-00061.007	MA19-00061.008	MA19-00791.010
Date				Nov-18	Dec-18	Dec-18	Jan-19	Jan-19
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	149	167	171	170	130
	Total Hardness as $CaCO_3$	300	mg/L	49.2	38.7	42.6	42.5	64.8
	Aluminium as Al^{+++}	0.1	mg/L	<0.05	<0.05	<0.05	0.07	0.06
	Chloride as Cl^-	250	mg/L	13.61	21.27	11.91	8.51	3.66
	Iron as Fe^{++}	0.3	mg/L	<0.02	0.03	0.03	0.04	0.05
	Sodium as Na^+	200	mg/L	5.23	4.57	4.9	4.77	7.66
	Sulphate	400	mg/L	5.76	4.32	5.35	4.73	1.44
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	4.2	3.4	3.7	3.7	5.3
	Calcium as Ca^{++}	150	mg/L	12.9	9.8	11.0	11.0	17.2
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Ammonia as N	0.5	mg/L	2.13	0.06	0.05	0.06	<0.03
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	<0.004	0.04	0.04	0.04	0.06
	Nitrate as NO_3	50	mg/L	1.89	2.33	4.48	3.64	<0.1
	Boron as boric acid	0.3	mg/L	Nil	Nil	Nil	Nil	14.07
	Boron as B		mg/L					
	Fluoride as F	1.5	mg/L	0.48	0.47	0.77	0.55	0.67
	Bromate as BrO_3	0.01	mg/L					<0.001
	Nitrite	0.003	mg/L	0.146	nd	nd	nd	<0.01
	Phosphates as PO_4^{3-}	2.2	mg/L	0.2	Nil	Nil	Nil	0.3
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.5	7.4	7.7	7.5	7.8
	Electrical conductivity	1,500	µS/cm	229	257	263	261	225
	Potassium		mg/L	2.6	2.1	2.2	2.2	3.2
	Strontium		mg/L	0.16	0.13	0.14	0.14	0.19
	SiO_2 as Si		mg/L	2.10	1.72	1.50	1.58	1.72
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	45	19	39	45	97
	Total Alkalinity		mg/L	71	203	152	152	140

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 12: Turkwel water chemistry - Samples 26 to 30

WATER QUALITY RESULTS				26	27	28	29	30
				Turkwel Dam reservoir	Turkwel Dam reservoir	Turkwel Dam reservoir	Tailrace Canal	Tailrace Canal
	Parameter	KS459 Limit	Units	MA19-00791.011	MA19-01483.007	MA19-01267.005	MA19-01267.006	MA19-01483.008
Date				Jan-19	Mar-19	Feb-19	Feb-19	Mar-19
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	129	169	163	162	222
	Total Hardness as $CaCO_3$	300	mg/L	64.7	80.4	75.4	76.6	115.2
	Aluminium as Al^{+++}	0.1	mg/L	<0.05	<0.05	<0.05	<0.05	0.57
	Chloride as Cl^-	250	mg/L	3.66	4.57	4.12	3.66	5.49
	Iron as Fe^{++}	0.3	mg/L	<0.02	<0.02	<0.02	<0.02	0.47
	Sodium as Na^+	200	mg/L	7.68	8.99	9.1	9.06	10.73
	Sulphate	400	mg/L	1.23	2.88	1.65	1.65	9.26
	Zinc as Zn^{++}	5	mg/L	<0.01	0.04	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	5.3	6.4	6.0	6.1	10.6
	Calcium as Ca^{++}	150	mg/L	17.2	21.6	20.3	20.7	28.7
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Ammonia as N	0.5	mg/L	<0.03	3.16	<0.03	<0.03	2.93
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	0.06	0.06	0.05	0.06	0.09
	Nitrate as NO_3	50	mg/L	<0.1	<0.01	<0.1	<0.01	2.21
	Boron as boric acid	0.3	mg/L	13.66	0.03	0.07	0.07	0.09
	Boron as B		mg/L					
	Fluoride as F	1.5	mg/L	0.68	0.53	0.65	0.61	0.17
	Bromate as BrO_3	0.01	mg/L	<0.001	to follow	<0.001	<0.001	<0.001
	Nitrite	0.003	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Phosphates as PO_4^{3-}	2.2	mg/L	<0.02	<0.02	<0.02	<0.02	0.4
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.6	7.4	7.9	7.5	7.7
	Electrical conductivity	1,500	µS/cm	221	260	251	249	342
	Potassium		mg/L	3.2	3.9	3.6	3.6	3.3
	Strontium		mg/L	0.19	0.22	0.21	0.21	0.20
	SiO_2 as Si		mg/L	1.54	1.04	1.12	1.53	12.13
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	97	113	113	113	146
	Total Alkalinity		mg/L	140	113	113	113	145

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 13: Turkwel water chemistry - Samples 31 to 35

WATER QUALITY RESULTS				31	32	33	34	35
				Turkwel Dam reservoir	Tailrace Canal	Turkwel Dam reservoir	Tailrace Canal	Tailrace Canal
	Parameter	KS459 Limit	Units	MA19-01946.002	MA19-01946.003	MA19-02445.001	MA19-02445.002	MA19-02987.001
Date				Apr-19	Apr-19	May-19	May-19	Jun-19
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	142	142	54	57	154
	Total Hardness as $CaCO_3$	300	mg/L	64.8	51.2	69.5	71.2	36.3
	Aluminium as Al^{+++}	0.1	mg/L	<0.05	<0.05	<0.05	<0.05	1.65
	Chloride as Cl^-	250	mg/L	5.03	4.57	10.06	10.98	4.12
	Iron as Fe^{++}	0.3	mg/L	<0.02	0.14	<0.02	<0.02	1
	Sodium as Na^+	200	mg/L	7.45	5.96	11.39	11.39	3.52
	Sulphate	400	mg/L	2.26	1.65	7.61	7	2.47
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	5.4	4.1	6.0	6.1	2.9
	Calcium as Ca^{++}	150	mg/L	17.0	13.7	17.9	18.4	9.8
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	0.09
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	0.19	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	0.86
	Ammonia as N	0.5	mg/L	<0.03	0.48	<0.03	<0.03	Nil
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	0.03
	Nickel as Ni	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	0.12
	Cyanide as CN	0.07	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	0.03	0.09	<0.004	<0.004	0.04
	Nitrate as NO_3	50	mg/L	<0.1	0.27	21.60	<0.01	0.87
	Boron as boric acid	0.3	mg/L	1.72	2.17	8.77	10.23	Nil
	Boron as B		mg/L					<0.005
	Fluoride as F	1.5	mg/L	0.65	0.62	0.64	0.63	0.59
	Bromate as BrO_3	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Nitrite	0.003	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Phosphates as PO_4^{3-}	2.2	mg/L	<0.02	<0.02	<0.02	<0.02	Nil
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.4	7.4	7.7	7.4	7.2
	Electrical conductivity	1,500	µS/cm	244	243	93	98	237
	Potassium		mg/L	3.2	2.7	4.8	4.8	1.7
	Strontium		mg/L	0.19	0.16	0.22	0.23	0.10
	SiO_2 as Si		mg/L	0.82	1.76	1.03	1.35	3.95
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	59	54	76	97	45
	Total Alkalinity		mg/L	103	97	119	140	91

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 14: Turkwel water chemistry - Samples 36 to 40

WATER QUALITY RESULTS				36 Turkwel Dam reservoir	37 Tailrace Canal	38 Turkwel Dam reservoir	39 Tailrace canal	40 Turkwel Dam reservoir
	Parameter	KS459 Limit	Units	MA19-02987.002	MA19-03718.001	MA19-03718.002	MA19-04381.001	MA19-04381.002
Date				Jun-19	Jul-19	Jul-19	Sep-19	Sep-19
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	164	143	137	146	144
	Total Hardness as $CaCO_3$	300	mg/L	41.2	58.0	60.8	30.7	35.6
	Aluminium as Al^{+++}	0.1	mg/L	0.76	<0.05	0.14	[0.25]	<0.05
	Chloride as Cl^-	250	mg/L	5.03	4.12	5.03	3.94	4.93
	Iron as Fe^{++}	0.3	mg/L	<0.02	0.35	0.1	0.14	<0.02
	Sodium as Na^+	200	mg/L	4.3	6.05	6.54	3.19	3.81
	Sulphate	400	mg/L	1.85	3.09	2.88	2.88	2.68
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	3.3	4.8	5.0	2.5	2.8
	Calcium as Ca^{++}	150	mg/L	11.1	15.3	16.1	8.2	9.7
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	0.05	<0.01	<0.01	<0.01	<0.01
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	0.01	0.04	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	0.07	<0.01	<0.01	<0.01
	Selenium as Se	0.01	mg/L	0.78	0.12	<0.01	[0.03]	[0.02]
	Ammonia as N	0.5	mg/L	Nil	3.66	3.91	Nil	Nil
	Chromium as Cr	0.05	mg/L	0.04	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	0.09	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	0.04	0.06	0.06	<0.004	<0.004
	Nitrate as NO_3	50	mg/L	1.09	6.70	5.10	3.80	1.88
	Boron as boric acid	0.3	mg/L	Nil	0.94	0.77	Nil	Nil
	Boron as B		mg/L	<0.005	<0.001	<0.005		
	Fluoride as F	1.5	mg/L	0.67	0.97	1.06	0.64	0.66
	Bromate as BrO_3	0.01	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Nitrite	0.003	mg/L	<0.01	<0.02	<0.02	0.03	0.03
	Phosphates as PO_4^{3-}	2.2	mg/L	Nil	0.1	0.1	0.0	0.0
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.6	7.5	7.6	7.3	7.3
	Electrical conductivity	1,500	µS/cm	252	220	211	225	222
	Potassium		mg/L	1.7	2.6	3.1	1.4	1.8
	Strontium		mg/L	0.11	0.16	0.17	0.09	0.11
	SiO_2 as Si		mg/L	0.65	3.82	2.74	2.32	1.65
	Lithium		mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	53	73	79	33	42
	Total Alkalinity		mg/L	96	91	96	91	99

Notes:
nd signifies "not detected"
d signifies "detectable"

Annex 15: Turkwel water chemistry - Samples 40 to 44

WATER QUALITY RESULTS				40	41	42	43	44
				Turkwel Dam reservoir	Turkwel Dam reservoir	Tailrace Canal	Turkwel dam reservoir	Tailrace canal
	Parameter	KS459 Limit	Units	MA19-04381.002	MA19-04849.002	MA19-03718.001	MA19-05340.001	MA19-05340.002
Date				Sep-19	Oct-19	Oct-19	Nov-19	Nov-19
Table 2 from KS 459-1:2007	Suspended matter	nd		d	d	d	d	d
	Total dissolved solids	1,000	mg/L	144	140	135	144	131
	Total Hardness as $CaCO_3$	300	mg/L	35.6	64.2	61.8	61.9	60.3
	Aluminium as Al^{+++}	0.1	mg/L	<0.05	<0.05	[1.29]	<0.05	<0.05
	Chloride as Cl^-	250	mg/L	4.93	9.86	4.93	7.39	17.25
	Iron as Fe^{++}	0.3	mg/L	<0.02	<0.02	[0.75]	0.07	[4.54]
	Sodium as Na^+	200	mg/L	3.81	7	7.04	7.68	7.65
	Sulphate	400	mg/L	2.68	1.65	1.44	3.29	7.82
	Zinc as Zn^{++}	5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Magnesium as Mg^{++}	100	mg/L	2.8	4.9	4.8	4.9	5.3
	Calcium as Ca^{++}	150	mg/L	9.7	17.6	16.8	16.6	15.4
Table 3 from KS 459-1:2007	Arsenic as As	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Cadmium as Cd	0.003	mg/L	nd	nd	nd	nd	nd
	Lead as Pb	0.01	mg/L	<0.004	<0.004	<0.004	<0.004	<0.004
	Copper as Cu	1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
	Mercury as Hg	0.001	mg/L	nd	nd	nd	nd	nd
	Manganese as Mn	0.5	mg/L	<0.01	0.1	[0.13]	<0.01	<0.01
	Selenium as Se	0.01	mg/L	[0.02]	[0.02]	<0.01	<0.01	<0.01
	Ammonia as N	0.5	mg/L	Nil	<0.02	<0.02	<0.02	<0.02
	Chromium as Cr	0.05	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Nickel as Ni	0.02	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02
	Cyanide as CN	0.07	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
	Barium as Ba	0.7	mg/L	<0.004	0.06	0.06	0.05	0.07
	Nitrate as NO_3	50	mg/L	1.88	0.04	5.90	<0.01	0.44
	Boron as boric acid	0.3	mg/L	Nil	0.37	0.32	Nil	Nil
	Boron as B		mg/L		<0.005	<0.001		
	Fluoride as F	1.5	mg/L	0.66	0.16	0.97	0.6	0.58
	Bromate as BrO_3	0.01	mg/L	<0.001	to follow	to follow	<1.0	<1.0
	Nitrite	0.003	mg/L	0.03	<0.01	<0.01	<0.01	<0.01
	Phosphates as PO_4^{3-}	2.2	mg/L	0.0	<0.02	<0.02	<0.02	<0.02
Additional Parameters (Laboratory)	pH	6.5 to 8.5	pH units	7.3	<0.04	7.4	7.3	7.5
	Electrical conductivity	1,500	µS/cm	222	<0.05	207	248	223
	Potassium		mg/L	1.8	3.3	3.2	3.3	3.7
	Strontium		mg/L	0.11	<0.005	<0.005	0.17	0.16
	SiO_2 as Si		mg/L	1.65	3.62	6.46	3.94	14.77
	Lithium		mg/L	<0.004	<0.04	<0.04	<0.004	<0.004
	Bicarbonate as $CaCO_3$		mg/L	42	54	108	97	86
	Total Alkalinity		mg/L	99	54	108	97	86

Notes:
nd signifies "not detected"
d signifies "detectable"

Water

D3

6 Assessment of the predicted zones of influence of planned groundwater abstractions

TECHNICAL MEMORANDUM

DATE 16 October 2019 **Reference No.** 1433956.636_B.0

TO Paul Mowatt, Tullow Kenya BV.

CC Oliver McCredie, Rachel Lansley, Anna Goodwin

FROM Richard Lansley, Andrew Morsley **EMAIL** amorsley@golder.com

ESTIMATE OF RADIUS OF INFLUENCE OF ABSTRACTIONS

Background

The Tullow FSD Project are proposing to obtain 1,560 m^3/day of water from 10 groundwater borehole sources to provide make-up water to the project for a period of 18 months in advance of an alternative supply coming on-line.

In this technical memorandum is presented an assessment of the potential radius of influence of these abstractions and hence the potential impact of the proposed abstraction on sensitive water receptors. Sensitive water receptors are considered to include wells, waterholes, hand dug wells and sand dams and hand dug wells in the ephemeral riverbeds. It is considered, for the purpose of this assessment, that if a discernible drawdown is observed at surface this would have a negative impact on these sensitive receptors.

Description of Wellfield

The locations of the 10 abstraction wells are shown on Figure 1. All the wells are located in proximity to watercourses in the catchment of the River Kalabata.

To meet the short-term make-up water demands it is proposed to extract groundwater from the boreholes at the rates presented in Table 1. Of the boreholes listed in Table 1 four are currently in active use and are pumped at the approximate rates shown in Table 1.

Table 1: Historic and proposed groundwater abstraction rates (m^3/day)

Well	August 2019 Rate	September 2019 Rate	Proposed Rate
Kengomo 1	-	-	130
Kengomo 2	-	-	100
Nakukulas 9	89	103	200
Kaeng'akalalio C	-	-	90
Nabolei	-	-	90
Ngamia East	79	67	240
Nakukulas 10	142	148	170

Well	August 2019 Rate	September 2019 Rate	Proposed Rate
East Lokichar WBHC	214	249	170
Ekunyuk	-	-	180
Ewoi	-	-	190

Figure 1: Map of borehole locations (The location of Kaeng'akalalio C has been plotted in place of Kaeng'akalalio A as the exact coordinates are unknown)

Based on the records provided for the wells by Tullow it is noted that they are drilled through the Plio-holocene alluvial deposits and weathered bedrock to target water strikes in multiple geological units. Insufficient data exist to indicate whether the targeted groundwater forms discrete aquifer units. For, the purpose of, this interpretation it is assumed that abstracted groundwater comes from an unconfined source and hence drawdown would be experienced at surface in response to pumping. A summary of the minimum dip to groundwater (inferred to be rest water level) reported geology and construction details of the abstraction wells are detailed in Table 2. The rest water level ranges from 4.06 m and 23.77 m below ground level which could indicate that shallow groundwater sources are dependent on perched ephemeral groundwater and not the deeper sources targeted by these boreholes.

Table 2: Well geology and construction summary

Well	Min dip to water	Depth	Reported geology of response zone	Depth Top	Depth Bottom	Length of Screen	Drilled Diameter
Kengomo 1	23.77	130	Highly Fractured Basalts	100	130	30	203
Kengomo 2	23.28	206	Weathered Basalts	140	206	66	203
Nakukulas 9	16.93	66	Decomposed Granites	33	36	3	242
				39	42	3	
Kaeng'akalalio C	16.18	Data unknown					
Nabolei	15.47	100	Weathered Rocks	75	78	3	242
				81	84	3	
				87	93	6*	
Ngamia East	7.45	Data unknown					
Nakukulas 10	4.06	63	Decomposed Granites	27	30	3	242
				42	45	3	
East Lokichar WBHC	8.43	Data unknown					
Ekunyuk	10.45	252	Volcanics	174	252	78	203
Ewoi	16.83	180	Fractured sandy sediments	120	180	60	203

* 3 m reported in Completion Report however interval range indicates 6 m.

The results of a number of pumping tests have been made available to Golder by Tullow. Where well completion data are available the pumping test data have been analysed using the Neuman unconfined method for the analysis of the pumping and recovery phases within the test interpretation package Aqtesolv® to calculate a Transmissivity and Specific Yield for each test. Well completion data and total depth are not known for Kaeng'akalalio C (test pumping data also applies to Kaeng'akalalio A) and East Lokichar, however the recovery of the pumping test has been interpreted using the Cooper Jacob method by considering the drawdown across one log interval of time to provide a first order transmissivity.

The results of the analyses are presented in Table 3.

Table 3: Test Pumping Analysis Results

Well	Transmissivity (m^2/s)	Specific Yield
Kengomo 1	7.05×10^{-5}	0.036
Kengomo 2	9.55×10^{-5}	0.5
Nakukulas 9	No data available	
Kaeng'akalalio C*	4.17×10^{-6}	0.1^
Nabolei	4.08×10^{-5}	0.1
Ngamia East	No data available	
Nakukulas 10	No data available	
East Lokichar WBHC	2.50×10^{-4}	0.1^
Ekunyuk	3.27×10^{-5}	0.5
Ewoi	3.73×10^{-5}	0.1

* Well completion data and total depth are not known for Kaeng'akalalio C (test pumping data also applies to Kaeng'akalalio A)

^ Specific Yield is applied at 0.1 when not output by the analytical method.

The radius of influence after pumping for 18 months can be estimated using Equation 1 (Cooper-Jacob, 1946):

$$R_0 = \sqrt{2.25\,T\,\frac{t}{S_y}}$$

Where: R_0 is radius of influence at time t; T is transmissivity; t is time elapsed since the start of pumping; and, S_y is the Specific Yield.

Based on the transmissivity and specific yield values presented in Table 3 the radius of influence after 18 months of pumping has been calculated (Table 4). As a sensitivity analysis the lower bound for specific yield of 0.02 from Fetter (1997) has been used to provide a more conservative assessment of the radius of influence. The calculated results are detailed in Table 4.

Table 4: Estimate of Radius of Influence

Well	Calculated Radius of Influence (m)	Sensitivity Analysis of Radius of Influence (m)
Kengomo 1	460	610
Kengomo 2	140	710
Kaeng'akalalio C*	70	150
Nabolei	210	470

Well	Calculated Radius of Influence (m)	Sensitivity Analysis of Radius of Influence (m)
East Lokichar WBHC	520	1,150
Ekunyuk	83	420
Ewoi	200	450

For the three wells that pumping test data has not been available a qualitative methodology has been applied to provide an indicative radius of influence in comparison to the estimates for the other wells. The completion reports for Nakukulas 9 and Nakukulas 10 provide a summary of drawdown after a 24 hour constant rate test. Based on this data it is inferred that a drawdown of 5 m and 7 m respectively was observed at a pumping rate that was comparatively high compared with the other boreholes considered. The completion report for these wells identifies the geology to comprise decomposed granite. Based on the assumption that the hydraulic conductivity of the decomposed granite is equivalent to a well graded sand, it is assumed that the hydraulic conductivity is 1×10^{-3} m/s. The response zone of both Nakukulas 9 and Nakukulas 10 is 6 m, hence the transmissivity at the well is calculated to be 6×10^{-3} m^2/s. Using the same approach as above this provides an indicative radius of influence after 18 months of pumping of approximately 2,500 m assuming a specific yield of 0.1 and of approximately 5,600 m using the sensitivity analysis specific yield of 0.02.

There is no completion report or test pumping data for Ngamia East however it is still possible to estimate indicative well performance based on known abstraction rate and level response. It is known that in 2015 the well was abstracted at a rate of around 192 m^3/day and during 2018 and 2019 the pumping rate was reported to be 79 m^3/day and 61 m^3/day respectively. Drawdown in 2015 was in the order of 45 m and in 2019 is in the order of 30 m. In terms of the drawdown to pumping rate relationship, Kengomo 1 and 2 are the most similar hence an indicative radius of influence in the order of 500 and 750 m is inferred at the estimate and sensitivity analysis respectively.

It is noted however that these wells are currently in production and the increase in pumping rate for Nakukulas 9, Nakukulas 10 and Ngamia East is proposed to be an increase of 100%, 260% and 15% respectively. As a first order estimate, this would mean that the amount of drawdown currently observed within the existing radius of influence may increase proportionately.

A presentation of all estimates of radius of influence are presented on Figure 2. It should be noted that no account has been taken of interference effects between abstractions of the influence of geological boundaries which may result in increased drawdowns and radius of influence.

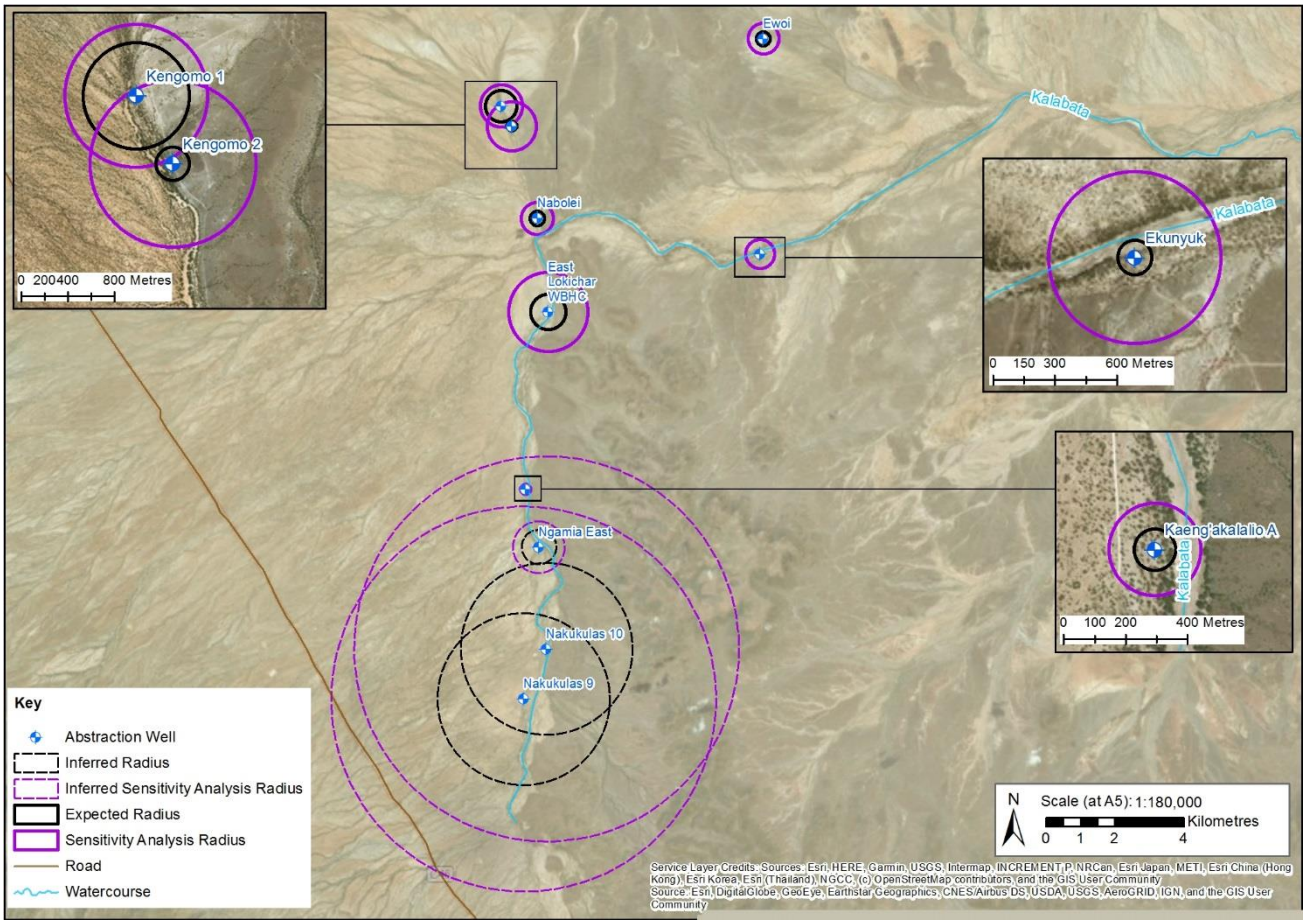

Figure 2: Calculated radius of influence after 18 months

An estimate of the in well drawdown has been completed by comparing the proposed rate against the test pumping rate and drawdown experienced during the pumping test. It is noted that the drawdowns relate to tests that were of shorter duration than the period of abstraction proposed. The estimated drawdown in the pumping wells is presented in Table 5.

Table 5: Indicative Drawdown of Operational Wells

Well	Proposed Utilisation Rate (m^3/day)	Estimate of pumping well drawdown (m)
Kengomo 1	130	35
Kengomo 2	100	16
Nakukulas 9	200	3
Kaeng'akalalio C*	90	52
Nabolei	90	25
Ngamia East	240	Insufficient data to determine
Nakukulas 10	170	3

Well	Proposed Utilisation Rate (m^3/day)	Estimate of pumping well drawdown (m)
East Lokichar WBHC	170	7.7
Ekunyuk	180	84
Ewoi	190	76

Impact Assessment

Based on the calculations presented above it is considered likely that any abstractions within 200 m of any of the abstraction wells considered may be derogated as a result of abstraction from the Tullow wells. The most significant combination of drawdown and radius of influence is at Kengomo 1 where a drawdown of 5 m is estimated at a distance of 200 m by considering a log drawdown relationship between the estimated pumping well drawdown of 35 m and radius of influence of 460 m.

The rest water level observed in the 10 abstraction boreholes ranges from 4.06 m and 23.77 m below ground level which could indicate that shallow groundwater sources are dependent on perched ephemeral groundwater and not the deeper sources targeted by these boreholes. Hence those sources, such as hand dug wells and sand dams, which rely on shallow ephemeral groundwater sources may not be significantly impacted

Summary and Conclusions

A summary of available data has been prepared and used to provide a first order estimate of the radius of influence of abstractions. In general, those abstractions with a larger radius of influence will have the least drawdown.

There may still be the requirement for monitoring and mitigation through providing an alternative supply of water to users of shallow waters such as hand dug wells, luggas and open waterholes.

Richard Lansley
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Biodiversity

D4

1 Approach to Assessment of Natural and Modified Habitats

TECHNICAL MEMORANDUM

DATE 20 August 2021 **Reference No.** 1433956_645_V.1

TO Alex Mayhook-Walker,

CC Tim Flower, Andrew Morsley

FROM Freddy Brookes **EMAIL** FBrookes@golder.com

APPROACH TO CRITICAL HABITAT ASSESSMENT

1.0 INTRODUCTION

The purpose of this Technical Memo is to clarify the approach taken in the critical habitat assessment (as required by the International Finance Corporation (IFC) Performance Standard 6.

2.0 BACKGROUND

For the purposes of implementation of this Performance Standard, habitats are divided into modified, natural, and critical. Critical habitats are a subset of modified or natural habitats (IFC, 2012).

2.1 Critical Habitat Criteria

Critical habitat criteria are areas of high biodiversity value and form the basis of any critical habitat assessment. The criteria for identifying areas of high biodiversity value are:

- Criterion 1: Habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;
- Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;
- Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- Criterion 4: Highly threatened and/or unique ecosystems; and/or
- Criterion 5: Areas associated with key evolutionary processes (IFC, 2012).

In addition, projects that are located within internationally and/or nationally recognised areas of high biodiversity value may require a critical habitat assessment. Examples of internationally and/or nationally recognised areas of high biodiversity value, as relevant to the project, include:

- Areas that meet the criteria of the IUCN's Protected Area Categories Ia, Ib and II; and
- Key Biodiversity Areas (KBAs), which encompass Important Bird and Biodiversity Areas (IBAs) (IFC, 2019).

The IFC requires mapping of critical habitats in the landscape of the project's area of influence in order to inform the applicability of Performance Standard 6 (IFC, 2019).

For projects located in critical habitats, the project proponent must ensure that external experts with regional experience are involved in the critical habitat assessment (IFC, 2019).

2.2 Critical Habitat Thresholds

To facilitate decision-making, numerical thresholds are defined for the first four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/congregatory species; threatened and unique ecosystems) (IFC, 2019).

2.2.1 Criterion 1: Critically Endangered and Endangered Species

The thresholds for Criterion 1 are:

a) Areas that support globally important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units[1] (GN16) of a CR or EN species);

b) Areas that support globally important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a); and

c) As appropriate, areas containing important concentrations of a nationally or regionally listed EN or CR species.

2.2.2 Criterion 2: Endemic / Range Restricted Species

In the IFC PS6 Guidance Notes (IFC, 2019) endemic and range restricted are treated as synonyms, and range restricted species are defined as species that have a limited Extent of Occurrence (EOO). Limited EOO is defined as follows:

- For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an EOO less than 50,000 square kilometres (km^2); and
- For aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to a 500 km linear geographic span (i.e., the distance between occupied locations furthest apart) (IFC, 2019).

The threshold for Criterion 2 is:

a) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species.

2.2.3 Criterion 3: Migratory and Congregatory Species

Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (IFC, 2019). Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis (IFC, 2019).

Thresholds for Criterion 3 are:

a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle; and

b) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.

2.2.4 Criterion 4: Highly Threatened or Unique Ecosystems

Highly threatened or unique ecosystems are identified based on assessments conducted at the national/regional level, carried out by governmental bodies, recognised academic institutions and/or other relevant qualified organisations (including internationally recognized NGOs) (IFC, 2019).

The thresholds for Criterion 4 are the following:

a) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for the IUCN status of CR or EN.

b) Other areas not yet assessed by the IUCN but determined to be of high priority for conservation by regional or national systematic conservation planning.

2.2.5 Criterion 5: Key Evolutionary Processes

The structural attributes of a region, such as its topography, geology, soil, temperature, and vegetation, and combinations of these variables, can influence the evolutionary processes that give rise to regional configurations of species and ecological properties (IFC, 2019). In some cases, spatial features that are unique or idiosyncratic of the landscape have been associated with genetically unique populations or subpopulations of plant and animal species

For Criterion 5, there are no numerical thresholds. Critical habitat determination is based on best available scientific information, knowledge of the project area and expert opinion.

3.0 STUDY AREA

The biodiversity assessment used the biophysical Area of Interest (AoI) which comprises the areas of potential direct and indirect effects during operations and construction of the Project, based on analysis completed in the ESIA. The critical habitat assessment was based on a wider ecologically appropriate area of analysis in order to determine the presence of critical habitat for each species and to assess whether the critical habitat overlaps with the Project's AoI.

4.0 CRITICAL HABITAT ASSESSMENT

IFC PS6 (IFC, 2012) stipulates that the critical habitat assessment be conducted in consultation with external experts with regional experience. The list of external specialists consulted in this assessment is provided in Table 1.

Table 1: External specialists consulted in the critical habitat assessment

Discipline	Specialist	Role
Flora	Mr. John Kimeu	Botanist – National Museum of Kenya (NMK)
Mammals	Mr. Bernard Agwanda	Mammologist - NMK
Bird	Ms. Philista Malaki	Avifaunal specialist - NMK

Discipline	Specialist	Role
Reptiles	Mr. Victor Wasonga	Herpetologist - NMK
Invertebrates	Mr. Morris Mutua	Entomologist - NMK
Fish	Mr. Dickens Odeny	Aquatic specialist - NMK

4.1 Identification of Potential CH Receptors

The first step of the critical habitat assessment was the identification of potential critical habitat species based on the list of species observed during the baseline assessment (Table 2). Taxa were selected for inclusion in the critical habitat assessment based on the IFC PS6 criteria listed in section 2.1.

4.1.1 Flora Assessment

Two range-restricted plant species (EOO < 50,000 km^2) were identified during the baseline assessment (Table 2). Populations of *Euphorbia turkanensis* were identified at various locations. *Blepharis turkanae* is a range restricted plant species (EOO of 10,138.7 km^2) previously only known from only 4 locations in the Lake Turkana region (Luke et al., 2015). During the baseline assessment it was recorded at Ewoi, to the east of the Project's AoI.

4.1.2 Avifaunal Assessment

Six potential critical habitat species were recorded during the baseline assessment (Table 2). This included two CR species, African White-backed Vulture (*Gyps africanus*) and Rüppell's Vulture (*Gyps rueppelli*), and two EN species, Lappet-faced Vulture (*Torgos tracheliotos*) and Steppe Eagle (*Aquila nipalensis*) (Table 2).

A further two species are listed as VU (Table 2). Tawny Eagle (*Aquilla rapax*) is listed as VU by the IUCN (2019), and Lesser Kestrel (*Falco naumanni*) by the Kenyan Wildlife Conservation and Management Act (KWCMA, 2013) (Table 2). According to the IFC PS6 Guidance Notes (IFC, 2019) species that are listed nationally/regionally as VU can be included if it can be shown that the AoI supports globally important concentrations of these species and that the loss of these populations would result in a change in their IUCN Red List status to EN or CR (IUCN, 2019).

4.1.3 Mammal Assessment

Three potential critical habitat species were recorded during the baseline survey (Table 2). African Elephant (*Loxodonta africana*) and Leopard (*Panthera pardus*) are listed as VU by the IUCN, and the Striped Hyaena (*Hyaena hyaena*) as Near Threatened (NT) (IUCN, 2019). All three species are listed as EN by the Kenyan Wildlife Conservation and Management Act (KWCMA, 2013). According to the IFC PS6 Guidance Notes (IFC, 2019) inclusion of species that are listed nationally/regionally as CR or EN should be considered on a project-by-project basis in consultation with competent professionals. Based on an assessment of available literature, and consultation with Mr Bernard Agwanda, a mammologist from the National Museum of Kenya (NMK) in Nairobi, it was decided to include all three species for assessment under Criterion 1. In East Africa, populations of all three species have seen substantial declines over the last few decades.

4.1.4 Herpetofaunal Assessment

The Turkana Toad (*Sclerophrys turkanae*) is a range-restricted species that was recorded in the Kalabata River in the vicinity of Amosing during the baseline assessment (Table 2). Its presence in the AoI represents a range

extension for this species, however, even with this extension its EOO remains < 50,000 km^2 qualifying it as a candidate for critical habitat status.

4.1.5 Invertebrate Assessment

During the baseline assessment, a single specimen of a previously undescribed beetle species in the genus Omophron was recorded in the Kalabata River in the vicinity of the village of Loperot (Table 2). As this species is only know from a single location and is new to science, it qualifies for assessment of critical habitat status in terms of Criterion 2 (Table 2).

4.1.6 Fish Assessment

Two range restricted fish species were recorded in the Turkwel River during the baseline assessment (Table 2). Both species were previously believed to be restricted to Lake Turkana and their presence in the Turkwel River represents a range extension. Being range restricted both species qualify for critical habitat assessment in terms of Criterion 2 (Table 2).

Table 2: List of potential critical habitat species recorded during the biodiversity baseline surveys

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
Plants								
	Blepharis turkanae	Unlisted	VU	-	-	-	10,138.7 km^2	Only known from 4 locations in the vicinity of Lake Turkana (Luke et al., 2015).
	Euphorbia turkanensis	Unlisted	Unlisted	-	-	II	Based on literature sources < 50,000 km^2	Type locality is 1.5 km south-west of Lokichar, and the species is known from a limited distribution at a small areaof north-west Kenya.
Birds								
Lappet-faced vulture	*Torgos tracheliotos*	VU	EN	I	Yes	II	34,200,000 km^2	Only a small, very rapidly declining population remains, owing primarily to poisoning and persecution, as well as ecosystem alterations. Observed on two occasions duringthe biodiversity baseline field surveys.

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
African white-backed vulture	*Gyps africanus*	NT	CR	I	-	II	23,400,000 km^2	Considered to be extinct along the border between Uganda & Kenya including the project area, Nasolot and South Turkana (BI, 2019). Confirmed as present in the AoI.
Rüppell's vulture	*Gyps rueppelli*	NT	CR	I	-	II	14,200,000 km^2	Faces similar threats to other African vultures, listed as CR due to severe declines in parts of its range (BI, 2017). Confirmed as present in the AoI in December 2019.
Steppe eagle	*Aquila nipalensis*	Unlisted	EN	I	-	II	10,800,000 km^2	Has undergone extremely rapid population declines across parts of its range. Large distributional range across Africa and Asia.
Lesser kestrel	*Falco naumanni*	VU	LC	I	Yes	II	24,800,000 km^2	Underwent rapid population declines from 1950 onwards but recent evidence indicates a stable or slightly positive population trend overall during the last three generations. Wide geographic range that covers most of Africa and Asia.

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
Tawny eagle	*Aquila rapax*	Unlisted	VU	II	-	II	52,700,000 km^2	Evidence for very rapid declines in this species from acrossits African range. Distributional range is large and covers much of Sub-Saharan Africa and parts of Asia.
Mammals								
African elephant	*Loxodonta africana*	EN	VU (EN, 2021)	II	Yes	I	Based upon literature sources > 50,000 km^2	The Kerio Valley elephant population (which includes Nasolot and South Turkana) is regarded as the largest in western Kenya and is regarded as a discrete management unit. The highest density of this population is found in the north, in the vicinity of Nasolot and South Turkana protected areas. Census data shows a decrease in 59.6% in this population between 1997 and 2010. Based on Edebeet al., 2010, the Nasolot-South Turkana-Rimoi-Kamnarok elephant population

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
								faces the greatest poaching threat of any elephant population in Kenya.
Striped hyena	*Hyaena hyaena*	EN	NT	-	Yes	III	Based upon literature sources > 50,000 km^2	Present throughout its range at very low densities. Major threat is persecution. Able to tolerate moderately high human density if not actively persecuted.
Leopard	*Panthera pardus*	EN	VU	II	Yes	I	Based upon literature sources > 50,000 km^2	Populations have become reduced and isolated, and they are now extirpated from large portions of their historic range.
Herpetofauna								
Turkana Toad	*Sclerophrys turkanae*	Protected	DD	-	Yes	-	Based on literature sources calculated at 15,892 km^2	Previously only known from two localities in north-central Kenya: Loiengalani on the south-eastern shores of Lake Turkana, and Ewaso

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
								Ngiro River in the Samburu Game Reserve. Recorded from the Kalabata River at Amosing during the baseline assessment.
Invertebrates								
Ground beetle	*Omophron* sp.	Unlisted	Unlisted	-	-	-	< 50,000 km^2	Previously undescribed beetle species recorded in the Kalabata River near to Loperot during the baseline assessment. Only known from a single location.
Fish								
	Haplochromis turkanae	Unlisted	LC	-	-	-	< 500 km linear distance	Range extension, previously only known from Lake Turkana.

Common name	Scientific Name	WCMA (2013)	IUCN (2019)	CMS (2019)	KWS (2019)	CITES (2019)	EOO	Comment
	Haplochromis macconneli	Unlisted	LC	-	-	-	< 500 km linear distance	Range extension, previously only known from LakeTurkana.

Notes:
- = not assessed

4.2 Threshold Assessment

The potential critical habitat species were assessed individually for each critical habitat criterion in order to verify whether they meet the thresholds for critical habitat status as per IFC PS6.

4.2.1 Flora Assessment

The results of the flora critical habitat threshold assessment are shown in Table 3.

Several individuals of *B. turkanae* were recorded at Ewoi beyond the eastern boundary of the AoI. It was recorded in rocky hill habitat that is largely situated beyond the eastern border of the AoI. Given that it was previously only known from 4 other locations, the individuals recorded at Ewoi could very likely represent >10% of the global population and thorough searches and it is believed that further searches in similar habitats east of the AoI are likely to yield >10 individuals. It therefore qualifies for critical habitat status although the critical habitat does not overlap with the AoI.

In contrast, *E. turkanensis* colonies were recorded at various locations between Lokichar and the Malmalte River. With several confirmed colonies and a type locality situated within the AoI, *E. turkanensis* meets the threshold for critical habitat status with >10% of the global population and >10 individuals recorded (Table 3).

This assessment was compiled in conjunction with Mr John Kimeu, a botanist employed by the NMK, who has extensive knowledge and experience of vegetation assessments in Turkana County. The locations of known *E. turkanensis* colonies and critical habitat is shown in Figure 2.

4.2.2 Avifaunal Assessment

The results of the avifaunal critical habitat threshold assessment are shown in Table 4.

Three of the six bird species identified as potential CH species met the threshold (Table 4). Lappet-faced, African White-backed and Rüppell's Vultures were recorded during the biodiversity baseline surveys (Figure 1). The extent of critical habitat for these species is shown in Figure 3.

Lappet-faced Vultures were observed on two occasions during the biodiversity baseline surveys, most recently in December 2019 (Table 2, Figure 1). In 1992, the global population of this species was estimated at 5,700 individuals. By 2016 the population had declined by 80% giving an updated global estimate of 1,140 individuals (BirdLife International, 2019). The threshold for critical habitat status would therefore be 6 individuals (0.5% of 1,140). Three individuals were observed over the course of the baseline surveys and it is believed that further surveys in previously inaccessible areas such as the riparian habitat along the Malmalte and Turkwel rivers may produce further individuals and potential nesting sites. Lappet-faced Vultures breed in tall acacia trees and are sensitive to human disturbance particularly when nesting. It is believed that the unrest associated with cattle raids along the Malmalte River and the avoidance of this area by most of the population may have provided ideal nesting habitat for Lappet-faced Vultures along with the confirmed presence of large herbivores in this area. Based on this assessment Lappet-faced Vultures qualify for critical habitat status in terms of IFC PS6 Criterion 1 (Table 2).

A total of 10 African white-backed Vultures were observed during the biodiversity baseline surveys. Most recently, 8 individuals were seen south of Amosing during the December 2019 Kalabata survey (Table 4, Figure 1). In 2018, the global population was estimated to be 270,000 with a rate of decline of 90% over three generations (i.e., 55 years) (BirdLife International, 2018). Based on the 2018 figures the threshold for critical habitat status would be 1,350 individuals (0.5% of 270,000). Given that the global population is known to be declining it is possible that the threshold value is also substantially lower than 1,350. This species has similar nesting behaviour to the Lappet-faced Vulture, with a preference for tall acacia trees. It is possible that this species may be nesting along remote parts of the Malmalte and Turkwel rivers and in areas such as South

Turkana and Nasolot NRs with higher densities of wildlife. Based on this assessment the African white-backed Vulture meets the threshold for critical habitat status in terms of IFC PS6 Criterion 1 (Table 2).

The first observation of Rüppell's Vulture during the biodiversity baseline surveys was in December 2019, when two individuals were seen, together with African White-backed and Lappet-faced Vultures south of Amosing (Figure 1). In 1992, the global population of Rüppell's Vulture was estimated at 22,000 individuals, with a rate of decline of 97% over three generations (i.e., 56 years) (BirdLife International, 2017). Based on these figures the global population in 2020 may be as low as 660 individuals with a threshold for critical habitat status of 3 individuals. Given that 2 individuals were sighted in December 2019 Rüppell's Vulture meets the threshold for critical habitat status in terms IFC PS6 Criterion 1 (Table 2). Rüppell's Vulture is a cliff nesting species and further surveys along the ridge separating Turkwel Dam from the rest of the AoI and in Nasolot NR may confirm the presence of a breeding colony.

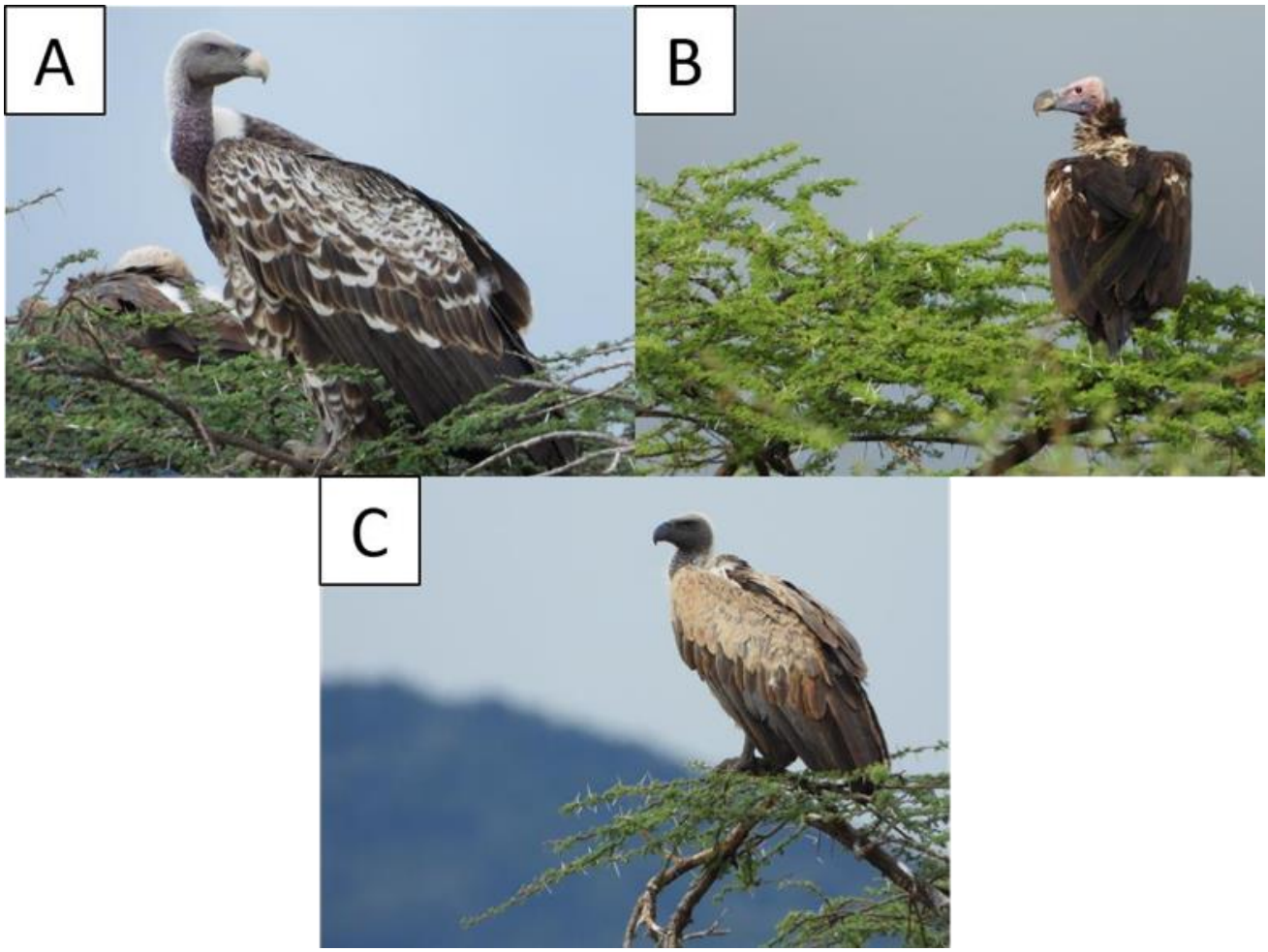

Figure 1 : A) Rüppell's vulture B) Lappet-faced vulture and C) African white-backed vulture observed at a sighting south of Amosing during the December 2019 Kalabata field survey

Table 3: Critical habitat threshold assessment – flora

Scientific Name	Extent of Occurrence (EOO)	Criterion 2: Threshold	Does this plant qualify for CH status
Blepharis turkanae	10,138.7 km^2 (Luke et al., 2015)	Areas that regularly hold ≥ 10% of the global population size AND ≥ 10 reproductive units of aspecies.	Yes. Only recorded at Ewoi to the east of the AoI. Given that it was previously only known from 4 locations, the plants at Ewoi may well constitute ≥ 10% of the global population. Therefore, this plant qualifies for critical habitat status.
Euphorbia turkanensis	Based on available literature EOO is substantially smaller than 50,000km^2	Areas that regularly hold ≥ 10% of the global population size AND ≥ 10 reproductive units of aspecies.	Yes. Known distributional range overlaps largely with AoI. Likelihood that the AoI holds ≥ 10% of the global population is very high. Therefore, it meets the threshold for critical habitat status.

Table 4: Critical habitat threshold assessment - avifauna

Common name	Scientific name	Global population estimate	0.5% of Global Population(Criteria 1 threshold)	Does population in AoI meet threshold forcritical habitat
Lappet-facedvulture	*Torgos tracheliotos*	Estimate of 5,700 in 1992 with an estimated global decline of 58% calculated in 2019 (Birdlife International, 2019). Updated estimate of global population =1,140 individuals.	6	Yes. Two sightings of 3 individuals over the course of the biodiversity baseline surveys indicates an established population within the critical habitat area of analysis.
African white-backed vulture	*Gyps africanus*	270,000 (BirdLife International, 2018)	1,350	Yes. Ten individuals observed during the biodiversity baseline assessment confirming the presence of an established population within the critical habitat area of analysis.
Rüppell's vulture	*Gyps rueppelli*	Estimate of 22,000 in 1992 (BirdLife International, 2017).Estimate of global decline of 97% gives an updated globalpopulation estimate of 660 individuals.	3	Yes. Two individuals observed in the AOI during theDecember 2019 biodiversity baseline survey. Cliff nesting species which may be nesting alongthe ridge separating Turkwel Dam from the remainder of the AOI and in mountainous parts of Nasolot NR.

Common name	Scientific name	Global population estimate	0.5% of Global Population(Criteria 1 threshold)	Does population in AoI meet threshold forcritical habitat
Steppe eagle	*Aquila nipalensis*	50,000 (lowest estimate)	250	No. A single observation of 2 individuals during the biodiversity baseline means it is unlikely that the population within the critical habitat area of analysis meets the Criteria 1 threshold.
Lesser kestrel	*Falco naumanni*	61,000 (lowest estimate)	305	No. A single observation was observed at Ngamia 3 in Nov 2015. It is unlikely that the population size within the AoI meets the Criteria 1 threshold.
Tawny eagle	*Aquila rapax*	100,000 (lowest estimate)	500	No. Observed in low abundance at various locations and times throughout the biodiversity baseline. Unlikely that the population size within the AoI meets Criterion 1 threshold of 500 individuals.

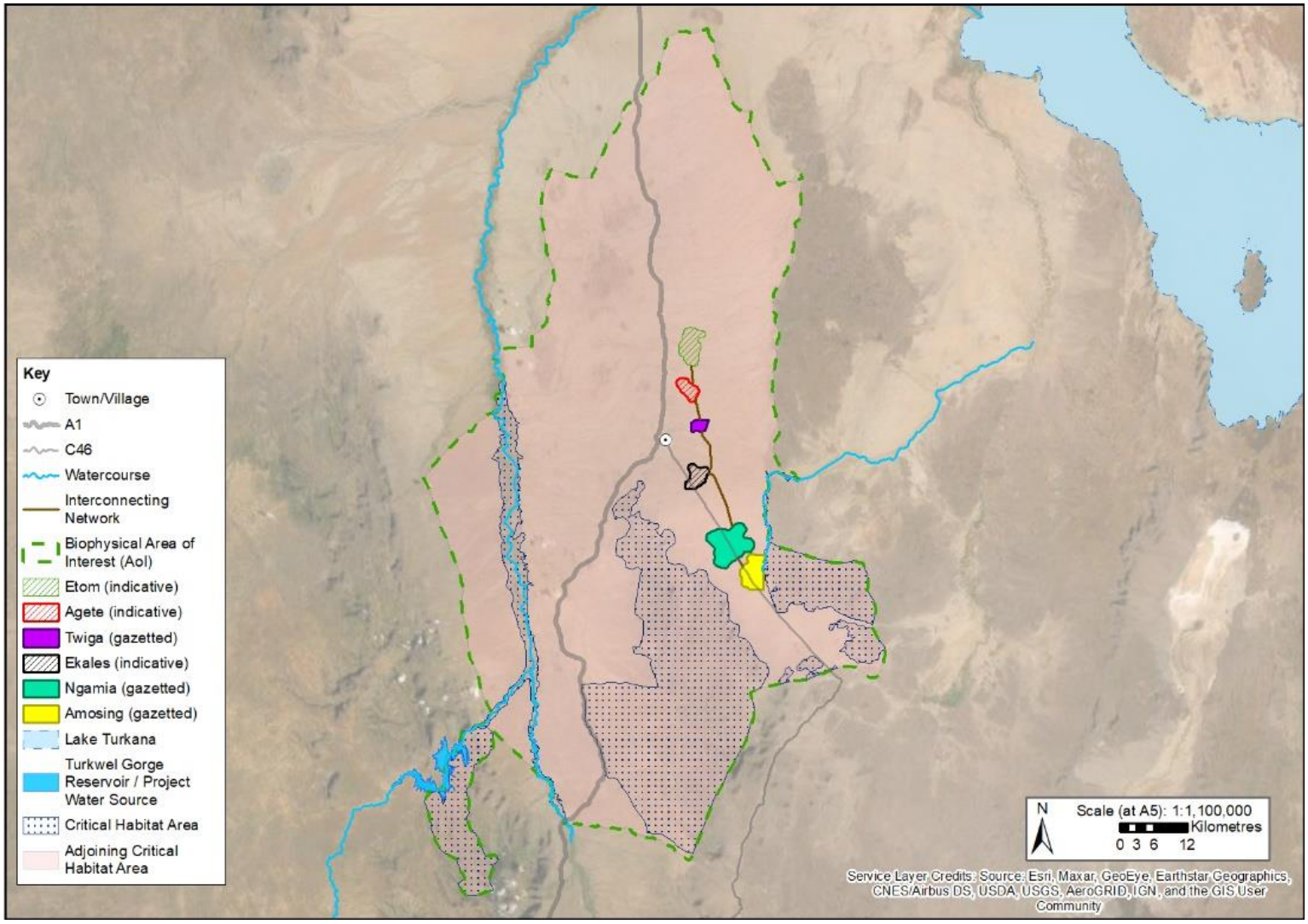

Figure 2: CH for 3 vulture species, Leopard and Striped Hyena within the AoI

4.2.3 Mammal Assessment

The Nasolot-South Turkana-Rimoi-Kamnarok elephant population is considered to be a discrete management unit that has decreased substantially in the past and continues to face a considerable poaching threat. Based on these factors and in consultation with Mr. Bernard Agwanda from the NMK, a regional expert with experience in Turkana County, it was decided to assess the critical habitat status based on the regional population rather than on the global population. Six hundred and sixty-two elephants were counted in the Nasolot-South Turkana-Rimoi-Kamnarok ecosystem during the 2015 Great Elephant Census Project (Chase et al., 2016). Most elephants in this region are found in the Nasalot and South Turkana NRs in the north and the Rimoi and Kamnarok NRs to the south (Chase et al., 2016). In 1990 Kenya Wildlife Service (KWS) estimated that 400 elephants utilized Nasolot and South Turkana NRs with another 100 in Rimoi and Kamnarok (Edebe et al., 2010). Based on the 2015 estimate of the Nasolot-South Turkana-Rimoi-Kamnarok elephant population the threshold for critical habitat status is 3 individuals. Although no elephants were observed during the baseline survey, relatively little time was spent at the Malmalte River due to the security situation. Evidence of recent elephant activity was evident during the June and December 2019 visits to the Malmalte River. Based on this assessment the African elephant population within the critical habitat area of analysis qualifies for critical habitat status in terms of IFC PS6 Criterion 1 (Table 5).

The elephant critical habitat was mapped based on the movements of four elephants fitted with radio collars and tracked over the period December 2017 to February 2019 (Ihwagi & Douglas-Hamilton, 2017). The elephant CH within the AoI is shown in Figure 4.

Based on the IUCN (AbiSaid, & Dloniak, 2015) the global population of Striped Hyaena ranges in number from 5,000 to 9,999 individuals and is known to be decreasing. If the precautionary principle is applied and the lower population estimate used, the 0.5% threshold for CH status is 25 individuals (Table 5). Four striped hyaena were recorded over the course of the baseline assessment within the *Acacia/Commiphora/Euphorbia* stunted bushland/thicket and wooded ephemeral stream vegetation communities. Given the confirmed presence and the number of individuals recorded striped hyaena meet the threshold for critical habitat status in terms of IFC PS6 Criterion 1 (Table 5).

Global population estimates for leopard (*Panthera pardus*) are widely variable. The IUCN Red List states that there are no robust estimates of the total number of mature individuals (Stein et al., 2020). However, it is known that the population in East Africa has seen substantial range declines over the past three generations (i.e., 22.3 years) (Stein et al., 2020). No leopard were recorded or observed over the course of the baseline assessment; however, it is known to occur in Nasolot NR which overlaps with a portion of the Project AoI (KWS, 2020). Given the uncertainty about the global population and the decline of the East African population, the precautionary principle is applied, and leopard afforded critical habitat status (Table 5).

Critical Habitat for leopard and striped hyaena is shown in Figure 3 and is divided into core areas, representing the refuge areas where these species are believed to spend most of their time, and where dens are likely to be situated. Adjoining areas are also included representing areas that these species are known to move through but where they are unlikely to reside for extended periods of time due to higher human density and conflict with pastoralists.

Cosen's gerbil (*Gerbillus cosensis*) was screened for potential CH trigger (criterion 2). However, it is understood that the range of this species is likely to exceed 50,000 km^2 (B. Agwanda, pers. Com, 2021). This species occurs from Twiga area northwards towards Etom but only within habitat where dwarf shrubs thrive and soil is not too compacted by overgrazing (B. Agwanda, pers. Com, 2021).

4.2.4 Herpetofaunal Assessment

A single Turkana toad was recorded in the vicinity of the Kalabata River near to Amosing 3 in June 2016. An additional survey was conducted in December 2019 in order to collect data on the distribution and habitat preferences of this species within the AoI. However, no additional specimens were collected. Prior to the biodiversity baseline surveys, the Turkana toad was only known from two locations in northern Kenya. Very little is known about the population status, habitat preferences, geographic range and conservation status of this species (IUCN SSC Amphibian Specialist Group, 2016). Given the paucity of information on this species the precautionary principle is applied, and this species is assigned CH status (Table 6).

A map showing the location of Turkana toad critical habitat within the AoI is shown in Figure 5.

4.2.5 Invertebrate Assessment

An additional survey was conducted in December 2019 in order to collect data on the distribution and habitat preferences of the unknown *Omophron* sp. however no additional specimens were collected suggesting that this species is either present in low abundances or that its lifecycle or ecology makes it less susceptible to collection by means of conventional trapping methodologies such as light traps. Based on the limited information on this species and the fact that it is currently only known from a single location the precautionary principle is applied and this species is assigned critical habitat status in terms of Criterion 2.

A map showing the location of the critical habitat for the *Omophron* sp. within the AoI is provided in Figure 6. The critical habitat comprises the Kalabata riverbed and riparian habitat.

4.2.6 Fish Assessment

Two range-restricted fish species were recorded in the Turkwel River during the June 2019 field survey. Both *Haplochromis turkanae* and *H. macconneli* were previously only known from Lake Turkana. Their presence in the Turkwel River therefore represents a range extension for both species. Despite the extension of their range, the geographic span of both species remains below the 500 km Criterion 2 threshold. The habitat of both species therefore qualifies for critical habitat status.

A map showing the location of the critical habitat of the two fish species is shown in Figure 7 and includes the mains branches of the Malmalte and Turkwel rivers.

Table 5: Critical Habitat Threshold Assessment - Mammals

Common Name	Scientific Name	Global population estimate	0.5% of Global Population (Criteria 1threshold)	Does population in project areameet threshold
African elephant	*Loxodonta africana*	662 individuals in the Nasolot-Turkana-Rimoi-Kamnarok ecosystem in 2015 (Chaseet al., 2016).	3	Yes. Based on the application of the Criteria 1 threshold to the populationof the Nasolot-Turkana-Rimoi-Kamnarok ecosystem and the confirmed presence of more than the threshold number in the Nasolot and South Turkana NRs.
Striped hyena	*Hyaena hyaena*	5000 (IUCN, 2019)	25	Yes. Four individuals recorded over thecourse of the baseline assessment. Based on the confirmed presence and the presence of an abundance of suitable habitat this species is assigned critical habitat status.
Leopard	*Panthera pardus*	Widely divergent estimates, population unknown. Known to have declined precipitously in East Africa over the last 3 generations (22.3 years) (Stein et al., 2020).	?	Yes. Not recorded during the baseline however known to occur in Nasolot NR which overlaps with the Project AoI. Given the uncertainty about global population size and declining population in East Africa the precautionary principle is appliedand this species is assigned critical habitat status.

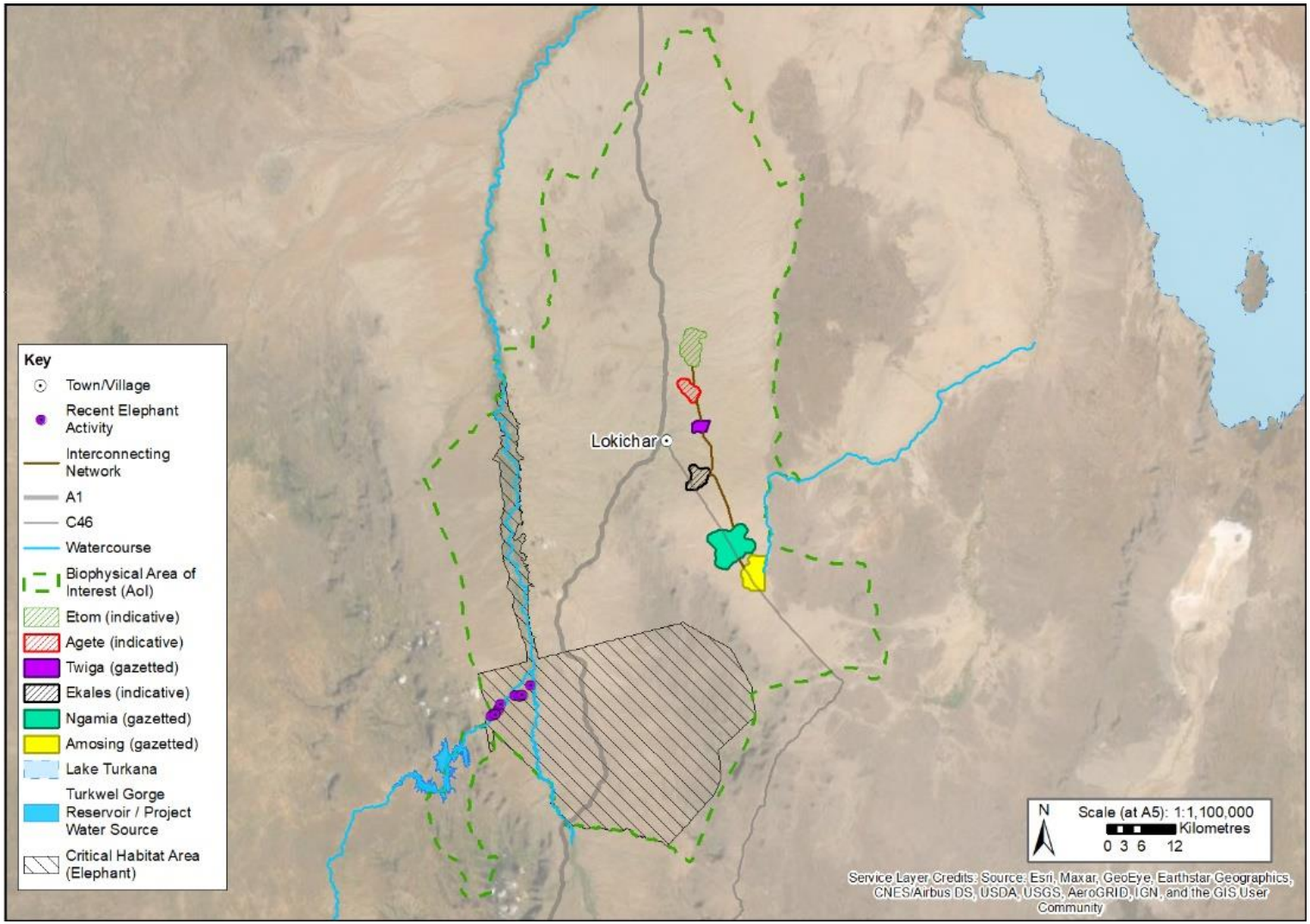

Figure 3: Location of African elephant critical habitat within the AoI

Table 6: Critical habitat threshold assessment - herpetofauna

Common Name	Species	Extent of Occurrence (EOO)	Criterion 2: Threshold	Does population meet Criteria 2Threshold
Turkana Toad	*Sclerophrys turkanae*	Based on literature sourcescalculated at 15,892 km^2	Areas that regularly hold ≥ 10% of the global population size AND ≥ 10 reproductive units of aspecies.	Yes. Only recorded from a single locationwithin the critical habitat area of analysis. Based on the limited information on this species the precautionary principle is applied, and this species is assigned critical habitat status.

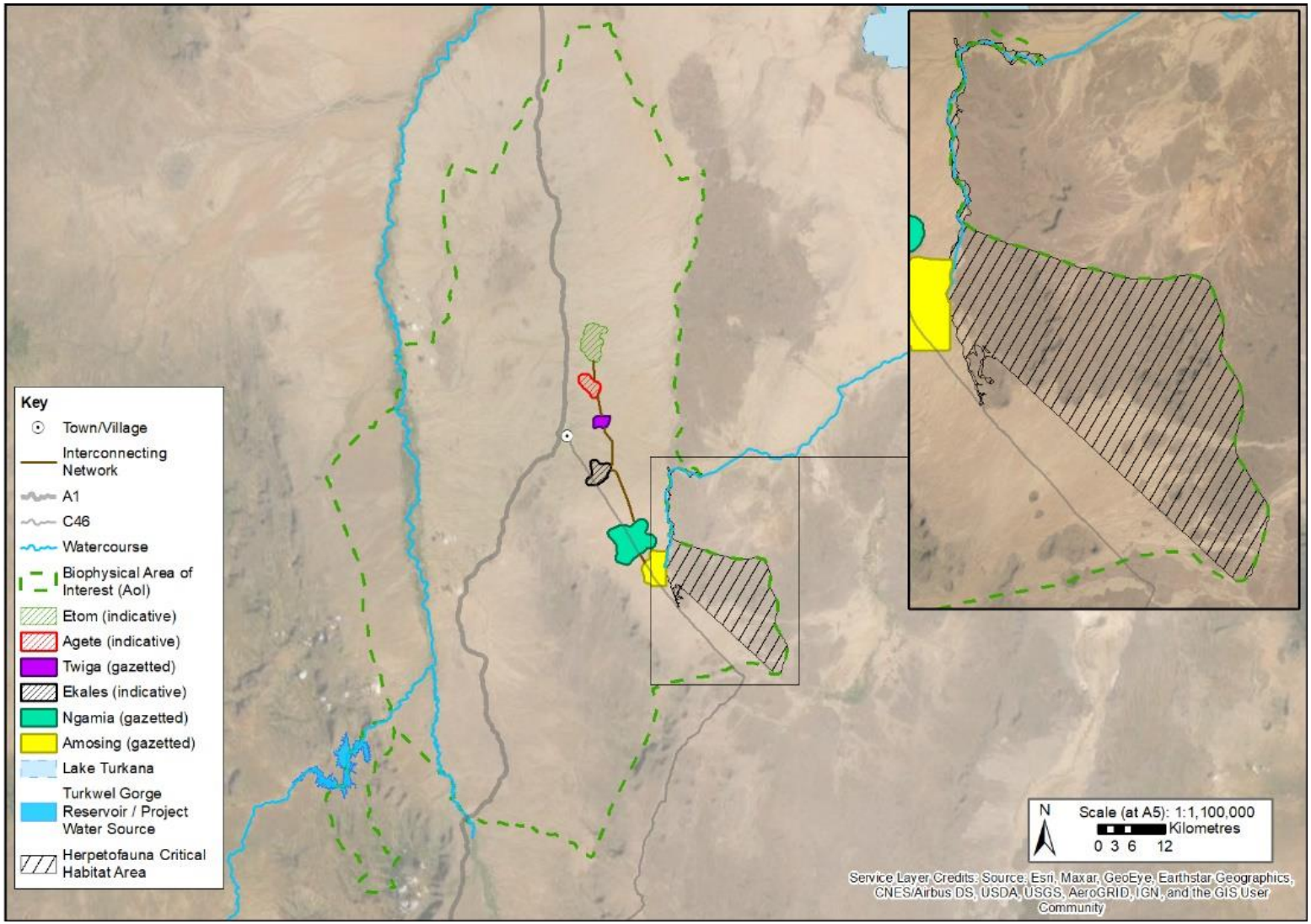

Figure 5: Location of Turkana toad CH within the AoI

Table 7: Critical Habitat threshold assessment - invertebrates

Common Name	Species	Extent of Occurrence (EOO)	Criterion 2: Threshold	Does population meet Criteria 2Threshold
Ground beetle	*Omophron* sp.	Uncertain, species only knownfrom a single location, EOO assumed to be < 50,000 km^2	Areas that regularly hold ≥ 10% of the global population size AND ≥ 10 reproductive units of a species.	Yes. Only known from a single location in the Kalabata River near to Loperot. The absenceof additional specimens despite focussed sampling suggests that this species is either present in low abundances or that its lifecycle or ecology makes it unlikely to be captured by conventional sampling methods such as light traps. Given the limited information available on this species a precautionary approach is followed and this species is assigned critical habitat status.

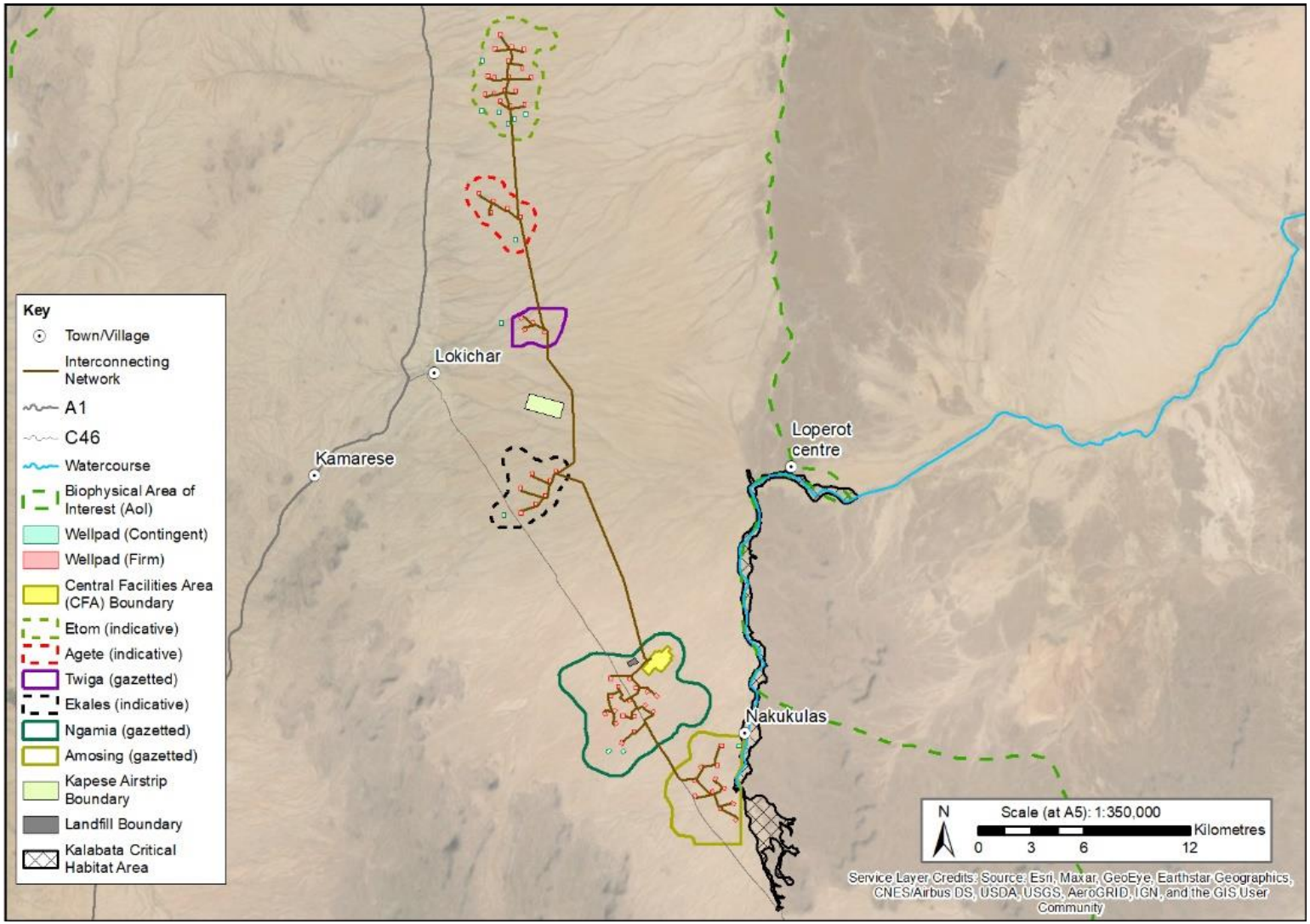

Figure 4: Location of invertebrate CH within the AoI

Table 8: Critical Habitat threshold assessment - fish

Species	Extent of occurrence (EOO)	Criterion 2: Threshold	Does population meet Criteria 2 Threshold
Haplochromis turkanae	415 km linear distance (Turkwel Gorge to northernmost point of LakeTurkana)	500 km linear geographic span (i.e., the distancebetween occupied locations furthest apart) (IFC GN, 2019) .	Yes. *H. turkanae* was previously only known fromLake Turkana. Despite the range extension the geographic span still falls below the threshold andtherefore the species qualifies for critical habitat status based on Criterion 2.
Haplochromis macconneli	416 km linear distance (Turkwel Gorge to northernmost point of LakeTurkana)	500 km linear geographic span (i.e., the distancebetween occupied locations furthest apart) (IFC GN, 2019) .	Yes. *H. macconneli* was previously only known fromLake Turkana. Despite the range extension the geographic span still falls below the threshold and therefore the species qualifies for critical habitat status based on Criterion 2.

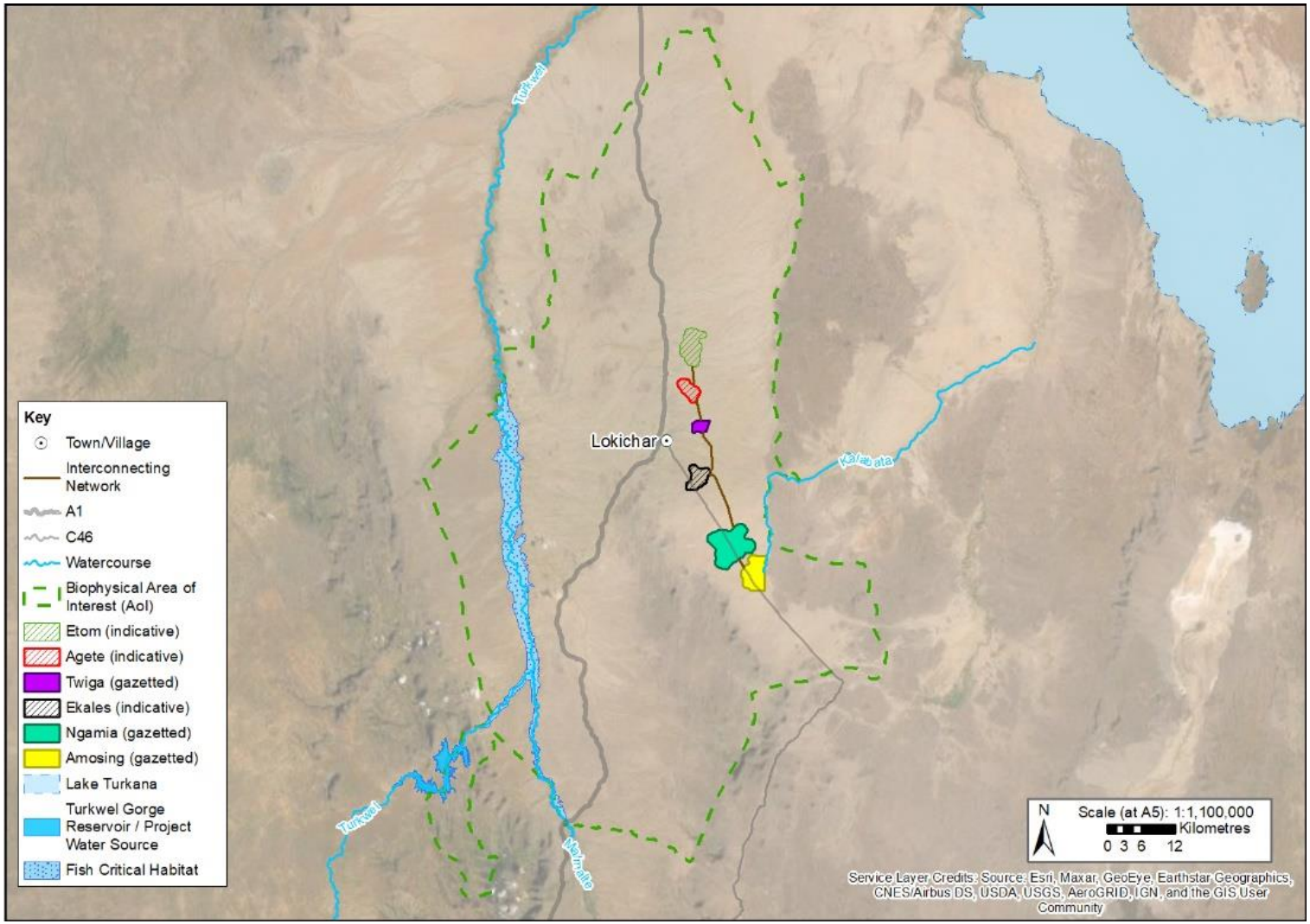

Figure 5: Location of fish CH within the AoI

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2 Critical Habitat Assessment

TECHNICAL MEMORANDUM

DATE 20 August 2021 **Reference No.**1433956_644 V.1

TO Alex Mayhook-Walker,

CC Tim Flower, Andrew Morsley

FROM Freddy Brookes **EMAIL** FBrookes@golder.com

APPROACH TO ASSESSMENT OF NATURAL AND MODIFIED HABITAT

1.0 INTRODUCTION

The purpose of this appendix is to provide the approach used for the determination of natural and modified habitats (as required by the International Finance Corporation (IFC) Performance Standard 6 (IFC, 2012a)), and the outcomes of that assessment. This document is based on the *South Lokichar – Approach to Identification of Natural and Modified Habitats during Site-Specific Assessments (SSA) – Holding Statement* submitted by Golder Associates to Tullow Kenya BV (TKBV) in 2017 (Golder Report No. 1433956.567 D.0, 2017).

2.0 BACKGROUND

This section presents a summary of the definitions of natural and modified habitats, as presented by the IFC in the 2012 Performance Standards (IFC 2012a) and associated Guidance Notes (IFC 2019). Those definitions, in combination with the knowledge of the baseline condition of vegetation communities present within the Area of Influence (AoI) were used as the context for the development of the approach to natural and habitat identification in the sections that follow. This approach was then used to identify the extent of natural and modified habitats in the AoI.

2.1 Natural Habitats

The IFC defines natural habitat as areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or areas where human activity has not essentially modified an area's primary ecological functions and species composition (IFC 2019, GN38).

The IFC stipulates that the proposed project will not significantly convert or degrade natural habitats, unless the following conditions can be met:

- No other viable alternatives within the region exist for development of the project on modified habitat;
- Consultation has established the views of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation; and
- Any conversion or degradation is mitigated according to the mitigation hierarchy (IFC 2019, GN38).

In areas of natural habitat, mitigation measures need to be designed to achieve no net loss of biodiversity, where feasible (IFC 2019, GN38).

The IFC further stipulates that the determination of natural habitat will be made using credible scientific analysis of best available information (IFC 2019, GN39).

Natural habitats should not be interpreted as untouched or pristine habitats (IFC 2012b, GN39). The question is the degree of impact. If, in the judgement of a competent professional, the habitat still largely contains the principal characteristics and functions of a native ecosystem(s), it should be considered a natural habitat regardless of some degree of degradation (IFC 2019, GN39).

2.2 Modified Habitats

The IFC defines modified habitat as areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition (IFC 2019, GN34).

According to the IFC, the determination of modified habitat can be based on the level of human-induced disturbance (for example, presence of invasive species, level of pollution, extent of habitat fragmentation, viability of existing naturally occurring species assemblages, resemblance of existing ecosystem functionality and structure to historical conditions, degree of other types of habitat degradation) and the biodiversity values of the site (for example, threatened species, ecosystems, and ecological processes necessary for maintaining nearby critical habitats) (IFC 2019, GN27).

3.0 IDENTIFICATION OF NATURAL AND MODIFIED HABITATS

The primary drivers of change in vegetation communities in the region are overgrazing by livestock (primarily goats, sheep, camels and donkeys), and timber harvest for firewood and/or charcoal production. The intensity of these effects tends to be magnified with the proximity to areas of permanent settlement, such as Lokichar and Nakukulas and with proximity to water supply points and roads (Golder Report No. 1433956.567 D.0, 2017).

In order to assess the distribution of anthropogenic elements within the AoI locations, the following features were plotted and mapped:

- Settlements (this includes both larger settlements such as Lokichar and Nakukulas and smaller rural settlements referred to as manyattas). Locations of settlements were plotted based on GIS information provided by the Kenyan Joint Venture (KJV), field observations and visual scanning of recent satellite imagery;
- Livestock corrals (*anok* in Turkana), these structures are made from *Acacia reficiens* branches that are harvested to make walls to keep livestock in at night). Livestock corrals are often situated near settlements and in many cases are large enough that they are identifiable on aerial imagery and were plotted based on field observations and photos. It is acknowledged that many smaller corrals may have been missed in the process;
- Roads and tracks (both national roads and smaller vehicle tracks) were plotted based on information provided by the KJV and visual assessment of satellite imagery; and
- Supplied community water points were plotted based on spatial information provided to Golder by the KJV.

A map showing the locations of these anthropogenic features within the AoI is provided in Figure 1. The locations of the various anthropogenic impacts showed a high degree of spatial correlation with roads and tracks

linking settlements and livestock corrals clustered around settlements (Figure 1). The KJV supplied community water points are similarly situated near to settlements, corrals and roads (Figure 1).

The impacts of these elements would not be limited to the locations plotted in Figure 1, but would radiate outwards along a gradient from these points. Habitats near roads, settlements and watering points can be expected to show the highest degree of utilisation and modification. In order to delineate the areas of highest utilisation, modification 5 km buffers were plotted around each of the anthropogenic elements (Figure 2). These boundaries are by no means definitive and it can be accepted that habitat modification extends outwards from areas of highest human density along a gradient and that the remotest areas would show the lowest degree of modification. Nevertheless, a large component of the local population comprises nomadic pastoralists that cover large distances to reach suitable grazing areas for their livestock.

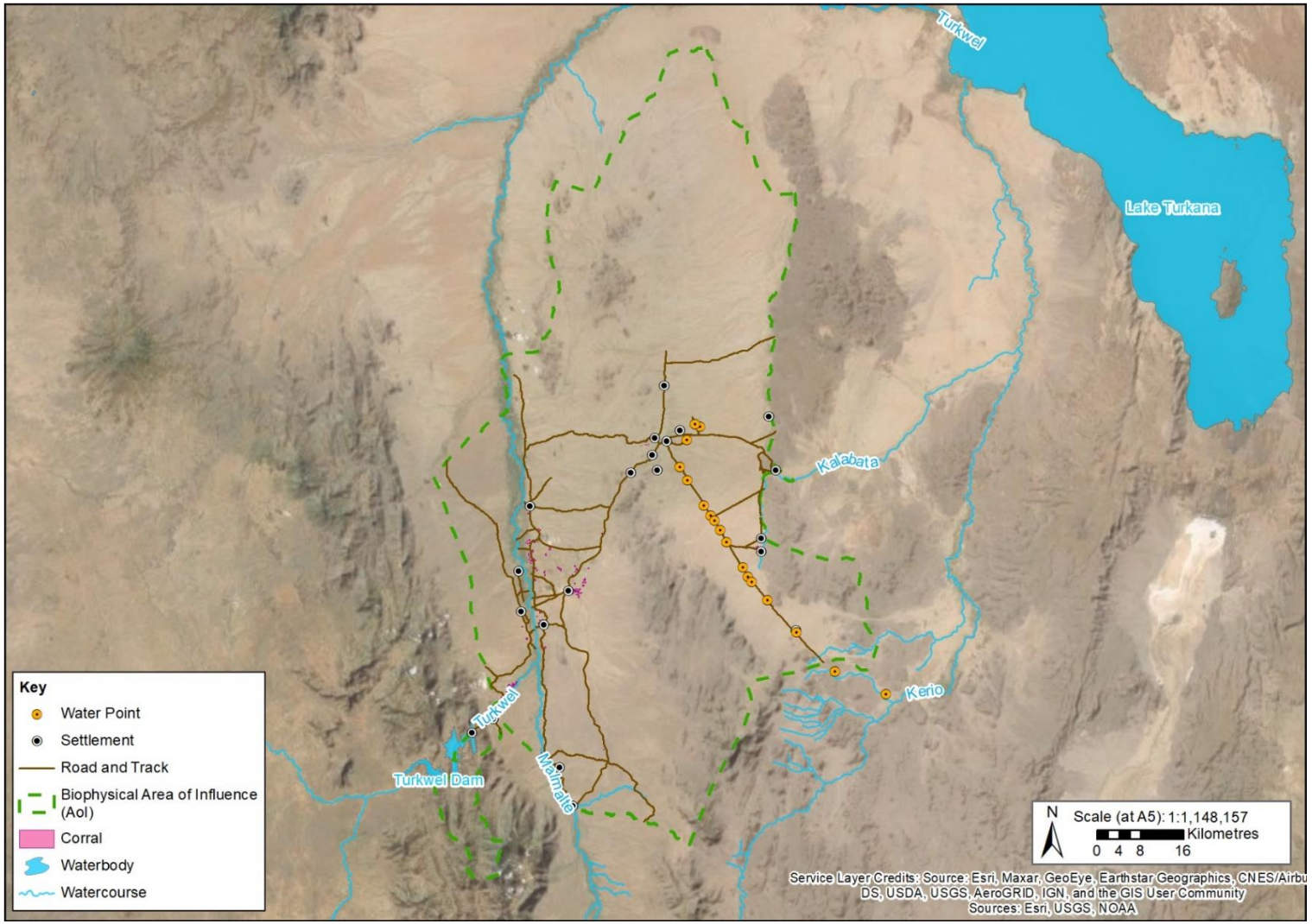

Figure 1: Location of anthropogenic elements within the AoI

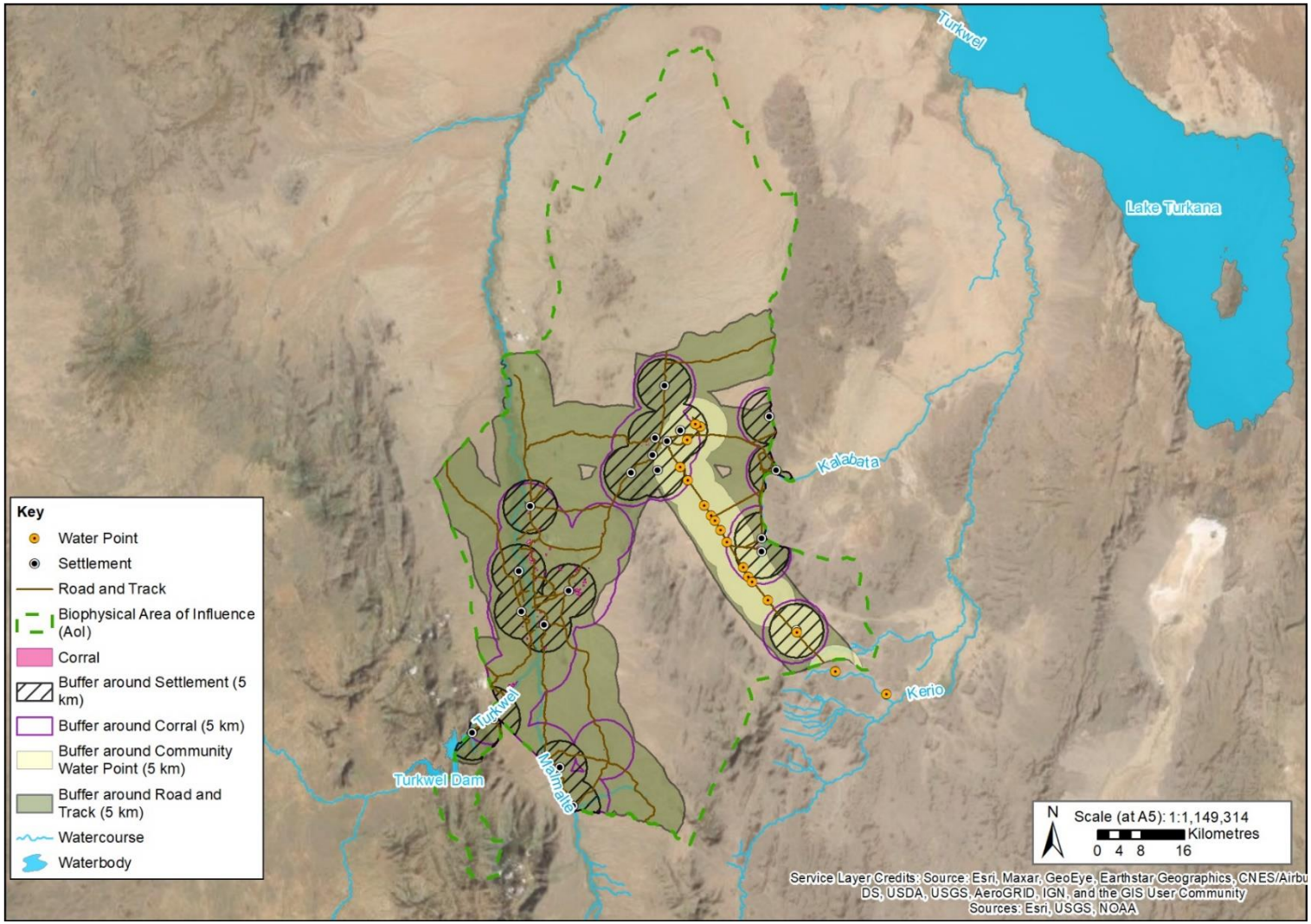

Figure 2: Anthropogenic elements with 5 km buffers

3.1 Quantifying Degree of Modification

The approach for quantifying habitat modification was based on the methodology proposed in the 2017 Golder Report (Golder Report No. 1433956.567 D.0, 2017) which in turn was based on the methodology proposed by based on that proposed by Herlocker (1989). Degree of habitat modification was plotted based on the overlap of the buffers shown in Figure 2. A map showing the degree of habitat modification within the AoI is provided in Figure 3.

Areas located more than 5 km away from any of the known sources of anthropogenic impacts (settlements, roads, livestock corrals and the KJV supplied community water points) were assigned a very low degree of modification (Figure 3). These areas are mostly situated on the periphery of the AoI far away from settlements, roads and tracks. A large portion of South Turkana National Reserve (NR) in the south-central portion of the AoI, and the mountainous area that separates Amosing and Ngamia from the Malmalte and Turkwel rivers is classified as having a very low degree of modification (Figure 3). Based on the IFC definition, these habitats would have the highest likelihood of being classified as natural. However, it should be noted that a large proportion of the population of Turkana county are nomadic pastoralists that move extensively with their livestock, and even these areas were confirmed to be far from pristine as shown in the Project Biodiversity Baseline report (Baseline Report - Golder Report No. 1433956.620.B.0, 2019). Vestiges of the original faunal community remain in these areas (Baseline Report - Golder Report No. 1433956.620.B.0, 2019), and the habitats provide core critical habitat for bird and mammal species of conservation concern as shown in Appendix A (Critical Habitat Assessment).

Areas that only fall within the extent of a single buffer area (within 5 km of a single source of anthropogenic impact) were assigned a degree of modification of low (Figure 3). These are primarily peripheral areas, mostly located > 5 km away from settlements, livestock corrals and POK community water points, but within 5 km from roads or tracks (Figure 3).

Habitats that overlap with 2 buffer areas were assigned a degree of modification of moderate (Figure 3). Again, these are mostly peripheral areas > 5 km away from settlements, but within proximity of livestock corrals, roads and tracks.

Areas within the 5 km buffer of settlements were mostly characterised as highly modified (Figure 3). These habitats are extensively utilised and modified, with vegetation intensively grazed and harvested for firewood. Little of the indigenous faunal community remains within these areas (Figure 3). It should, however, be remembered that both natural and modified habitats may contain high biodiversity values, thereby qualifying as critical habitat (IFC 2012b, GN28). In fact, the habitat along the Kalabata River was identified as critical habitat for the Turkana toad, undescribed Omophron beetle, and vulture species with much of this habitat categorised as highly modified.

Habitats within the extent of all the buffer areas were assigned a very high degree of modification (Figure 3). These are the habitats in the AoI with the highest human and livestock densities near to settlements, roads, livestock corrals and the KJV supplied community water points. In addition to the inhabitants of the settlements and their livestock, these areas also attract large numbers of nomadic pastoralists. These habitats are situated in the vicinity of the large settlements of Lokichar and Nakukulas (Figure 3).

3.2 Natural and Modified Habitats within the Project Footprint

In order to assess and characterise the habitats most likely to be impacted upon by the project, a 500 m buffer was drawn around all the proposed project infrastructure and this was superimposed on the habitat modification map (Figure 3).

None of the habitats within the project footprint were categorised as having a very low degree of modification (Figure 3). Based on this assessment as well as baseline data none of the habitats within the project footprint can be classified as natural. The habitat at all the proposed wellpads ranged from moderately to very highly modified (Figure 3 below).

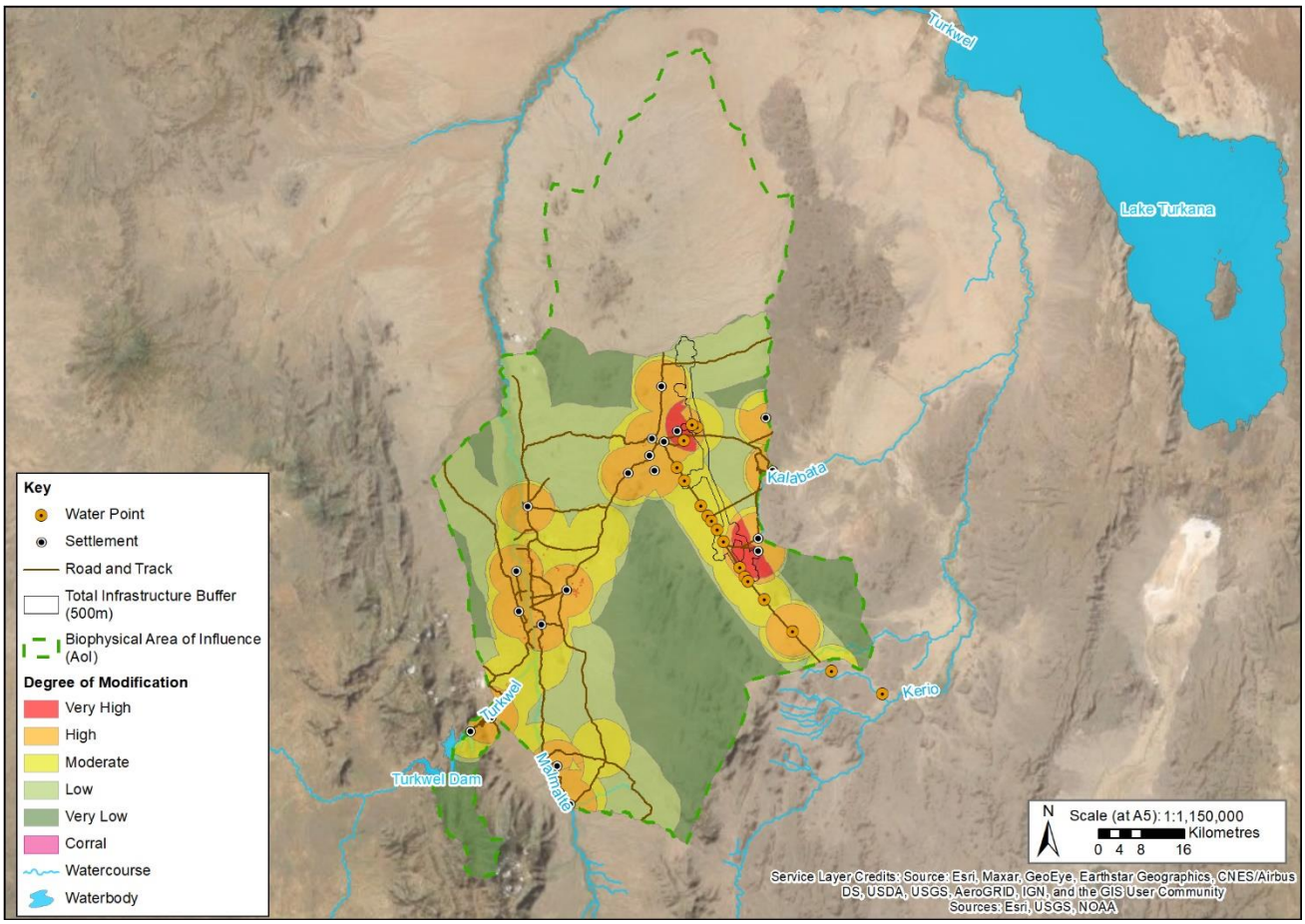

Figure 3: Degree of habitat modification based on overlaps of buffers around known sources of anthropogenic impact

4.0 CONCLUSIONS

The presence of natural habitat would require mitigation measures designed to achieve no net loss of biodiversity. Based on this assessment as well as baseline data, none of the habitats within the project footprint were classified as natural.

5.0 REFERENCES

Herlocker, D. (1989). A survey method for classification of range condition (Range Monitoring Series No.1). in Range Management Handbook of Kenya Volume III.7. Edited by S.B. Shaabani & D. Walther. Ministry of Livestock Development, Range Management Division.

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Cultural Heritage

D5

1 Expanded Definition of the importance criteria for living cultural heritage, intangible cultural heritage and archaeological receptors

1.0 CULTURAL HERITAGE – EXPANDED DEFINITIONS OF RECEPTOR IMPORTANCE

Receptor Importance	Example Cultural Heritage Receptors
Very high	■ Living cultural sites of international importance with significant cultural or touristic value. Sites that cannot be moved because they are natural features or part of the physical landscape or that are non-replicable. Sites that are critical[1] and/or rare at the national or international level. ■ Intangible cultural heritage with the greatest social[2] and/or historic[3] and/or scientific[4] and/or environmental[5] value. Intangible cultural heritage that is recognised and designated at international level. ■ Archaeological and historic sites of international importance, with significant cultural or touristic value or the highest potential for further, significant discoveries to be made. Archaeological and historic sites with rare and/or previously unstudied or understudied features with a high potential for crucial further research. Archaeological and historic sites which are afforded protection and where no intrusion is permitted.
High	■ Living cultural sites of national or regional importance with significant cultural value. Non-replicable cultural sites that are not critical and/or rare, or cultural sites that are potentially replicable and that could be moved in highly exceptional circumstances (in consultation with site guardians and the affected communities). ■ Intangible cultural heritage with significant social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage that is recognised and designated at national level. Intangible cultural heritage endemic to a certain place or group of people (and therefore 'rare'), and which is widely representative of that specific place or group. ■ Archaeological and historic sites of national or regional importance, with high potential for further discoveries to be made. Archaeological and historic sites with understudied features and/or high potential for further research.
Medium	■ Living cultural sites of local importance with significant cultural value. Sites that are common and potentially replicable and that can be moved in exceptional circumstances (in consultation with site guardians and the effected communities). Sites that are unused, but are known to the community and associated with settlement history/oral history ■ Intangible cultural heritage with some social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage that is common and widely representative of the population as a whole. ■ Archaeological and historic sites of local importance, with some potential for further discoveries to be made. Archaeological and historic sites with features which have been comprehensively studied and/or are poorly preserved, with limited potential for further research.

[1] 'Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use, or have used within living memory, the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designations' (IFC, 2012a).

[2] Value to society in the present.

[3] Value to our understanding of the human past.

[4] Value to our understanding of people and their environment.

[5] Value to our understanding of the environment.

Receptor Importance	Example Cultural Heritage Receptors
Low	■ Living cultural sites of limited local importance and cultural value. Cultural sites that are defunct and/or have little or no historic value. Cultural sites that are common and/or are replicable and that can be moved or destroyed (in consultation with site guardians and the affected communities). ■ Intangible cultural heritage with limited social and/or historic and/or scientific and/or environmental value. Intangible cultural heritage that is common and widespread, but only representative of a limited proportion of the population. Intangible cultural heritage that is associated with common and/or replicable cultural heritage assets and so has the greatest potential to be replicated (through community engagement). ■ Archaeological and historic sites of limited local importance, with low or no potential for further discoveries to be made. Archaeological and historic sites with features which have been comprehensively studied and/or are poorly preserved/destroyed, with no potential for further research.

2.0 CULTURAL HERITAGE – EXPANDED DEFINITIONS OF IMPACT MAGNITUDE

Magnitude of Impact	Description Criteria	
	Adverse	**Beneficial**
High	■ 'Living' cultural heritage receptors, or component parts thereof, are altered, removed or damaged such that their value and/or functionality/setting/accessibility are entirely changed or lost. Receptor use is prevented, or significantly limited; ■ Intangible cultural heritage receptors are entirely changed, and traditional beliefs, practices or behaviours cannot continue and are lost, or are severely inhibited; and ■ Archaeological receptors or their settings are altered and key elements are changed such that the resource value is entirely altered or lost.	■ 'Living' cultural heritage receptors, or component parts thereof, are altered or maintained such that their value/ functionality/setting/accessibility is improved. ■ Intangible cultural heritage receptors are safeguarded for the future, with the sustainability of traditional beliefs, practices and behaviours supported. ■ Archaeological information is disseminated and contributes towards an improved understanding of the archaeological record in the area.
Medium	■ 'Living' cultural heritage receptors, or component parts thereof, are altered such that their value and/or functionality/setting/accessibility are changed, and modification of receptor use is required; ■ Intangible cultural heritage receptors are changed, and traditional beliefs, practices or behaviours are modified; and ■ Archaeological receptors or their settings are altered and key elements are changed such that the resource value is modified and/or information is lost.	
Low	■ 'Living' cultural heritage receptors, or component parts thereof, are altered such that their value and/or functionality/setting/accessibility are slightly changed, but no modification of receptor use is required; ■ Intangible cultural heritage receptors are slightly changed, but traditional beliefs, practices or behaviours are not modified; and ■ Archaeological receptors or their settings are slightly altered, but their integrity is maintained or archaeological receptors are altered but no information is lost (through archaeological excavation and recording).	
Negligible	No predicted change from baseline for tangible or intangible cultural heritage receptors.	

ANNEX I

Signature Page

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03 September 2021

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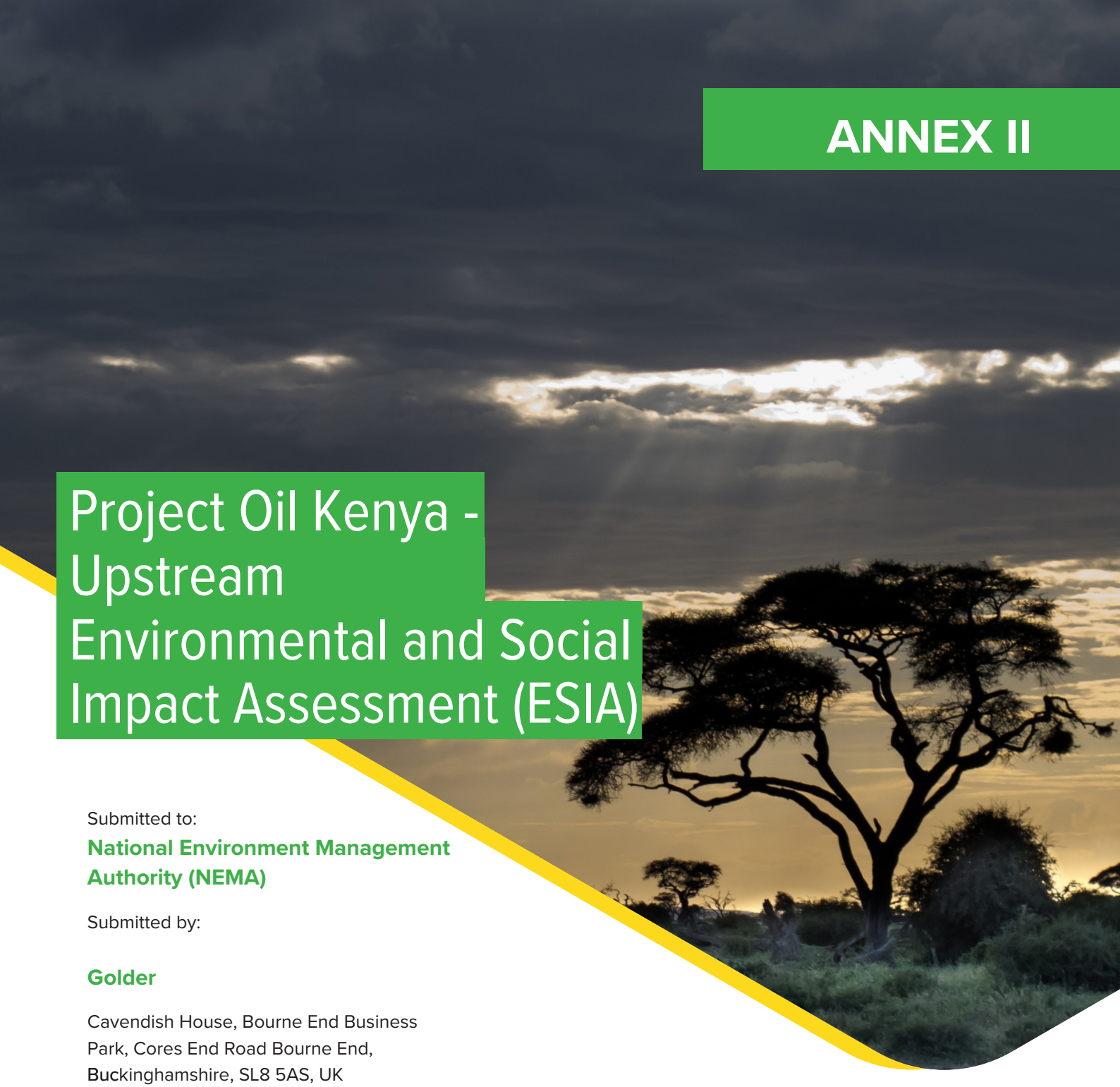

ANNEX II

Project Oil Kenya - Upstream Environmental and Social Impact Assessment (ESIA)

Submitted to:

National Environment Management Authority (NEMA)

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ANNEX II

A Stakeholder Engagement Plan

B Stakeholder Engagement Consultation Report

C Resettlement and Livelihood Restoration Framework

ANNEX II

A

Stakeholder Engagement Plan

1 Project Oil Kenya Upstream Stakeholder Engagement Plan

PROJECT OIL KENYA

UPSTREAM STAKEHOLDER ENGAGEMENT PLAN

July 2021

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1 INTRODUCTION

The ***Stakeholder Engagement Plan*** (SEP) is designed to ensure effective engagement with local communities and other key stakeholders during the current pre-FID phase of Project Oil Kenya (calendar year 2021).

The SEP builds on the historical engagement work which commenced with early exploration activities. Since this time, Project Oil Kenya has maintained frequent dialogue with local communities (affected parties) together with other interest groups such as non-government organizations (NGOs), local and regional regulators, community-based organizations (CBOs) and public interest groups. Project Oil Kenya is committed to continuous consultation as the Project reaches an advanced stage of planning and through the subsequent Project stages.

During the pre-FID phase, there is a significant reduction in field activity and field staff, however there are a number of critical activities that need to be completed to support the completion of a Field Development Plan by the end of 2021.

The objective of the SEP is to:

- Define how upstream stakeholders will be engaged pre-FID;
- Set out how Project Oil Kenya will work with National and County Government concerning community relations and grievance management;
- Set out how Project Oil Kenya will seek to maintain positive two-way relationships with local communities and other stakeholders;
- Define a fit for purpose grievance management system;
- Provide a summary of previous engagement related to the Project ESIA;
- Set out how engagement related to the Project ESIA is undertaken.

1.1 The Project

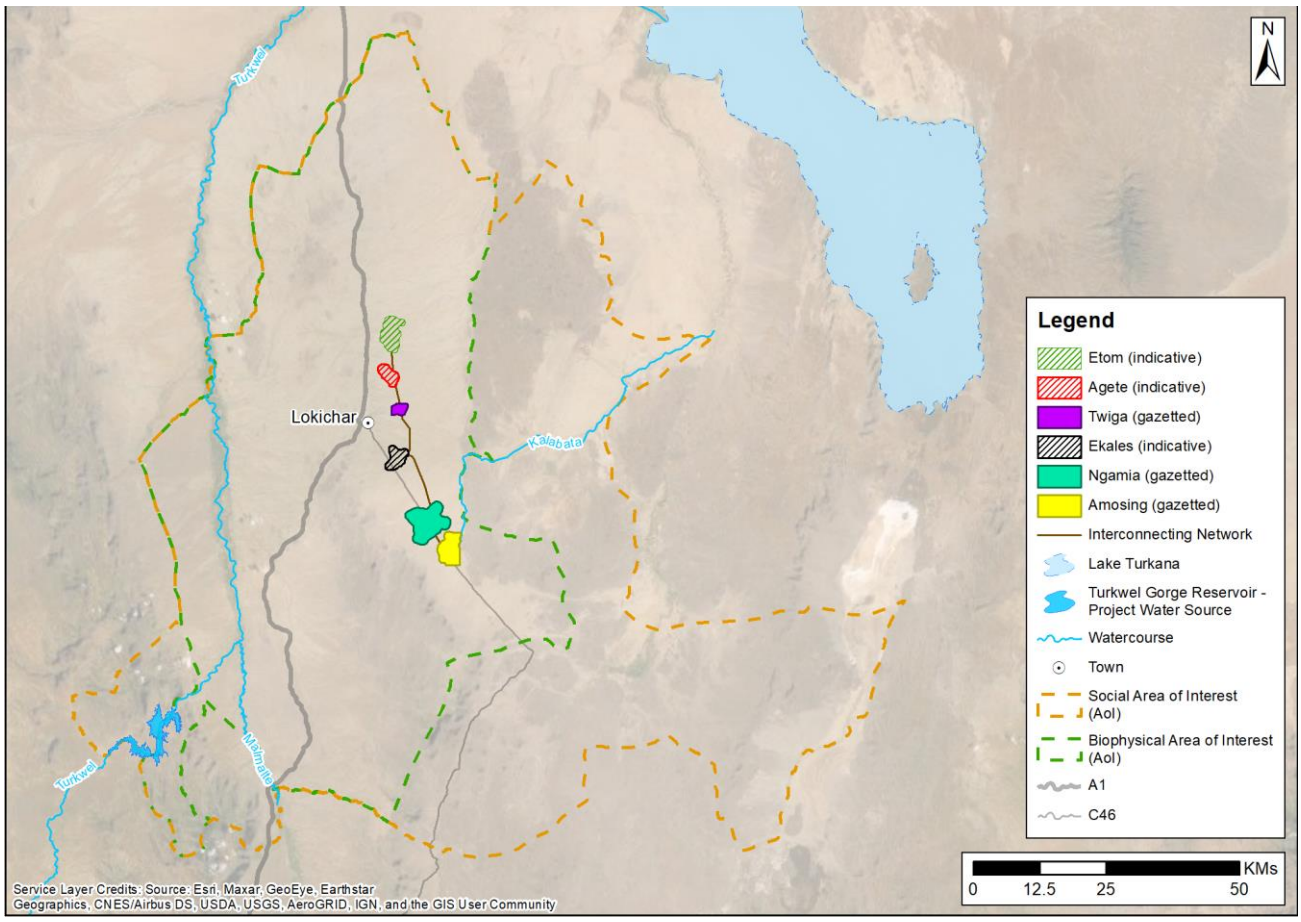
Project Oil Kenya ("POK" or "the Project") is the development of six oilfields in Turkana County in north-west Kenya. The Project is being planned and developed by a Joint Venture of international oil companies, on behalf of the Government of Kenya (represented by the Ministry of Petroleum & Mining). The Joint Venture of oil companies, also known as the Kenya Joint Venture or KJV, comprises Africa Oil Turkana Ltd, TotalEnergies EP Kenya and Tullow Oil Kenya Ltd.

The Project is located between Lake Turkana and the Turkwel River valley to the south and west of Lake Turkana, in north-west Kenya, approximately 450 km north of Nairobi.

The location of the Project's facilities in a regional setting are shown in the adjacent figure. The nearest town is Lokichar.

The oilfields and Project's facilities are located in Turkana South and Turkana East sub counties in Turkana County. Water will be sourced from the Turkwel Gorge reservoir, located in West Pokot County.

Figure 1: Project Location



1.2 Engagement Objectives During the Pre-FID Phase

During the 2021 pre-FID phase, the key stakeholder engagement goals for Project Oil Kenya are:

- To maintain relationships with local communities, government authorities and other stakeholders;
- To support completion of the Field Development Plan (FDP);
- To support the completion of the ESIA including:
    - Project disclosure to stakeholders
    - Supporting stakeholder consultation on project impacts and mitigations
- To support the completion of Project social performance and environmental management commitments including:
    - Consolidation of existing waste to the Twiga-1 waste storage facility;
    - Development and hand-over to Tukana County Government of a sustainable community water supply for in-field areas;
    - Handover of existing social investment projects,;
    - Management of Kapese Integrated Operating Base (IOB) on a care and maintenance basis;
    - Development of a Community Development Plan for the Project, to be implemented following FID;

- Development of the Project's Resettlement and Livelihood Restoration Plan, following statutory land acquisition by the National Land Commission.

2 APPROACH TO STAKEHOLDER ENGAGEMENT

Project Oil Kenya recognises that effective stakeholder engagement is critical to securing and maintaining the Project's social licence to operate. In that process, the Government of Kenya (GOK) is a central stakeholder as the Operator is a contractor to GOK, with the Ministry of Petroleum and Mining (MoPM) being the "host" ministry for the Project.

Working in close coordination with MoPM, the Project will work with National Government and County Adminstrations to plan and implement stakeholder engagement activities. This approach will enable the project to engage with and work through existing administrative structures, particularly the office of County Commission and County administrative officers, to identify and communicate with stakeholders, manage community questions, complaints and grievances, and to work with local communities in a collaborative and transparent manner to develop mutually beneficial relationships.

Project activities are subject to significant regulatory, stakeholder and third-party scrutiny and MoPM will support and advise the Project on how best to conduct its activities. In support of this, the MoPM-led stakeholder engagement process will be geared towards:

- Representing Project Oil Kenya (POK) to stakeholders;
- Building relations in project area of influence;
- Promoting awareness and understanding of Project Oil Kenya (POK) activities;
- Facilitate field activities through Project Oil Kenya (POK) community engagement;
- Manage expectations around key issues such as local employment and business opportunities;
- Managing issues proactively and reactively;
- Recording, reporting and acting upon grievances.

2.1 Stakeholder Engagement Principles

The principles that guide how stakeholders are engaged are:

- **Government leadership** - Ensure that the Stakeholder Engagement, public consultation, and disclosure process is led by the Government through the MoPM in collaboration with Turkana County Government (TCG), West Pokot County Government (WPCG) and the Operator.
- **Compliance** - Comply with national legislation and regulation and well as international good practice as defined by the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability.
- **Activity Specific** - Ensure that Stakeholder Engagement activities are Project specific, tailored to the stage of the Project and it commences early before Project implementation to inform the stakeholders and manage expectations.
- **Pro-Active Engagement** - Work with affected persons, groups, companies or organisations to avoid and minimize impacts where possible through strong contractor management.
- **Appropriate and Inclusive** - Ensure the stakeholder engagement process is culturally appropriate and inclusive of all stakeholders affected by land acquisition and is free of interference, manipulations, intimidation or coercion.

3 STAKEHOLDER ENGAGEMENT REQUIREMENTS

Project Oil Kenya will comply with Kenyan legislative, regulatory and policy requirements, and international good practice related to stakeholder engagement.

3.1 Kenyan Requirements

The Kenyan regulatory framework contains a number of stakeholder engagement requirements. The principle relevant regulations and requirements are as follows:

The Constitution of Kenya (2010):

- Article 1(1) provides that all sovereign power belongs to the people of Kenya. Article 1 (2) further states that people may exercise their sovereignty directly or through their elected representatives. Public participation is direct exercise of sovereignty;
- Article 10(2) indicates that public participation is among the national values and principles of governance;
- Article 33 guarantees the freedom of expression including the freedom to seek, receive or impart information or ideas;
- Article 35 provides for the right to access information. It guarantees every citizen the right to access information held by the state;
- Article 42 that every person has a right to a clean and healthy environment. Subsection 1 adds that this includes the protection of the environment for the benefit of present and future generations through legislative and other measures;
- Article 43 follows declaring the economic and social rights of every Kenyan and details them in subsections, including: (a) the right to the highest attainable standard of health, which includes the right to health care services, including reproductive health care, and (d) the right to clean and safe water in adequate quantities;
- Article 174(c), gives powers of self-governance to the people. The people can derive direct benefit from meaningful public participation as this contributes to better informed decision-makers armed with additional facts, values and perspectives obtained through public input;
- Article 174(d) recognizes the rights of communities to manage their own affairs and to further their development. Article 232(1) (d) provides for the involvement of the people in the process of policy making and part (f) provides for transparency and provision to the public of timely and accurate information. Access to information for Kenyan citizens is guaranteed by Article 35 of the Constitution; and
- Article 37 and 104 include a provision on grievance mechanisms, including a right to assemble, demonstrate, to picket and to present petitions or seek redress within the judicial system.

Environmental Management and Co-ordination Act 1999, as amended in 2015.

- Environmental Management & Coordination Act (1999): establishes the principle of public participation in the development of policies, plans and processes for the management of the environment, including within the EIA process.
- Environmental (Impact Assessment & Audit) Regulations (2003) (as Amended): Reg. (17) contains public participation requirements during the ESIA study regarding seeking the views of the people or communities which are likely to be affected by the Project. This includes requirements related to public announcements and notices, public meetings and recording of oral and written comments.

- The Draft Environmental Management and Coordination (Strategic Assessment, Integrated Impact Assessment and Audit) Regulations, 2018. The draft regulations provide for the need to register environmental assessment experts and the requirement for an environmental assessment expert licence. The regulation spells out requirements for a project report as well as the submission comment and authorisation process. The regulations spell out the requirements for the integrated environmental impact assessment, environmental audit and monitoring, and strategic environmental assessment processes in some detail. The need for stakeholder engagement is indicated in a number of aspects. Of specific relevance is a requirement to invite comments by the public, development of a SEP as well as reporting on the implementation thereof.

3.2 International Good Practice

Project Oil Kenya will use the IFC Performance Standards on Environmental and Social Sustainability (2012) to guide stakeholder engagement activities. The IFC Performance Standards set out a framework for managing and improving project performance from planning and assessment, through construction and operations to closure and after-care. Compliance will be documented in a Supplemental Assessment to be prepared and disclosed following the POK ESIA.

The IFC Performance Standards state that stakeholder engagement is an ongoing process that may involve, in varying degrees, the following elements: stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities.

Key requirements are set out in *IFC Performance Standard 1 : Assessment and Management of Environmental and Social Risks and Impacts*. Specific requirements of IFC PS1 includes:

- Stakeholder Analysis and Engagement Planning:
    - Identify affected stakeholders and other stakeholders that may be interested in the project and consider how external communications might facilitate a dialogue with all stakeholders; and
    - Development of a SEP, including measures to allow for the effective participation of stakeholders identified as disadvantaged or vulnerable;
- Disclosure of Information:
    - Provision of relevant project information on (i) the purpose, nature and scale of the Project; (ii) duration of the proposed activities; (iii) any risks to and potential impacts on such stakeholders and the relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism;
- Consultation:
    - Undertake a process of consultation that provides affected stakeholders with opportunities to express their views on project risks, impacts and mitigation measures;
    - Include a two-way process which (i) begins early in the process of identification of environmental and social impacts and continues on an on-going basis as impacts arise; (ii) is based on prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information that is in a culturally appropriate local language; (iii) focuses inclusive engagement on those directly affected as opposed to those not directly affected; (iv) is free of external manipulation, interference, coercion, or intimidation; (v) enables meaningful participation where applicable; and (vi) is documented; and
    - Tailor consultation to the language preferences of the affected communities, their decision-making process and the needs of disadvantaged or vulnerable groups;

- Informed Consultation and Participation:
    - Conduct an Informed Consultation and Participation (ICP) process that will result in affected stakeholders' informed participation;
    - Managed a consultation process that (i) captures both men's and women's views, if necessary, through separate forums or engagements, and (ii) reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate; and
    - Document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected communities, and will inform those affected about how their concerns have been considered;
- Free, Prior, and Informed Consent:
    - For projects with adverse impacts to Indigenous Peoples (IP), the Project is required to engage them in a process of ICP and in certain circumstances the Project is required to obtain the Free, Prior, and Informed Consent (FPIC) of IP (as defined in *IFC PS7: Indigenous Peoples*).
- External Communications:
    - Implementation of a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track and document responses; and (iv) adjust the environmental and social management program;
- Grievance Mechanism for Affected Stakeholders:
    - Establish a grievance mechanism to receive and facilitate resolution of affected stakeholders' concerns and grievances about the environmental and social performance; and
    - Inform the Affected Stakeholders about the mechanism in the course of the stakeholder engagement process;
- On-going Reporting to Affected Stakeholders:
    - Provision of a schedule for periodic reports to the affected stakeholders that describe the progress with implementation of the Project action plans on issues that involved ongoing impacts on affected stakeholders and on issues that the consultation process or grievance mechanism have identified as a concern to those communities; and
    - Provision of reports not less than annually (IFC, 2012).

3.3 Approach to Vulnerable and Marginalized Groups

The term "indigenous people" is not used by the Government of Kenya, in Kenyan law or the Constitution (2010). The Constitution uses the terms vulnerable and marginalised communities and groups and Article 260 defines "marginalised community" as meaning:

- (*a) a community that, because of its relatively small population or for any other reason, has been unable to fully participate in the integrated social and economic life of Kenya as a whole;*
- *(b) a traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social and economic life of Kenya as a whole;*
- *(c) an indigenous community that has retained and maintained a traditional lifestyle and livelihood based on a hunter or gatherer economy; or*

- *(d) pastoral persons and communities, whether they are: (i) nomadic; or (ii) a settled community that, because of its relative geographic isolation, has experienced only marginal participation in the integrated social and economic life of Kenya as a whole.*

The World Bank 2016 report[1] states that "*The 2010 Constitution of Kenya captures the disadvantaged position of vulnerable and marginalized groups in relation to other dominant communities in Kenya"* and includes constitutional pledges to protect their rights and cultural diversity, see Box 1.

Box 1: Constitution of Kenya 2010 – Articles protecting Vulnerable & Marginalised Groups

Article 10 (2)(b): The Constitution states that national values and principles of governance include "human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination and protection of the marginalised".

Article 21(3): The Constitution requires the state to "address the needs of vulnerable groups within society", including "minority or marginalised communities and members of particular ethnic, religious or cultural communities".

Article 56 requires the state to ensure that "minorities and marginalised groups…are provided special opportunities in educational and economic fields;...special opportunities for access to employment; develop their cultural values, languages and practices; and have reasonable access to water, health services and infrastructure".

It also provides for: affirmative action programs and policies for minorities and marginalized groups (Articles 27(6) and 56); rights of "cultural or linguistic" communities to maintain their culture and language (Articles 44(2) and 56); protection of community land, including "ancestral lands and lands traditionally occupied by hunter-gatherer communities" (Article 63); and an equalization fund to provide basic services to marginalized areas (Article 204).

Article 7(b) obligates the State "to promote the development and use of indigenous languages" and Article 11(2)(a) obliges it to promote all forms of cultural heritage.

The World Bank report examines the extent to which groups identified as "vulnerable and marginalized" by GoK are similar to groups described as Indigenous Peoples by the World Bank or IFC. It concludes that there is considerable overlap between groups identified by the Government of Kenya as vulnerable and marginalized and groups that have triggered WB OP4.10 and IFC PS7 requirements, and who are therefore recognised by the World Bank / IFC as "Indigenous Peoples".

General Principles & Approach Adopted by the Project

Based on the above, the Project has adopted the approach that all Affected Communities will be treated as vulnerable and marginalized. This means that:

- Consultation and engagement with stakeholders will be on the basis of Informed Consultation & Participation (ICP).
- Land acquisition is the responsibility of the Government of Kenya within the framework of the Land Act (2012). Although land acquisition is Government led, additional steps will be taken by the Project

[1] "Country Social Analysis of Vulnerable and Marginalized Groups in Kenya. *Guidance for applying the World Bank Operational Policy 4.10 on Indigenous Peoples"* (2016)

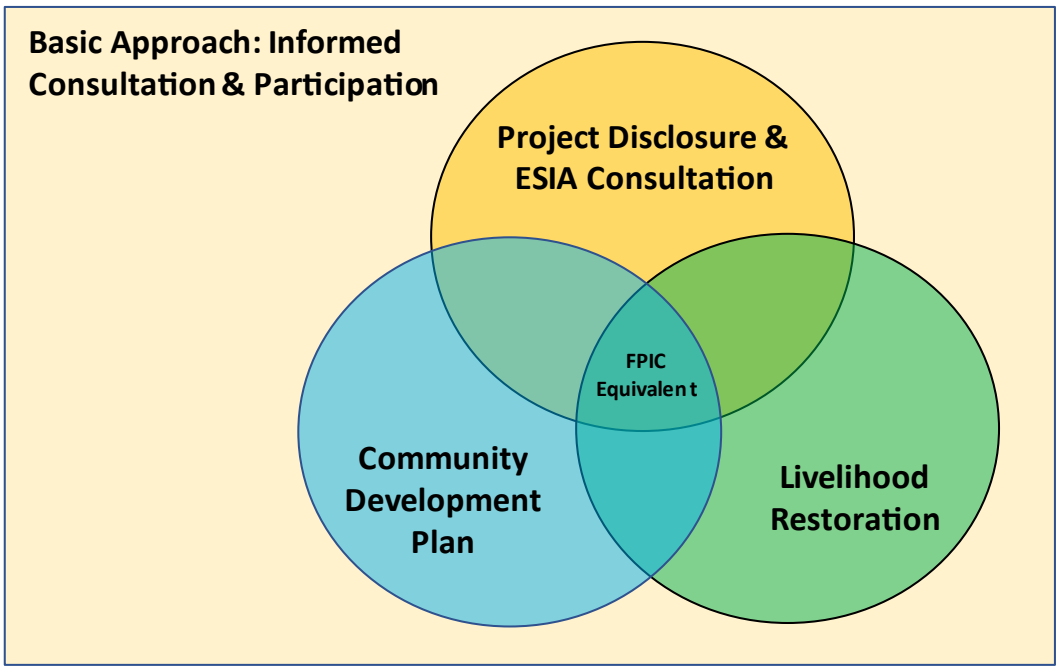
to meet the requirements of IFC PS5 and PS7[2]. These will be set out in a Supplemental Assessment which will document compliance with IFC Performance Standards.

- A broad-based approach to community engagement is viewed as the best way to maximise opportunities for stakeholder participation in the process. There is no single, legally recognised entity to negotiate on behalf of the South Lokichar community and hence three "strands" of overlapping engagement will be undertaken (National, County, Affected Community).

A Community Development Plan (CDP) will be developed which will provide a framework under which the project impacts and benefits will be addressed. The CDP process will also provide a vehicle for community consultation and involvement in the management of impacts and benefits.

Broadly-based community "consent" will be demonstrated by multiple and overlapping documented engagement processes with stakeholders.

Figure 2: Project Approach to Informed Consultation & Participation



The multi-stranded engagement approach, based on ICP, which when combined delivers an outcome that is consistent with the intent of IFC Performance Standards 1 and 7. This is driven by the constitutional and administrative dynamics in Kenya and within Turkana County where devolution has led to the development of responsive and representative democracy.

4 OVERVIEW OF PREVIOUS ENGAGEMENT

Project Oil Kenya has been active in Kenya since 2010. During the course of previous engagement and consultation activities, stakeholders have raised a range of different issues. Various engagement methods have been used with prioritisation to oral and visual engagement, given the prominence of such methods in Turkana's traditional society. Engagement methods included:

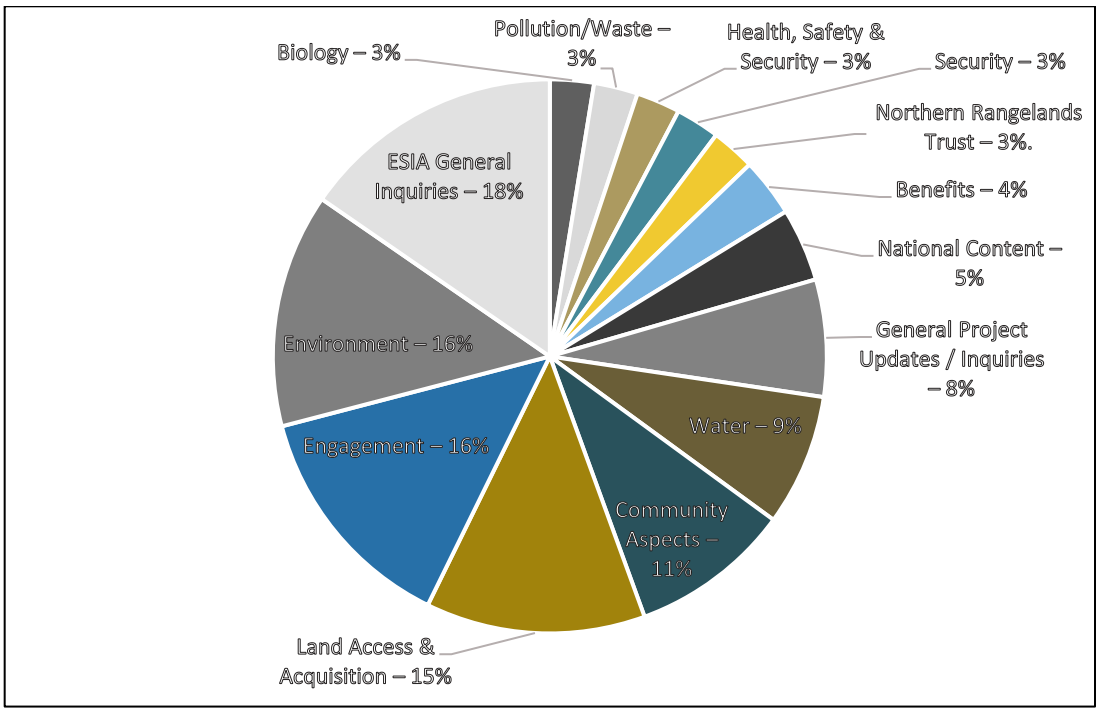
[2] As stated in IFC PS5 (para 30) "*where land acquisition and resettlement are the responsibility of the government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with this Performance Standard*".

- Engagement through the previous Community Resource Centres (Nakukulas, Lokichar, Lokori and Lodwar in Turkana County);
- Individual, focus group or baraza (traditional community meeting) community engagement;
- Information, education and communication material, including written materials and video;
- Preparation and distribution of a monthly community newsletter, Eana Atopupokin, Turkana for "Let's Talk and Agree";
- Participation in radio engagements;
- Use of theatre groups to explain specific topics such as the TKBV's Grievance Mechanism; and
- Targeted site visits for community representatives and leaders, in order, to explain ongoing TKBV activities.

4.1 Full Field Development Scoping Consultation

At the scoping stage, the Project was described as development of up to 5 fields. ESIA scoping consultations for the Project were initiated by a Golder and Project Oil Kenya team in November 2015 and included a series of meetings to disclose the Project concept, explain the ESIA process and collate issues and concerns. Consultations were held with government, international organisations, international, national and regional NGOs and regional media. During the meetings, a total of 188 issues, questions and concerns were documented.

Figure 3: Issues raised during FFD scoping consultation (2015)

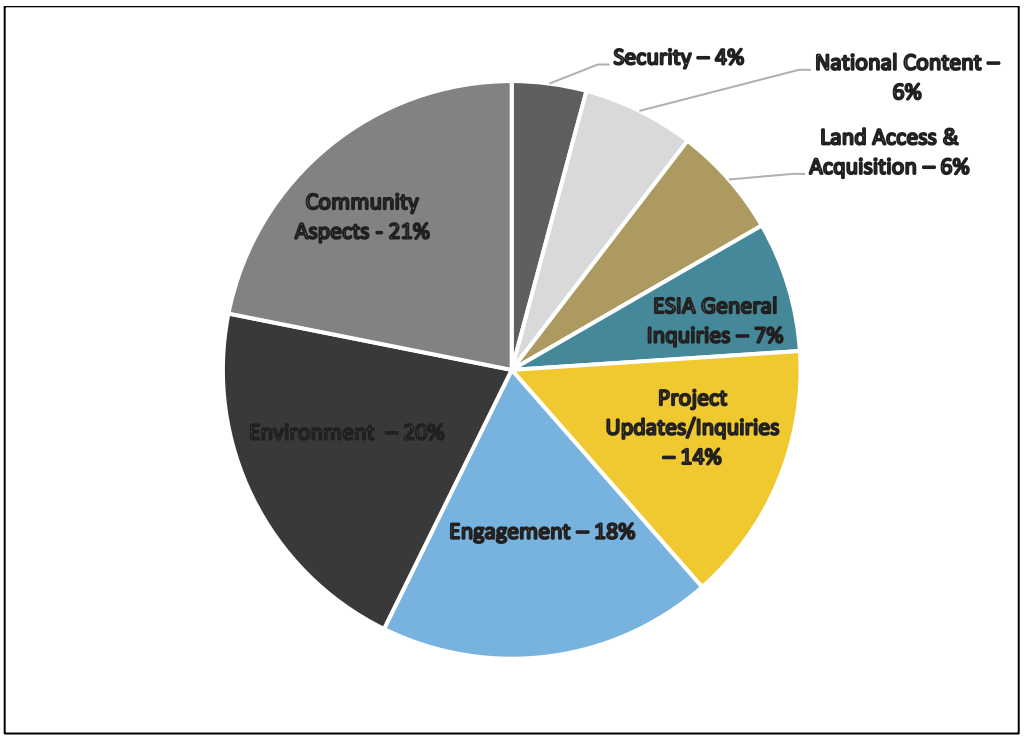


4.2 Early Oil Production Scheme

ESIA scoping consultations were held in May and June 2016. These meetings consisted of a series of sessions to disclose the Project concept and explain the ESIA process for the Early Oil Pilot Scheme (EOPS) Phase II ESIA. The EOPS Phase II ESIA consultations started in June 2018 with the majority of the meetings in late

September 2018 to further explain the ESIA process and collate issues and concerns relating to the EOPS Phase II ESIA. During the meetings, a total of 327 issues, questions and concerns were documented.

Figure 4: Issues raised during EOPS ESIA consultation (2018)



4.3 Full Field Development Project

The draft ESIA for the Foundation Stage Development (FSD), a predecessor to the current project design, was shared publicly. However. due to COVID-19 restrictions in 2020, it was not fully consulted upon. The Project design and the ESIA has been updated since that time. The ESIA for the current project design is subject to consultation during July – August 2021.

5 STAKEHOLDER IDENTIFICATION

The basic standard of consultation and engagement adopted by Project Oil Kenya is informed consultation and participation (ICP). This is particularly relevant to pastoralists who are recognised as potentially being vulnerable and marginalised, and will therefore be engaged in a culturally appropriate manner to ensure they have full opportunities to be involved in Project consultation and engagement activities, and also to have the opportunity to share in development opportunities provided by the Project.

5.1 Definition of Stakeholders

A Stakeholder is:

- Any person, group or organization directly or indirectly affected by Project Oil Kenya.
- Any person, group or organization who can affect the Project Oil Kenya.
- Anyone who has an interest in the Project Oil Kenya and who can affect it positively/negatively.

5.2 Identification of Stakeholders

Key stakeholders for Project Oil Kenya are set out below.

Table 1: Project Stakeholders

Category	Stakeholders
County Governments – Turkana & West Pokot	• The Executive • County Assemblies • Specific Ministries • Sub County Administrators and Ward Administrators
National Government – Turkana & West Pokot	• County Commissioners • County security and intelligence committee (CSIC) • Presidential Delivery Unit – PDU • LAPSSET • Deputy County Commissioners (DCCs) - Turkana East, Turkana South and Pokot central • National Police services • Chiefs and Assistant Chiefs • Specific Ministries at the county level
Political Leadership	• Senators • Members of Parliaments • Members of County Assemblies
Communities	• Area of influence villages, elders, pastoralist, women, youth and vulnerable groups • Council of elders • Traditional governance leaders
Civil society, faith-based organisations and other specialised groups	• Turkana and West Pokot chamber of commerce • Inter-religious councils in Turkana and West Pokot • Civil society and National and County Based NGOs
Water and Environmental Institutions	• NEMA • WRMA • KenGEN
Media Organisations	• Radio Stations: Sayare Radio, Akicha, Jambo, Maata

5.3 Traditional Governance and Vulnerable & Marginalised Communities

Project Oil Kenya seeks to achieve the principles of Informed Consultation and Participation (ICP) by developing robust, open and transparent channels of communication with all Project-affected communities. Achieving communication with Vulnerable & Marginalised communities requires developing direct lines of engagement with different categories of stakeholders that each represent different interests among that group of people.

These multiple lines of engagement must provide a reasonable and equal opportunity to participate, receive information in advance and to receive information in a culturally appropriate format that allows them to understand how the project and proposed mitigation and benefit enhancement will affect their lives. With this in mind, engagement must be freely open to multiple entities. These entities are divided into categories described in the table above. The priorities among these categories are those stakeholders that are from

regional administrative units affected by the Project or that represent the Project-affected people, with a priority to engage and pursue agreement from Traditional and pastoralist groups, but also considering:

1. County Government Elected and Appointed officials who represent traditional and pastoralist groups; and
2. National Government Elected and Appointed officials who represent traditional and pastoralist groups.

For these formal government structures, it has been relatively simple to identify specific stakeholders that represent Project-affected people, including vulnerable groups. However, additional work has been conducted to identify and prioritise traditional leadership. Specifically, this work has involved the identification of traditional pastoralist units (*Adakar*, *Arumrum*[3] *or Mongots*[4]) within a given administrative unit. While it is clear that County Government and National Government officials are key representatives of pastoralists, there are other traditional structures that exist and need to receive an opportunity to receive information and give feedback.

Experience has clearly shown that while County and National officials have direct lines of contact with traditional leaders, some traditional leaders may have felt excluded. This is partially linked to the mobile nature of the traditional groups and their challenges in convening in centrally located settlements.

5.4 Engagement with Traditional Leadership

The approach that POK will adopt for engagement of traditional leadership in Turkana will follow the approach adopted in Turkana by the Office of the County Commissioner (CC) National Government Administrative Officers and NEMA for previous public consultation on the LLCOP ESIA.

The approach to be used for ESIA consultation and Project disclosure will be as follows:

- Engagements are to be planned well in advance;
- Once dates and proposed locations are agreed, POK will discuss with respective DCCs and provide a list of the proposed groups to be engaged to be added to the DCCs knowledge of Traditional Leaders and convened at centralised locations;
- POK will request via the respective DCCs that traditional Leadership representatives from sub locations within the area of influence are offered the opportunity to participate in engagement meetings:
    - Representatives for the following sub locations will be invited to meetings in Lokichar:
        - Lokichar
        - Kapese
    - Representatives for the following sub locations will be invited to meetings in Lomokamar:
        - Lokichar (Kasuroi,Lomokamar and Nayana Ereng villages)
    - Representatives for the following sub locations will be invited to meetings in Karoge
        - Lochwaangamatak
        - Napusmoru
    - Representatives for the following sub locations will be invited to meetings in Nakukulas
        - Kochodin
        - Lopii
        - Lokwamosing

[3] These are terms for clusters of homesteads. Adakar are sometimes referred to as “cattle camps” even if the herd does not contain cattle. This term is used interchangeable with the term kraal, a term more commonly used in South Africa. Arumrum is a relatively new form of social organisation that started in the mid-1990s. It is a large encampment of multiple heard owners that seek to build barriers to fend off attacks from outsiders. Such clusters can be up to 100 households.

[4] This refers to a traditional pastoralist grouping of homesteads in West Pokot.

- Representatives for the following sub locations will be invited to meetings in Kalapata
  - Loperot
  - Nakalale
  - Kangakipur
- Representatives for the following sub locations will be invited to meetings in Lokori
  - Lokori
  - Kangitit
  - Lotubae
- Representatives for the following sub locations will be invited to meetings in Kaputir
  - Kalomwae
  - Nakwamoru
  - Lorogon
  - juluk

- Representatives for the following sub locations will be invited to meetings in Kalemngorok
  - Katilu
  - Lokapel
  - Kalemngorok
  - Kanaodon
- Representatives for the following sub locations will be invited to meetings in Turkwel:
  - Kositei (WP)

- Once the invitee list is agreed, DCCs and Chiefs will advise on those to be invited to represent different interest groups.
- DCC and Chiefs will be provided with materials via Whatsapp and other means, ahead of the meetings for them to share with stakeholders.

This process will ensure that the formal representative structures are respected, and the range of interest groups are invited to participate.

6 STAKEHOLDER ENGAGEMENT ACTION PLAN FOR PRE-FID PHASE

The Action Plan for this phase is divided into ongoing engagement and planned activities. Ongoing activities comprise day to activities that will be undertaken irrespective of other activities. Planned activites are the limited number of activities that will be undertaken during the current pre-FID phase.

6.1 Engagement to Support Ongoing Activities

The following core schedule will be used in the planning and implementation of stakeholder engagement to support ongoing activities:

- **Daily** - operations support where required, targeted outreaches and internal planning, through phone or meetings
- **Weekly/Regular** - walk in meetings with CC, DCC, Sub-County Administrators and Chiefs in Turkana East and South
- **Quarterly** - meetings with select communities in the Project Area and civil society, brief to county and national administration in West Pokot
- **Adhoc** – manage community work interruptions and grievances

The approach on how to deliver on the activities would be as per the table below.

Table 2: Engagement Schedule - Ongoing Activities

Approach	Deliverables	Key activities	Target stakeholders	Mode of engagement
Information sharing	- Informed stakeholders - Stronger stakeholder relations	- Messaging to key stakeholders - Management of expectations and addressing any community concerns - Giving feedback on the current changes and overview of the operations - Keeping the stakeholders informed and updated on the operation	Turkana South and East and West Pokot key stakeholders	- Weekly walk in meetings with CC, DCC, Sub-county admins and chiefs in Turkana East and South - Monthly brief to administration in West Pokot. - quarterly meetings with select communities and civil society
Operation support	- Uninterrupted activities	- Managing expectation on the specific activity - Secure the social license to operate - Ensure the project is interrupted by highlighting the social risks, gathering intelligence and defining how the risks can be mitigate - Create a conducive environment for the delivery of the project, includes managing issues before they escalate to grievances and community work interruption	Project impacted stakeholders	- Internal planning in liaison with operations - Early engagement before the project starts to allow time for messaging to impacted stakeholders and management of expectations - Daily support was required on need basis once the project starts
Outreach/ Relationships building	- Stronger stakeholder relations	- Maintaining robust stakeholder's relations - Keep the stakeholders informed - Continuous messaging and sharing of information	Stakeholders within the area of influence	- Monthly meetings with target groups - Walk in engagements and phone updates
Forced engagement/ community work interruption	- GoK administrators and CIPU to take lead in addressing community work interruption	- Establish and implement and grievance management approach that is reliant on GOK structures, based on the current situation - Establish stakeholder's confidence	Complainants and grievant	adhoc

Approach	Deliverables	Key activities	Target stakeholders	Mode of engagement
	- Register, analyse and Resolve grievances	- Manage and address grievances		
Grievance Management	- Register, analyse and Resolve grievances	- Receive and address any grievances raised by complainants - Review and align grievance mechanism with Turkana Grievance management committee - Integrate grievance mechanism within the team for everyone to take responsibility in receiving and management of grievances	Complainants and grievant	adhoc

6.2 Engagement to Support Planned Activities

Planned activities, for which stakeholder engagement support will be required, comprise:

- **Waste consolidation** - Consolidation of existing waste to the Twiga-1 waste storage facility;
- **Community water supply** - Development amd hand-over to Turkana County Government of a sustainable community water supply for in-field areas;
- **Social investment hand over** - Handover of existing social investment projects to Turkana County Government, including handover of Lokori OPD, Karoge Dispensary, Namaide Classroom and Lomokamar and Lotunguna classrooms are fulfilled;
- **Kapese base management** - Management of Kapese Integrated Operating base (IOB) on a care and maintenance basis;
- **Community Development Plan** - Development of a Community Development Plan for the Project, to be implemented following FID;
- **Land access** - Development of the Project's Resettlement and Livelihood Restoration Plan, following statutory land acquisition by the National Land Commission.

Table 3: Engagement Activities - Planned Activities

Area of focus	Deliverables	Key activities
Waste consolidation	- Consolidate the waste at Twiga 1 and retain Twiga 2 - Reduce on the site manning once the waste is consolidated	- Identify the impacted stakeholders, inform them of the activity and seek their consent - Ensure the requisite legal requirement and licensing is met - Disclose community benefits/local content associated with the project
Water – community and operation -	- Sustainable water solution - Handover community water deliveries to TCG	- Meeting with MoPM and TCG to align how sustainable water solution will be achieved - Handover of Kode Kode water reticulation - Cost effective running of the current community water trucking and boreholes prior to handover
Kapese IOB decommissioning	- Management on a care and maintenance basis	- Messaging to key stakeholders (Kapese community and Kapese Community Trust)
Community Development Plan (CDP)	- provide a framework under which all the project impacts and benefits can be addressed - a basis for POK and communities to define and deliver 'Shared Prosperity'	- Stakeholders identification and engagement
National Land Commission (NLC) land access	- Acquire land for upstream and midstream development ***Note**: This issue is outside the control of POK and POK involvement is only related to issues following the statutory acquisition of land*	- Stakeholders identification and engagement - Land acquisition and resettlement framework
ESIA Disclosure	- ESIA disclosed. Consultation completed	- Pre engagement / stakeholder mapping - Disclosure - ESIA consultation

7 POK-LED ENGAGEMENT AND COORDINATION WITH THE PROJECT ESIA

7.1 Integration with ESIA

The results of stakeholder engagement will be integrated into the impact analysis in the ESIA. Stakeholder issues must be considered in the ESIA and in the project planning and design.

Stakeholder engagement during the Project Oil Kenya (Upstream) ESIA includes the following phases:

- Phase 1: Scoping consultation (2015)
- Phase 2: Disclosure of the Project Oil Kenya planned development (2021); and

- Phase 3: Consultation on ESIA impacts and mitigations (2021).

7.2 Proposed Engagements Methods Prior to ESIA Consultation

Engagement with key stakeholders (Table 1) prior to ESIA consultation to provide project updates, project disclosure and collate concerns and issues relating to Project Oil Kenya will be led by Project Oil Kenya via the following mechanisms:

- National Government, and relevant NGOs will be engaged through National Coordination Forums;
- County Government and Executives, Business communities and Water institutions, local NGOs and Media organisations will be engaged through Technical Coordination Forums on at least a quarterly basis in Turkana. West Pokot stakeholders will be identified and engaged as appropriate;
- Traditional leadership and community stakeholders will be engaged through existing governmental structures (Chiefs and County Commissioner's Office) supported by Project Oil Kenya and MoPM on an ongoing basis in both Turkana (and West Pokot as appropriate). Project Oil Kenya will establish representation with communities and traditional leadership by building on stakeholder mapping completed to date and updated grievance management procedures. As appropriate, information will also be disseminated via local media and radio; and
- Project Oil Kenya Grievance Mechanism, which will allow stakeholders within the project affected area to raise concerns, complaints or grievances (Section 12).

The methods of engagement adopted during the full field development Project ESIA consultation will seek to provide consistent messages about Project Oil Kenya, the potential for impacts and the proposed mitigation and management methods to address any impacts, through the presentation or distribution of presentations, maps and documents. These methods will include, but will not be limited to:

Key informant interviews and Focus Group Discussions: Stakeholder engagement is closely linked with environmental and social baseline studies. As specialists conduct primary data and information collection, they will also make sure key informants, Project-Affected People (PAP) and other interested groups receive standardised project information and have the chance to raise issues, concerns and questions;

Workshops/Seminars – Workshops and seminars will be convened for stakeholders in various stakeholder groups. Such grouping will seek to provide sufficient time for people to raise issues and may be organised around specific themes;

Posters – Information shall be presented via posters in select public places and communal areas. Pictorial content shall be used to facilitate communication to all interested parties. Such posters must present the project and related information visually;

Settlement Meetings – These meetings will be considered for ESIA disclosure to share information and receive comments or issues on the project-aspects discussed. These meetings may occur when and if necessary, to gain public opinion and maintain open avenues of communication; and

Media advertisements – Media advertisement will be considered to involve local stakeholders and raise awareness about various engagement events.

7.3 Materials to Support ESIA Disclosure & Consultation

Project Oil Kenya and the ESIA consultant will use the most appropriate material for ESIA consultation meetings considering all needs from stakeholders (e.g. using visual illustrations and verbal explanations for illiterate stakeholders). These materials will be in Swahili, ki-Turkana, English and other local language as appropiate to maximise communication and understanding of the project-engagement.

The following consultation materials will be available during the engagement process at local, county and national level:

- A Background Information Document (BID): This document gives and overview of project features, scope of work and project area, and will provide contact information to continue capturing issues and responses from stakeholders;
- A Non-Technical Summary (NTS) in English and Swahili;
- Summary of key commitments relating to the ESIA in English and Swahili as a minimum;
- Posters: A group of posters shall be produced and be available during engagements to provide a visual aid to some of the key messages in ESIA documents;
- Registration and comment sheets: this element should be available at all times for stakeholders to raise and send comments/issues to project proponent. Issues and responses are captured in a database and will be summarised within the draft ESIA;
- Power point presentations: Various visual presentations will be produced and will varying depending on the stakeholder group; and
- Project Oil Kenya Kenya webpage (hosted on the MoPM website) – a dedicated webpage designed to provide up-to-date information and contact details.

7.4 Process Record-Keeping

Project Oil Kenya will ensure that stakeholder-facing staff and representatives have appropriate training to ensure that they can maintain appropriate records of stakeholder engagement activities, comments received and responses throughout the period prior to ESIA consultation.

During ESIA consultation and project disclosure meetings the following aspects shall be considered as part of the record-*keeping* process during consultation:

- All stakeholder interactions will be recorded. Contact details of individuals and instutions engaged shall be recorded and included into the Project stakeholder database;
- Minutes-of-meetings will be prepared as part of the records;
- An Issues and Response database will be maintained to capture of issues raised at meetings. This report shall be available to attendees for verification;
- Digital photographs and video recordings on approval to participants attending engagements meetings; and
- Recording the times and content of media advertisements, radio broadcasts and interactive talk shows, and the issues raised during these consultation processes.

7.5 COVID-19 restrictions

POK will ensure that COVID restrictions will be complied with at all times.

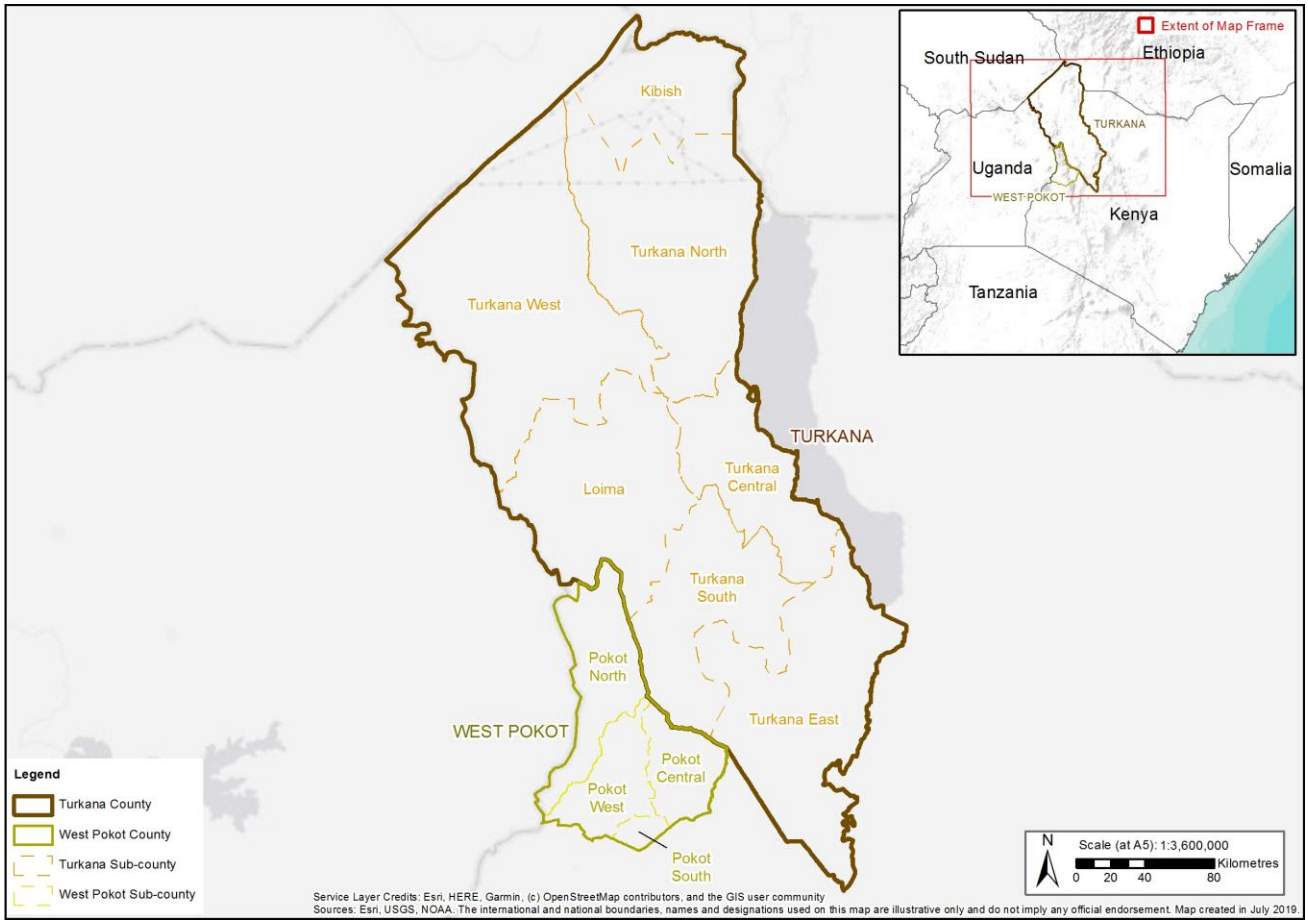
8 SCHEDULE

8.1 Project Disclosure – June-July 2021

From early 2021, Project Oil Kenya will continue the ongoing process to identify traditional leadership within Government and County administrative units in relevant sub-counties of Turkana South, Turkana East and Pokot West Sub-counties.

During project disclosure efforts will be made to give leadership and community representatives in Turkana and West Pokot an opportunity to receive information. This will be more concentrated work in those Sub-counties that are closer to the Project (i.e. where the Project anticipates any infrastructure to be developed, which potentially could affect traditional livelihoods) and where identified Project-affected communities are located. A map of Sub-county administrative units is shown in Figure 5. Leadership from all relevant administrative units will be provided with an opportunity to attend engagement meetings. This is particularly important given the migratory practices of pastoralists who can travel great distances in their use of pastureland and water. However, it is not practical to hold local meetings in all local administrative units.

Figure 5: Turkana and West Pokot County and Sub-county administrative units.



The timeframe for engagement activities cover the following aspects:

- Update engagement tools: Project Oil Kenya stakeholder register and issues and concerns matrix.
- Project Oil Kenya to complete courtesy visits/calls and face-to-face meetings with National and County representatives to provide an update on planned engagement activities.
- Project Oil Kenya to continue to update stakeholder register and issues and concerns matrix.
- Once the project description is established, Project Oil Kenya will complete a full project disclosure exercise with relevant stakeholders.

8.2 ESIA Consultation – July-August 2021

With the completion of the ESIA, including impact analysis and proposed mitigation commitments, the ESIA engagement programme is planned to enter the final phase in Q3 2020. Consultations will provide outputs and commitments from the ESIA to all stakeholders from the following levels:

Nairobi:

National government officials and agencies; and

National NGOs, multi-national organisations.

Lodwar / Kapenguria:

National government officials;

County government officials (Governor, County Executive Committee, Members of the County Assembly) County Ministries and technical specialists;

Council of Elders (Turkana only); and

Regional NGOs, multi-national organisations.

Turkana South & East Sub-counties / Pokot West Sub-county:

National government officials;

County government officials;

Council of Elders (Turkana only);

Sub-County Administrators;

Ward Administrators;

Village Administrators (positions being filled as part of devolution process under the new Constitution);

Traditional leadership (Seers and Elders) in Locations, Sub-Locations, and Wards where infrastructure will be located;

Local/International NGO/CSOs; and

Community meetings.

- Engagement events during this phase are based on the draft ESIA report, which includes baseline studies, impact analysis, mitigation or management strategies. Results of this consultation phase will be compiled, summarised and presented as part of the revised ESIA document.
- All stakeholders will be provided with an opportunity to review and comment on the findings of the ESIA, including the associated mitigation commitments that aim to reduce all negative impacts and enhance benefits to the extent possible.

The detailed schedule (provisional and subject to change) is set out below.

Table 4: Provisional Project Disclosure & ESIA Consultation Engagement Schedule

Day	Activity	Location
Mon 28 June	Disclosure – Parliamentarians	Nairobi
Tues 29 June	Travel to Lodwar, planning	Lodwar
Weds 30 June	Disclosure– Turkana County Government	Lodwar
Thurs 1 July	Disclosure – Turkana County Civil Society Travel to Lokichar	Lodwar
Fri 2 July	Disclosure – Lokichar (Administrative units)	Lokichar

Day	Activity	Location
Sat 3 July	Disclosure – Lokichar (Community & Civil society)	Lokichar
Sun 4 July	Rest	
Mon 5 July	Disclosure – Lomokamar Community Meeting	Turkana
Tues 6 July	Disclosure – Karoge Community Meeting	Turkana
Weds 7 July	Disclosure – Nakukulas Community Meeting	Turkana
Thur 8 July	Disclosure – Kalapata	Turkana
Fri 9 July	Disclosure – Lokori	Turkana
Sat 10 July	Disclosure – Lokori Community Meeting Travel Back to Nairobi	Nairobi
Sun 11 July	Rest	
Mon 12 July	Travel to West Pokot	Kapenguria
Tues 13 July	Disclosure – Kapenguria County Meeting	West Pokot
Weds 14 July	Disclosure – Turkwel Community Meeting	West Pokot
Thurs 15 July	Disclosure – Kaputir Community Meeting	Turkana
Fri 16 July	Disclosure – Kalemngorok Community Meeting	Turkana
Sat 17 July	Travel Back	Nairobi
Sun 18 July	Rest	
Mon 19 July	Disclosure - National Government Institutions and Civil Society	Nairobi
Tues 20 July	Break	
Weds 21 July	Break	
Thurs 22 Jul	Preparations for ESIA Stakeholder Consultations	
Fri 23 Jul	Preparations for ESIA Stakeholder Consultations	
Sat 24 Jul	Preparations for ESIA Stakeholder Consultations	
Sun 25 Jul	Rest	
Mon 26 Jul	Disclosure - National Government Institutions and Civil Society	Nairobi
Tues 27 Jul	Travel to Lodwar, planning	Lodwar
Wed 28 Jul	Consultation– Turkana County Government & Civil Society	Lodwar
Thurs 29 Jul	Consultation – Lokichar Administration, CSO & community	Lokichar
Fri 30 Jul	Consultation – Lomokamar Community Meeting	Turkana
Sat 31 Jul	Consultation – Karoge Community Meeting	Turkana
Sun 1 Aug	Rest	
Mon 2 Aug	Consultation – Nakukulas Community Meeting	Turkana
Tues 3 Aug	Consultation – Kalapata community meeting	Turkana
Weds 4 Aug	Consultation – Lokori community meeting	Turkana
Thurs 5 Aug	Consultation – Kaputir Community Meeting	Turkana
Fri 6 Aug	Consultation – Kalemngorok Community Meeting	Turkana
Sat 7 Aug	Travel Back to Nairobi	Nairobi
Sun 8 Aug	Rest	
Mon 9 Aug	Travel to Lokichar	Lokichar
Tues 10 Aug	Consultation – Turkwel Community Meeting	West Pokot
Weds 11 Aug	Consultation – Riting Community Meeting	West Pokot
Thurs 12 Aug	Consultation – Lorogon Community Meeting	Turkana
Friday 13 Aug	Kapenguria – County Meeting	Kapenguria
Sat 14 Aug	Travel to Nairobi	Nairobi
Sun 15 Aug		
Mon 16 Aug	Consultation - National Government Institutions and Civil Society	Nairobi
TBC	Members of Parliament & Senate	

8.3 Outputs of Engagement Process

All environmental and social management actions, including those influenced by stakeholder concerns gathered during consultation, will be disclosed in the ESIA. The output of communication with all stakeholders including vulnerable and marginalised groups will also be recorded in the ESIA.

Revised ESIA documents will highlight where the engagement process causes substantial changes as a result of feedback and negotiation on the mitigation strategies. Benefit enhancement initiatives will be set out within the Community Development Plan (CDP) to be develooed following completion of the Project ESIA.

8.4 Monitoring, Evaluation and Reporting

Recording, monitoring, evaluating, and reporting upon Project Oil Kenya's Stakeholder Engagement program is critical for ensuring that stakeholder engagement activities do not simply occur in isolation, but that they support business objectives and occur in an on-going coordinated manner.

The objectives of Project Oil Kenya's recording, monitoring, evaluation and reporting efforts are to:

- Record stakeholder engagement efforts and identify potential impacts and risks;
- Assess risks and impacts and their consequences on project-affected peoples;
- Consult on new impacts and risks that are identified during the planning and assessment process;
- Provide input into proposed mitigation measures, as well as the opportunities for sharing of community benefits;
- Ensure compliance with Project commitments that have been made;
- Verify the effectiveness of the resolution of community grievances; and
- Manage and track the degree to which Project Oil Kenya has been able to build broad community support.

A summary of all stakeholder issues will be included in the final ESIA report. This final report will highlight any critical questions or areas of disagreement identified during the disclosure and discussions around impact analysis and mitigation.

9 MANAGEMENT OF COMPLAINTS AND GRIEVANCES

9.1 Purpose

The Project recognizes concerns will arise as the Project advances planning, land access, clearance, construction and moves into operations.

The grievance resolution process applies to all complaints related to Project Oil Kenya. However, because land acquisition for the Project is being undertaken by GoK as part of the statutory land acquisition process, any grievances relating to statutory land acquisition and compensation will be the responsibility of GoK in line with mechanisms and rights to appeal set out in Kenyan law.

The Project's grievance resolution process has been developed to meet Kenyan legal requirements relating to grievance resolution and international requirements for grievance management and is in line with IFC's Environmental and Social Performance Standards.

The detailed procedure is held by POK and this section provides a summary of that procedure.

9.2 Process

The grievance resolution process is owned and adjudicated by Project Oil Kenya, but certain elements will be administered by MoPM and County Administration. All outcomes will be reviewed by the Project, but mitigation responsibility may reside with other parties such as MoPM, County Government or Administration and GOK.

In considering mitigations to address a grievance existing processes or structures will be leveraged to resolve concerns where possible.

9.2.1 Registering a Complaint

Stakeholders can register complaints by a number of routes:

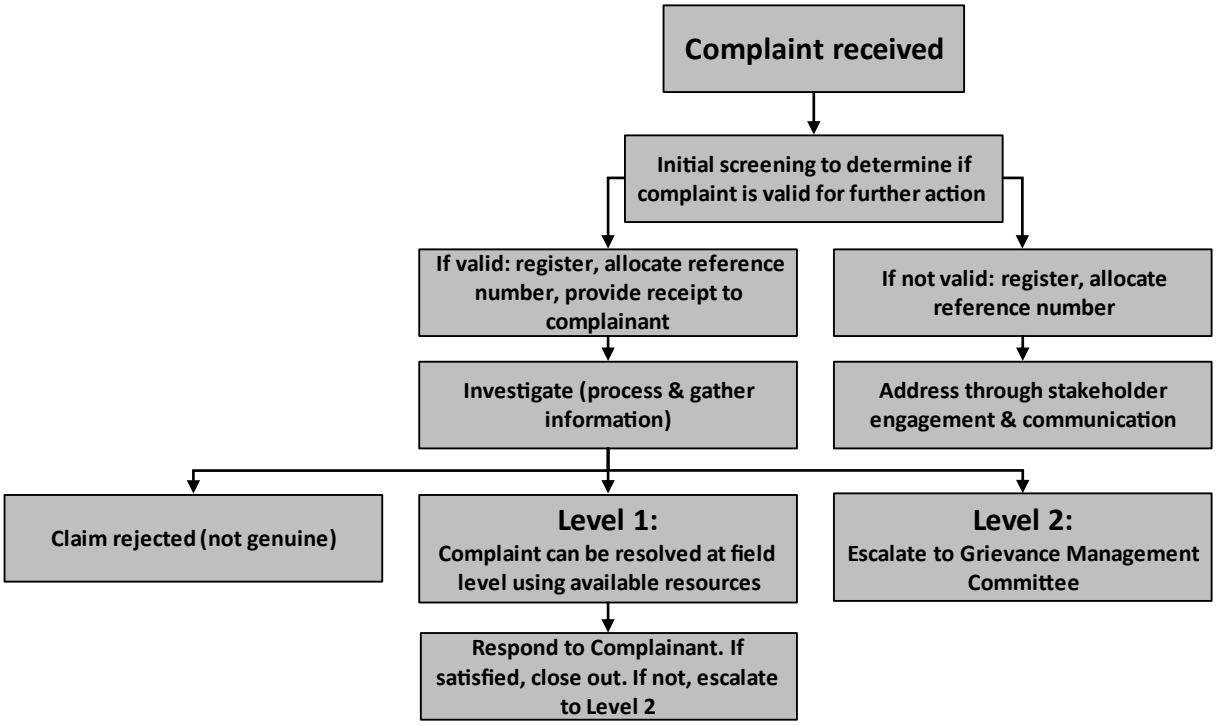
- **Via telephone, SMS, WhatsApp and email** – contact details will be disseminated amongst community members, local Chiefs and will be posted on community notice boards.
- **Directly with POK community relations staff** – POK workers will be instructed to inform the POK community relations staff if a stakeholder wishes to register a complaint. The POK community relations staff member will meet the stakeholder and record the relevant information. The staff member is responsible for documenting and recording the grievance.
- **With Chiefs** – Local Chiefs will be instructed to accept complaints made, and forward information to the office of the Deputy County Commissioner where details will be registered in a log book held at the office of the deputy County Commissioner.
- **With the Deputy County Commissioner** – A log book will be maintained at the office of the Deputy County Commissioner where complaints can be registered. POK community relations staff will inspect log books on a regular basis and collect any complaints made for action in accordance with the Grievance Procedure.

All complaints will be accepted by POK for consideration. For POK to respond to the Complainant, contact details must be provided (Name, location, ID number, phone number).

9.2.2 Level 1 Grievances: Resolved at Field Level

These grievances deal with issues and complaints that can generally be resolved at field level. Internally, these grievances should be resolved within 14 days however until the Procedure is rolled out successfully, the notification for the claimant will be 30 days. Resolution of these grievances may require engagement with other stakeholders in the field, provision of information, compensation agreed upon with the aggrieved, an apology or any other resolution option within the limits and capacity of the field staff and their local networks.

Figure 6: Level 1 Grievance Process



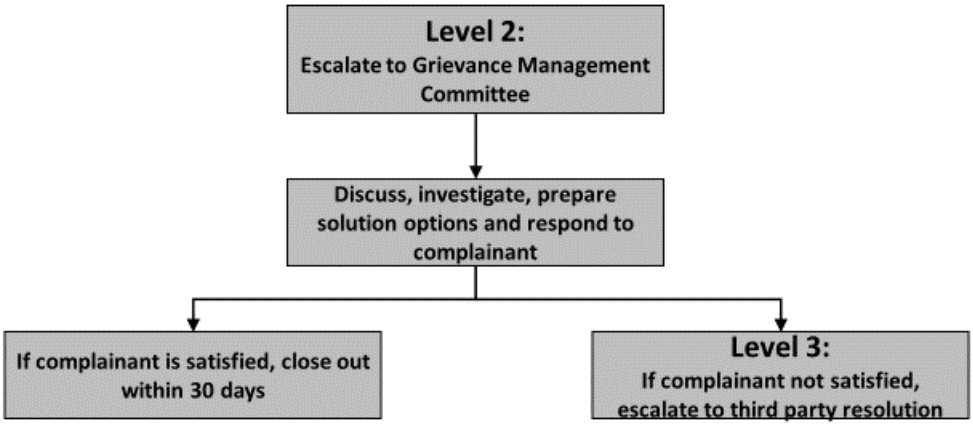
Escalate to Level 2

If all resources and options have been totally exhausted at field level and the claimant still appeals the resolutions proposed by Project Oil Kenya, the case needs to be escalated to level 2.

9.2.3 Level 2 Grievances: Resolved through a Grievance Management Committee

These are complex claims usually related to project aspects that could have adverse impacts on the claimant's livelihood, health and safety and cultural norms and traditions.

Figure 7: Level 2 Grievance Process



The Grievance Management Committee will be constituted on an as-needed basis and will comprise:

- MoPM Representative (Chair)
- POK Project Director
- POK Security & Logistics Manager
- POK Community Relations Manager
- County-level representatives (on a case by case basis as deemed necessary)

9.2.4 Escalate to Level 3

Should the complainant or group of complainants still feel aggrieved after this process, he/she/they will have the right of appeal to any recognised institution open to any resident and citizen as stipulated by Kenyan legislation. Every effort should be exercised within POK to avoid escalating grievances to that level, as they will consume time, effort, cost and reputation.

9.2.5 Level 3 Grievances: Referred to Third Party

A grievance that remains unresolved despite following all available avenues to resolve it through first and second levels grievance resolution will become a Level 3 Grievance. In those situations, the aggrieved person/group or POK have the right to refer such issues to the courts. Turkana residents would normally refer their appeals to the County Courts. Under Kenyan constitution, all citizens have the right to legal counsel even if they are unable to pay for it.

Correspondence pertaining to such cases will be referred to the POK Project Director, and copied to the Community Relations Manager. Upon request of the POK Legal Advisor, the Social Performance Manager and / or General Manager will attend court proceedings whenever a legal issue is to be heard at the court.

Project Oil Kenya also has the right to appeal to any recognised institution if not satisfied with a ruling given in any case. In the event that an investigation confirms the grievance is legitimate, the Community Relations Manager will immediately initiate the administrative procedure to redress the grievance. This will be a legal determination that requires authorisation by POK legal advisors.

Project Oil Kenya will comply with all legal requirements and will follow up regularly to assess the status of all such outstanding cases.

9.2.6 Close Out and Lessons Learnt

When a complaint has been closed out (at whatever level of resolution), the POK community relations manager will undertake a lessons learnt process and communicate findings as necessary. Grievance records will also be updated and necessary documentation retained.

9.2.7 Timescale

For each grievance registered:

- A written receipt will be provided within seven (7) calendar days
- A proposal for resolution will be made within a maximum of thirty (30) calendar days thereafter
- Subject to the claimant's acceptance of the proposed resolution, referral to County Government or Administration may be required if it remains unresolved following two attempts at resolution by The Project

In a situation where urgent resolution is required, for example, if imminent, unplanned, damage to property might occur and a solution is required as soon as possible. In these cases, the POK Grievance Coordinator will treat the case as urgent and specific timeline commitments decided on a case by case basis.

9.3 Roles and Responsibilities

The following table outlines key responsibilities in management of the grievance resolution process.

Table 5: Roles & Responsibilities in Managing the Grievance Resolution Process

Role	Responsibilities
Project Community Relations Manager	• Receive and record grievances • Log grievance into The Project database for allocation to action party • Allocate agreed grievances to county level process for resolution and keep The Project central team informed • Follow up with The Project Grievance Coordinator to maintain timelines • Feedback proposed resolution of grievances to complainants
Project Oil Kenya Grievance Coordinator	• Review received grievances for completeness of information • Refer grievance to appropriate party for resolution • Follow up as required to ensure grievance timelines are maintained • Feedback resolutions to POK management

9.4 Reporting

A monthly complaints and grievances report will be prepared for POK management. Performance and findings will be shared externally as necessary.

10 RESOURCES

Implementation of the Stakeholder Engagement Plan will be managed by the Community Relations Manager, supported by other members of the Project Oil Kenya team.
Ongoing engagement will be undertaken by the Community Relations Manager, supported by other members of the field team. Engagement related to planned activities will also be coordinated by the Community Relations Manager, supported by other members of the Project Oil Kenya team.

ESIA-related engagement will be managed and undertaken as follows:

- ESIA disclosure will be undertaken by the Project Oil Kenya team;
- Presentation of ESIA impacts and mitigations will be completed by the ESIA consultant, supporting the Project Oil Kenya team lead ESIA consultation.

11 CONTACT DETAILS

Issues, questions and concerns relating to this SEP and the Stakeholder Engagement Process can be provided to POK, at the following:

- Tel: +254 702 956331
- Email: POK@africaoilkenya.com

12 MONITORING AND REPORTING

All engagement meetings will be documented and a summary saved in the Project data system.

A monthly Engagement Summary will be prepared. This will be a one-page diary setting out in tabular format:

- Meeting topic;
- Location;
- Stakeholders Engaged;
- Topics discussed;
- Outcomes/Actions.

The monthly Engagement Summary will be submitted to the Project Oil Kenya management team once completed at the end of each month.

The Stakeholder Engagement Manager will be responsible for ensuring that the recording, reporting and monitoring of stakeholder engagement activities.

ANNEX II

B

Stakeholder Engagement Consultation Report

1 Consultation Report

REPORT

Project Oil Kenya - Upstream

Project Disclosure and ESIA Consultation Report

Submitted to:

Tullow Kenya BV

Submitted by:

Golder Associates (UK**) Ltd**

Cavendish House, Bourne End Business Park, Cores End Road,
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September 2021

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APPENDICES

1.0 INTRODUCTION

This report describes the process and results of stakeholder engagement activities carried out in July and August 2021 for the Project Oil Kenya – Upstream development ("the Project") in South Lokichar, Turkana County in Kenya.

Three companies, Africa Oil Corporation (AOC), TotalEnergies and Tullow Kenya BV (TKBV), form the Kenyan Joint Venture (KJV) partners that will execute the Project.

Project Oil Kenya is the term used to describe the Government of Kenya (GoK) led program to deliver Kenyan oil production, of which the Upstream development is an integral component. The KJV partners are represented by TKBV as the Operator.

Stakeholder engagement forms an integral part of the environmental and social impact assessment (ESIA) process as it provides stakeholders with Project information and an opportunity to comment and/or ask questions that will be addressed in the ESIA and management plans. Early and ongoing stakeholder engagement throughout the ESIA process is consistent with international good practice (i.e., World Bank and International Finance Corporation) and a requirement in Kenya under the Environmental Management and Coordination Act of 1999 (as amended in 2015), and various Articles of the Constitution of Kenya (2010).

Stakeholder engagement activities have been carried out throughout the course of the Project ESIA, from early days of project planning beginning in 2010, with public and face to face meetings supported by ongoing communications and information distribution. All stakeholder engagement materials are written in Swahili or presented in spoken Turkana at barazas (public meetings).

The purpose of the meetings held between July and August 2021 was to provide an update on the Project, conveying the results of the ESIA, and presenting the proposed mitigation measures. These stakeholder engagement "rounds" formed the final programme of stakeholder engagement during which the Project proponents sought to ensure that stakeholders were confident that their questions and issues raised during previous rounds had been addressed in the ESIA. As the project planning proceeds, consultation will be ongoing, throughout the life of the project.

In this document, the term 'Project' refers to all proposed oil facilities and associated infrastructure (e.g., access roads, worker camps, buried and water flowlines, central processing facility) and the activities associated with the construction, operation and closure of the facilities and associated infrastructure. A separate ESIA is to be carried out on the water pipeline and results are not yet available. Questions and issues about the water pipeline that were brought forward in the meetings, however, were recorded.

1.1 Stakeholder Engagement: Approach to Project Disclosure and ESIA Consultation Meetings

The 2021 Project Disclosure and ESIA Results Consultations build on the historical engagement that was led by the Operator and supported by Golder Associates, the international ESIA consultant and their local partners Ecoscience and Engineering Ltd, beginning in 2015 as summarized below:

- In November of 2015 ESIA scoping consultation were held on "full field development" which was described as development of up to 5 fields. These consultations consisted of a series of meetings to disclose the Project concept, explain the ESIA process and collate issues and concerns.
- In May and June of 2016, scoping consultations were held to present the Early Oil Production Scheme (EOPS) and then again in 2018 to conduct ESIA consultations on EOPS.
- A draft ESIA for the Foundation Stage Development (FSD), a predecessor to the current project design was shared publicly, however it was not fully consulted upon due to COVID-19 restrictions in 2020.

- Since the time of the FSD disclosure, the project has changed and includes development of 6 fields. The current project design was subject to consultation in July and August 2021, as described in this report.

It is recognised that effective stakeholder engagement is critical to securing and maintaining the Project's social privilege to operate. In that process, the Government of Kenya (GoK) is a central stakeholder as the Operator is a contractor to GOK, with the Ministry of Petroleum and Mining (MoPM) being the "host" ministry for the Project.

In close coordination with MoPM, the KJV work with National Government and County Administrations to plan and implement stakeholder engagement activities, such as the project disclosure and ESIA findings meetings. This approach has enabled the Project to engage with and work through existing administrative structures, particularly the office of County Commission and County administrative officers, to identify and communicate with stakeholders, manage community questions, complaints and grievances, and to work with local communities in a collaborative and transparent manner to develop mutually beneficial relationships. Various techniques and tools have been used for ongoing engagement and information sharing, in addition to planning formal project disclosure and ESIA consultation sessions. The approach to engagement throughout various project planning phases has included:

- Staffing Community Resource Centres (Nakukulas, Lokichar, Lokori and Lodwar in Turkana County);
- Regular information sharing through phone or in-person meetings on a frequent basis;
- Weekly walk-in meetings with County Commissioner (CC), District CC, Sub-County Administrators and Chiefs in Turkana East and South;
- Individual, focus group or baraza (traditional community meeting) community engagement meetings;
- Information, education and communication material, including written materials and video;
- Preparation and distribution of a monthly community newsletter, Eana Atopupokin, (Turkana for "Let's Talk and Agree"); and
- *Ad hoc* participation in radio engagements.

Many categories of stakeholders[1] (communities, CSOs, NGOs, political leaders, etc.) were identified and invited or made aware of the 2021 consultation meetings. In addition to inviting and working with National and County Government Elected and Appointed officials who represent traditional and pastoral groups, additional work was undertaken to prioritize engagement with traditional leadership and ensure their participation (Section 1.2).

The fundamental principle of stakeholder engagement is for stakeholders to have meaningful input throughout the ESIA process. The program for disclosure and ESIA consultation meetings was designed to address the following three goals:

1) Disseminate information to stakeholders and concerned members of the community, including, but not limited to, the current and final Project description, potential environmental and social impacts, planned mitigation measures and monitoring throughout the various phases of the Project;

2) Actively seek comments from stakeholders regarding potential environmental and/or social impacts of the Project and possible mitigation measures that could be incorporated to resolve those issues; and

3) Document and respond to all issues raised in a timely manner.

[1] For a description of stakeholder groupings and additional information on the approach to engagement, see the Operator Stakeholder Engagement Plan, June 2021.

1.2 Process and Stakeholder Engagement Materials

In consideration of the unique situation of pastoral and traditional leaders, the approach used for Project disclosure and ESIA consultations was as follows:

- Engagements were planned well in advance;
- Once dates and proposed locations were agreed, discussions were held with respective District CCs to provide a list of the proposed groups to be engaged and convened at centralised locations, which were to be added to the DCC's knowledge of Traditional Leaders;
- If practical, Traditional Leadership was offered the opportunity to convene at a Sub-location for engagement meetings;
- Once the invitee list was agreed, DCC and Chiefs advised on those to be invited to represent different interest groups; and
- DCC and Chiefs were provided with materials ahead of the meetings via WhatsApp and other means for them to share with stakeholders

Materials were prepared for the project disclosure and ESIA results meetings (Appendix A). A Background Information Document (BID) with key project information was produced in English and Swahili. Key information included Project features, location, schedule and profile of the development team, as well as how people could get involved in consultations or receive more information about the Project. A Non-Technical Summary, also produced in Swahili and English, was presented using a "frequently asked questions" approach and provided visuals of oil production and photos of drill rigs, in addition to helpful information on the ESIA. Power point presentations were prepared to cover the history of the project and included tables of results of discipline specific impact assessments, such as those for water resources, air quality, noise, visual impact, biodiversity, cultural resources and social impacts. A series of images were used to illustrate posters that were presented to explain the Project. Materials were used as 'leave behind' documents or made available at county official offices.

2.0 PROJECT DISCLOSURE

Project disclosure meetings were held in July 2021. The objectives of the Project Disclosure Consultations were to:

- Present the Project description, introduce the ESIA team and briefly describe the approach to the ESIA;
- Allow key stakeholders to raise issues of concern and suggestions for enhanced benefits; and
- To contribute relevant local information and knowledge to the ESIA.

2.1 Project Disclosure Schedule of Meetings

The following meetings to present the Project were held as follows:

Table 1: Project Disclosure Meetings

Date	Meeting location	Participants	Number of Attendees
June 30, 2021	Lodwar	Turkana County Government and National Government Representatives at County Level	39
July 01, 2021	Lodwar	Civil Society Organizations	26
July 02, 2021	Lokichar (Black Gold Hotel)	National and County Government Administrators	52
July 03, 2021	Lokichar (Baraza Park)	Lokichar community	245
July 05, 2021	Lomokamar village	Lomokamar community	160
July 06, 2021	Kaaroge village	Kaaroge community	110
July 07, 2021	Nakukulas village	Nakukulas	159
July 08, 2021	Loperot village	Kalapata community	103
July 09, 2021	Lokori	Lokori community	69
July 13, 2021	West Pokot	West Pokot County and National Government Officials	54
July 14, 2021	Lorogon	Lorogon community	100
July 14, 2021	Turkwel (Primary school)	Turkwel community	168
July 15, 2021	Kaputir village	Kaputir community	265
July 16, 2021	Kalemnng'orok	Kamemng'orok community	185

2.2 Summary of Results

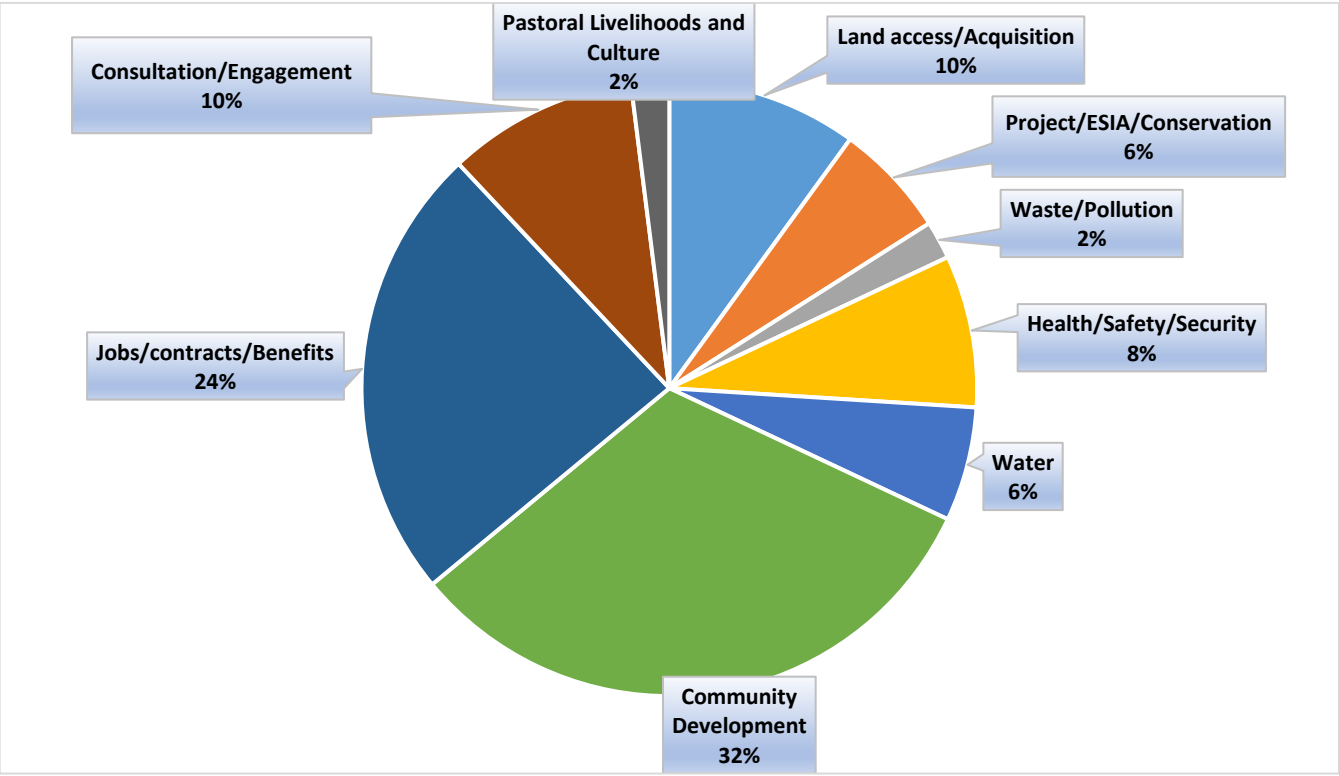

Figure 1: Summary of Issues from Project Disclosure

The meetings were usually opened by a Sub-location Chief or senior Chief, followed by a prayer. Then, opening remarks were made by the Chief or Sub-location Chief to explain the purpose of the meeting, the materials that participants could take home and acknowledged the various groups and representatives in attendance. The engagement team made presentations and spoke using the photos to explain various aspects of the Project. One of the engagement team members then led a "question and answer" period. People spoke freely and meetings covered many topics and where possible, the engagement team answered questions during the meeting. Meeting minutes are attached in Appendix B.

Questions and comments were counted and categorized as shown in Figure 2. During the Project Disclosure meetings, most questions and comments were requests for community development (CD) and clarifications about the number of jobs, hiring practices, diversity policy and local contracting opportunities. Community development requests were counted per request for an individual project, and the requests were primarily for water irrigation and water security projects, school classrooms and health care service enhancements. After CD and jobs questions, meeting participants showed interest in the consultation process itself, particularly asking about the grievance redress system, as well questions about land acquisition, access and compensation. Questions, comments and ideas about how the Project could contribute to improved security in the area were categorized under 'health and safety'; there were a few questions about the spread of disease and health impacts. Water access and effects of the water pipeline were dominant in West Pokot meetings, as water security is a critical issue in the area. However, most questions about water were really requests for various projects, including creation of water points. Waste disposal was a topic of concern in some meetings. Questions and comments about disruption of pastoral life and how graves would be addressed also came up in a few of the meetings.

3.0 ESIA CONSULTATION

ESIA consultation meetings were held in July and August 2021. Objectives of ESIA Consultations were to:

- Present results of the ESIA;
- Provide opportunity for stakeholders to verify that their issues, comments, and suggestions have been considered in the impact assessment or Project design; and
- Allow for comments on the findings of the ESIA.

3.1 ESIA Results Schedule of Meetings

Table 2: ESIA Consultation Schedule

Date	Meeting Location	Participants	Number of Attendees
July 28, 2021	Lodwar	Turkana County Government & Civil Society	69
July 29, 2021	Lokichar	Lokichar Administration, CSO & community	176
July 30, 2021	Lomokamar	Lomokamar Local Administration & Community Meeting	169
July 31, 2021	Karoge	Karoge Local Administration & Community Meeting	147
August 2, 2021	Nakukulas	Nakukulas Local Administration & Community Meeting	56

Date	Meeting Location	Participants	Number of Attendees
August 3, 2021	Kalapata	Kalapata Local Administration & Community Meeting	82
August 4, 2021	Lokori	Lokori Local Administration & Community Meeting	100
August 5, 2021	Kaputir	Kaputir Local Administration & Community Meeting	215
August 6, 2021	Kalemngorok	Kalemngorok Local Administration & Community Meeting	311
August 9, 2021	Lodwar	Turkana County Government, Civil Society	23
August 10, 2021	Lorogon	Turkana County Government & Civil Society	204
August 11, 2021	Riting	Turkana County Government & Civil Society	144
August 12, 2021	Turkwel	Turkana County Government & Civil Society	136
August 13, 2021	Kapenguria	West Pokot County Government & Civil Society	18
August 16, 2021	Nairobi	National Government Institutions & Civil Society	33
TBA	n/a	Members of Parliament and Senate	n/a

TBA = to be announced; n/a = not applicable

3.2 Summary of Results

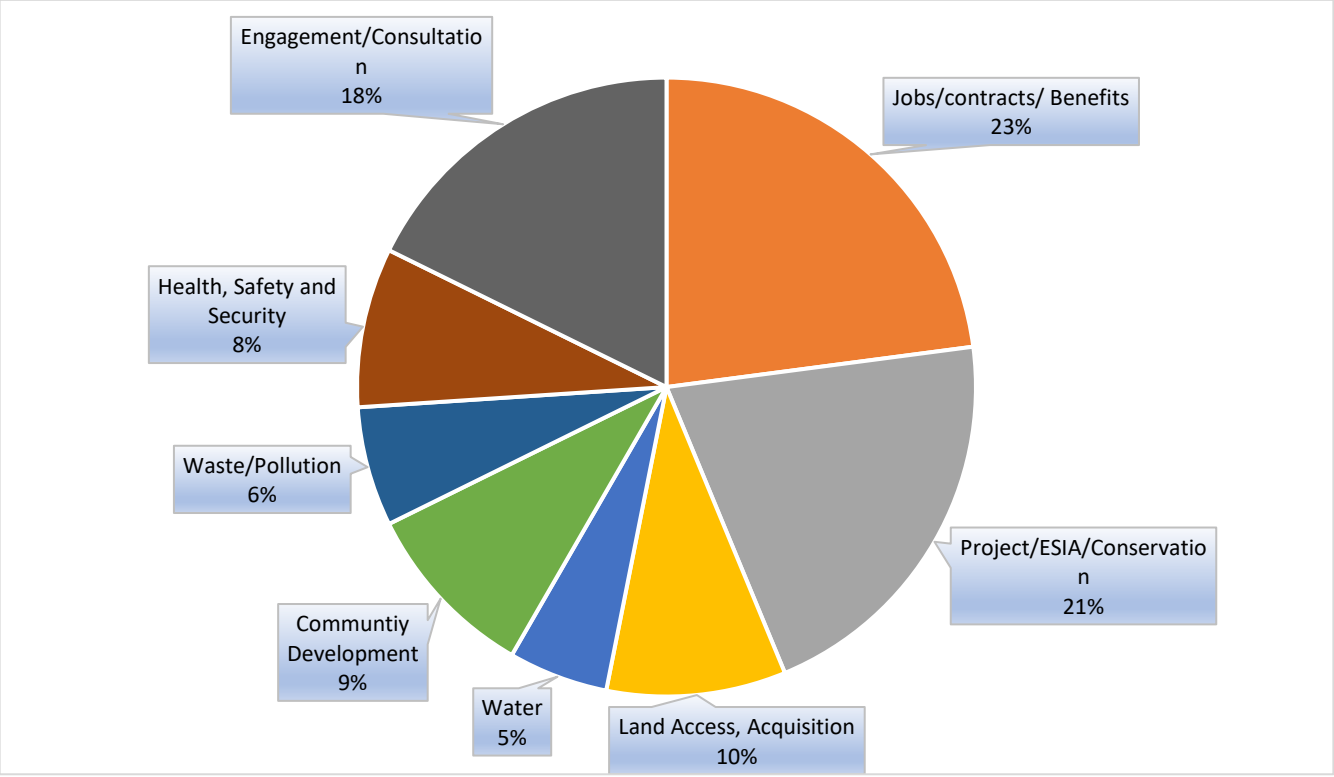

Figure 2: Summary of Issues from ESIA Consultation

Issues arising from the ESIA consultation focused primarily on employment and economic benefits (21% of all issues), followed by questions about the Project, the ESIA, and wildlife conservation (20%), and engagement/consultation concerns (17%). People in communities most often raised issues about employment (including noting that employment practices should be equitable, transparent and gender sensitive). Several people noted that there are low literacy rates and the Project should also provide employment for unskilled workers. Questions about the Project and ESIA related to requests for protection for vegetation and biodiversity, concerns about dust, noise, and light, and if the Project accounted for population influx and climate change. The National Museums of Kenya raised questions about plans to safeguard heritage resources near or under all project facilities including a pipeline from the Turkwel Gorge Reservoir. Some doubt was expressed about the proposed mitigation measures for various impacts and if they will be properly implemented, with some reference to the perception that mitigation for EOPS was not implemented. In relation to consultation, attendees asked for details about the grievance mechanisms and argued for inclusion of more stakeholders during consultation. Minutes of ESIA consultation meetings are included in Appendix C.

Overall, there is support for the Project both within governments at all levels and on the part of people of Turkana. At the national level, it is recognized that the Project is comparatively large, and as such would significantly contribute to economic and oil and gas sector growth, add to government revenues and result in infrastructure improvements of value to the national economy. There is confidence in the results of the ESIA and that the Operator will follow through with monitoring and management of environmental and social impacts. However, dialogue will need to continue on the more challenging issues, such as those related to land acquisition, and on the distribution of jobs. Security and ethnic conflict in the region are also a challenge and will need continuous monitoring.

District and local governments and people recognize that the Project would bring a measure of economic development to the area. Communities are, however, somewhat wary, as there has been activity for more than

a decade and a project has not yet been developed, and people feel they have experienced little benefit from all this interest. The engagement team has worked hard to explain the time it takes to develop a project of this scale.

It is also clear that almost without exception, communities have high expectations that the Project, if it proceeds, will provide assistance to communities in priority areas, such as access to water, provision and delivery of education and health services, and improving livelihoods. It is expected that such assistance will target the less fortunate within communities, including women, youth and the old. Demand for more information on the Project as it moves forward was also evident.

3.3 Issues Raised and Addressed in ESIA

All comments and questions raised at the open house events and stakeholder meetings have been collated and will inform further stakeholder engagement activities, events, and further development of mitigation and management plans. A summary of where issues are discussed in the ESIA is presented in Table 3.

Table 3: Issues and Where they have been Addressed

Issue	ESIA Section where issue is addressed
Jobs, contracts, benefits	Section 7.9 (Social)
Project information	Section 5.0 (Project Description)
ESIA methods and results	Sections 3.0 (Impact Assessment Methodology) and 7.0 (Potential Impacts and Mitigation)
Conservation issues	Section 7.7 (Biodiversity)
Land access	Section 7.9 (Social)
Land acquisition and compensation	Section 7.9 (Social)
Water	Section 7.3 (Water Quantity), Section 7.4 (Water Quality), Section 7.8 (Ecosystem Services) and Section 7.9 (Social)
Community development	Section 7.9 (Social)
Waste	Section 5.0 (Project Description), Section 7.0 (Potential Impacts and Mitigation)
Pollution	Section 7.1 (Air Quality), Section 7.2 (Noise and Vibration), Section 7.3 (Water Quantity) and Section 7.4 (Water Quality).
Health	Section 7.9 (Social)
Safety and Security	Section 7.9 (Social)
Engagement, Consultation and Grievance process	Section 7.9 (Social) and Stakeholder Engagement Plan
Pastoral livelihoods	Section 7.8 (Ecosystem Services), Section 7.9 (Social) and 7.10 (Cultural Heritage)
Culture and cultural resources	7.10 (Cultural Heritage)

Signature Page

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APPENDIX A

Materials Used in Consultation

The ESIA Process

Under Kenyan law, all new projects that are likely to affect the environment in any way must undertake an ESIA, and the ESIA report will then be submitted to NEMA for review and approval.

The ESIA study will assess the positive and negative impacts of the Project construction and operations. That will lead to the development of mitigation and management measures to address the issues and impacts identified. This will be done through field investigations, document review, professional analysis and stakeholder engagements.

The ESIA study is planned to be completed during August 2021.

Stakeholder Engagement Process

Stakeholder engagement is a requirement under Kenyan law and provides opportunities for communities and other stakeholders to participate in the ESIA process by raising issues, concerns, asking questions and contributing local knowledge.

This helps to ensure that stakeholder concerns are integrated into the assessment and are addressed where feasible in the Project design.

Stakeholder engagement in 2016 was used to inform the scope of the ESIA. The current round of stakeholder engagement is to discuss the results of the ESIA.

Now that the ESIA report has been drafted, the Project Oil Kenya team will undertake an initial round of Project disclosure meetings to familiarise stakeholders with the Project. Following that, the ESIA consultant team will then undertake a consultation process with stakeholders on the ESIA report, to discuss potential impacts identified and proposed mitigations.

Special efforts will be made to engage potentially affected people including women, young people, as well as community organisations, research institutions, NGOs, and others.

Availability of reports, times, and location of public meetings will be advertised in local media and via other suitable mechanisms. The final ESIA report will be made available in public offices, and online.

Your Views are Important!

Interested stakeholders are invited to contribute to the process by completing a registration and comment sheet at an engagement meeting or by contacting the Stakeholder Engagement Office (see details below).

Your comments will enrich the ESIA and the decision-making process ensuring that issue of concern are identified and addressed.

Stakeholder contributions will be recorded and disclosed in the final ESIA report.

Stakeholder Engagement

South Lokichar Basin Oil Project

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BACKGROUND INFORMATION

BACKGROUND INFORMATION DOCUMENT

SOUTH LOKICHAR BASIN OIL PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

AfricaOil Corp.

TOTAL

TULLOW OIL PLC

June 2021

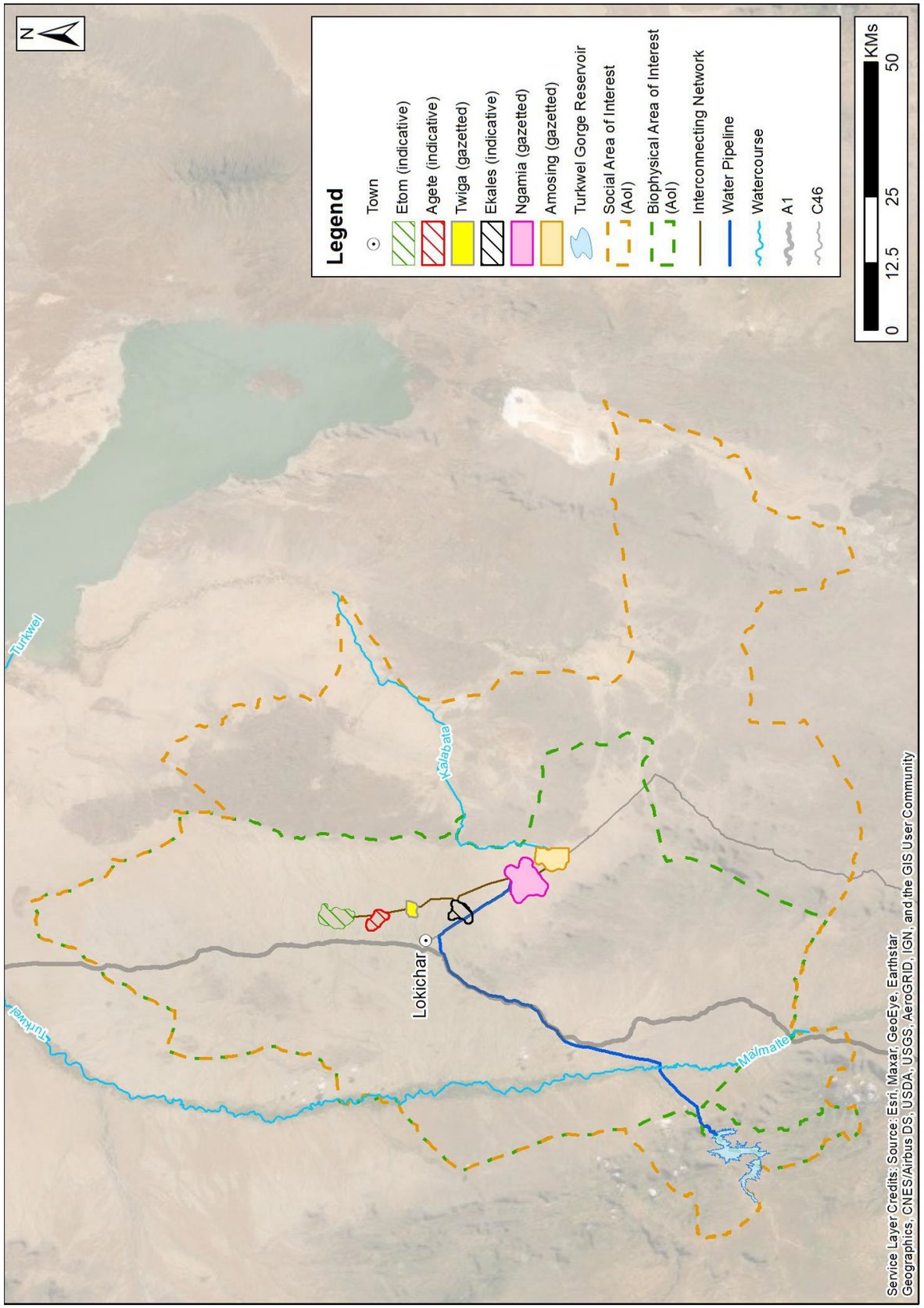

Figure 1: Project Overview Map

Introduction

This Background Information Document provides stakeholders with information about the proposed South Lokichar Basin Oil Project and explains how to provide comments or ask questions.

Major development projects require an Environmental and Social Impact Assessment (ESIA) under the Environment Management and Co-Ordination Act (1999). The ESIA report prepared will be submitted to the National Environment Management Authority (NEMA) for approval.

Golder Associates in partnership with Kenya-based Ecologics have been appointed to undertake the ESIA study for the proposed project.

Project Proponent

The Project is being developed by a consortium of international oil companies (the Kenya Joint Venture or " KJV") on behalf of the Government of Kenya (represented by the Ministry of Petroleum & Mining ("MoPM")).

The KJV comprises:

- Africa Oil Turkana Ltd
- Total Oil Kenya Ltd
- Tullow Oil Kenya Ltd

Land Access

Land needed for the Project is currently being acquired by the National Land Commission on behalf of the Ministry of Petroleum and Mining. Land will then be leased to Project for the duration of the licence.

Land is being acquired in polygons that equate to the extent of the various oil fields. Existing pastoralist land use will be able to continue across these areas, except at well pads and other Project facilities where fencing will be erected for safety and security.

All questions related to land access should be addressed to the National Land Commission.

Project Description

The Project comprises the phased development of six oil fields in a staged manner over a 10-year construction period, with an overall license duration of 25 years:

- Amosing, Ngamia, Twiga – first oil production in Year 3;
- Ekales – first oil in Year 5;
- Agete – first oil in Year 7;
- Etom – first oil in Year 10

Oil will be produced from production wells located on multiple wellpads across the six fields. Initial focus will be on developing the most mature fields of Amosing, Ngamia and Twiga.

A water supply pipeline will be constructed from Turkwel Gorge Reservoir and hot water will be pumped into the underground oil reservoirs to maintain pressure and productivity of the oil fields as oil is extracted. The oil will be pumped to a Central Processing Facility located adjacent to the Ngamia field for treatment prior to transportation via the Lokichar to Lamu Crude Oil Pipeline.

The Project will include:

- 75 well pads across six oil fields;
- Buried interconnecting water and oil flow lines;
- Electrical power distribution;
- A water pipeline from Turkwel Gorge Reservoir;
- A Central Facilities area, including the Central Processing Facility, Waste Management Facility, worker accommodation;
- An engineered landfill;
- New access roads
- Support facilities and infrastructure, including construction camps, laydown areas.

Mchakato wa ESIA

Chini ya sheria za Kenya, miradi yote mpya ambayo inaweza kuathiri mazingira kwa njia yoyote lazima ifanyiwe ESIA, na ripoti ya ESIA kuwasilishwa kwa ofisi za NEMA kwa ukaguzi na idhini.

Utafiti wa ESIA utatathmini athari chanya na hasi za ujenzi na shughuli za Mradi huu. Utafiti huo utabuni hatua mwafaka za kupunguza athari na kutoa mwongozo kwa usimamizi wa kushughulikia maswala ya kupunguza athari zilizoainishwa. Hii itafanywa kupitia uchunguzi wa uwanja, uhakiki wa hati, uchambuzi wa kitaalam na ushiriki wa wadau.

Utafiti wa ESIA umepangwa kukamilika mnamo Agosti 2021.

Mchakato wa Ushiriki wa Wadau

Ushiriki wa wadau ni sharti chini ya sheria za Kenya na hutoa fursa kwa jamii na wadau wengine kushiriki katika mchakato wa ESIA kwa kuibua maswala au wasiwasi na kuchangia maarifa ya ndani.

Hii inasaidia kuhakikisha kuwa wasiwasi wa wadau umejumuishwa katika utathmini huu na aidha kushughulikiwa iwezekanavyo katika muundo wa Mradi.

Ushiriki wa wadau mnamo 2016 ulitumika kuarifu wigo wa ESIA. Duru ya sasa ya ushiriki wa wadau ni kujadili matokeo haswa ya utathmini wa ESIA.

Sasa kwa kuwa ripoti ya ESIA imeandikwa, Timu ya Mradi wa Mafuta Kenya (Project Oil Kenya) itafanya awamu ya kwanza ya mikutano kwa minajili ya utangazaji wa Mradi ili kuwajulisha wadau kuhusu Mradi huo.

Kufuatia ushiriki huo, timu ya washauri ya ESIA itafanya mchakato wa mashauriano na wadau juu ya ripoti ya ESIA, ili kujadili athari zinazoweza kutambuliwa na kupunguzwa katika mikakati ya upunguzaji athari.

Jitihada maalum zitafanywa kuwashirikisha watu watakaoweza kuathiriwa kukiwemo wanawake, vijana, na pia mashirika ya kijamii, taasisi za utafiti, na wengineo.

Upatikanaji wa ripoti hiyo ya ESIA, na pia nyakati, na mahali pa mikutano ya hadhara itatangazwa kwenye vyombo maalum vya utangazaji vya mtaani hapa na kupitia njia zingine zinazofaa. Ripoti ya mwisho ya ESIA itapatikana katika ofisi za umma, na mtandaoni.

Maoni yako ni muhimu!

Wadau wanaovutiwa wanaalikwa kuchangia kwenye mchakato huu kwa kukamilisha karatasi za usajili na maoni kwenye mkutano wa ushiriki au kwa kuwasiliana na Ofisi ya Ushiriki wa Wadau (angalia maelezo hapa chini).

Maoni yako yataimarisha ESIA na mchakato huu wa kufanya maamuzi kuhakikisha kuwa suala la wasiwasi linatambuliwa na kushughulikiwa.

Michango ya wadau itarekodiwa na kutolewa katika ripoti ya mwisho ya ESIA.

Ushiriki wa Wadau

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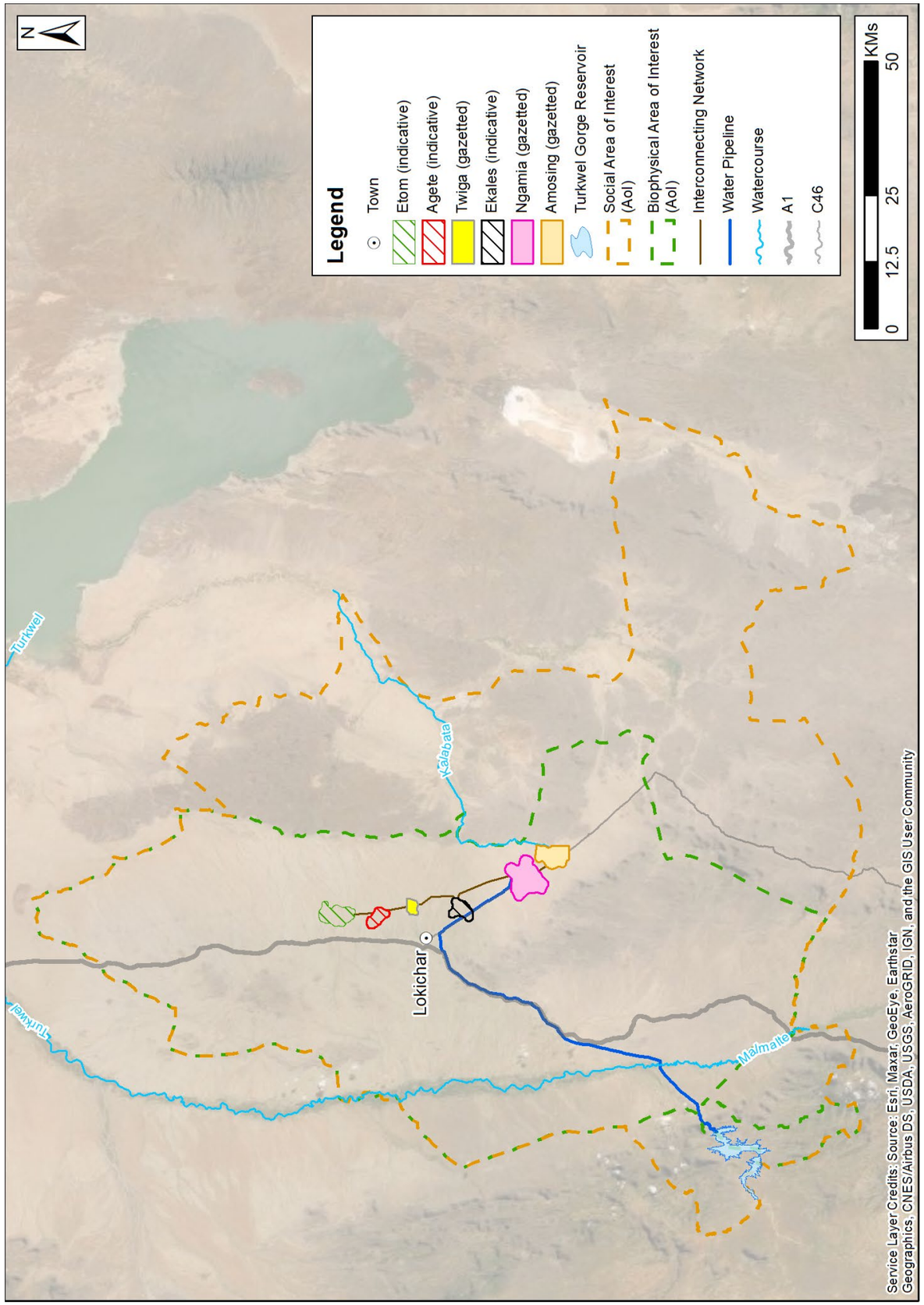
HATI YA HABARI KUHUSU MRADI

HATI YA HABARI KUHUSU MRADI

MRADI WA MAFUTA BONDE LA KUSINI MWA LOKICHAR

UTATHMINI WA ATHARI ZA MAZINGIRA

Juni 2021



Takwimu 1: Mtazamo wa Eneo za mradi

Utangulizi

Hati hii ya Habari Asili inapeana wadau habari kuhusu Mradi uliopendekezwa wa Mafuta katika Bonde la kusini Lokichar na inaelezea jinsi ya kutoa maoni au kuuliza maswali.

Miradi mikubwa ya maendeleo inahitaji Tathmini ya Athari kwa Mazingira na Jamii (ESIA) chini ya Sheria ya Usimamizi na Udhibiti wa Mazingira (1999) ya Kenya. Ripoti ya ESIA iliyoandaliwa itawasilishwa kwa Mamlaka ya Kitaifa ya Usimamizi wa Mazingira (NEMA) ikiomba idhini.

Washirika wa Golder kwa kushirikiana na kampuni ya humu nchini ya Ecologics wameteuliwa kufanya utafiti wa ESIA kwa mradi uliopendekezwa.

Msimamizi wa Mradi

Mradi huu unabuniwa na muungano wa kampuni za kimataifa za mafuta (Kenya Joint Venture au "KJV") kwa niaba ya Serikali ya jamuhuri ya Kenya (inayowakilishwa na Wizara ya Petroli na Madini ("MoPM").

KJV nayo inajumuisha:

- Africa Oil Turkana Limited & Africa Oil Kenya BV
- Total E&P International (K2 & K3) Limited
- Tullow Oil Kenya BV

Upatikanaji wa Ardhi

Ardhi inayohitajika kwa Mradi huu itanunuliwa na Tume ya Kitaifa ya Ardhi (NLC) kwa niaba ya Wizara ya Petroli na Madini. Mradi utakodishwa Ardhi hii kwa muda wote wa leseni ya uchimbuaji.

Ardhi itanunuliwa kwa visehemu ambavyo vinalingana na kiwango cha sehemu mbali mbali za upataji mafuta gafi. Matumizi ya ardhi kwa wafugaji katika maeneo haya yataweza kuendelea kama kawaida, isipokuwa kwenye eneo za visima (well pads) na vifaa vingine vya Mradi ambapo uzio utajengwa kwa minajili ya usalama.

Maswali yote yanayohusiana na upatikanaji wa ardhi yanapaswa kushughulikiwa na Tume ya Kitaifa ya Ardhi (NLC).

Maelezo kuhusu Mradi

Mradi huu unajumuisha maendeleo ya awamu ya eneo sita za mafuta kupitia mpangilio maalum utakao chukua kipindi cha miaka 10 ya ujenzi, na jumla ya urefu wa leseni wa miaka 25:

- Amosing, Ngamia, Twiga - mafuta ya kwanza katika Mwaka wa 3;
- Ekales - mafuta ya kwanza katika Mwaka wa 5;
- Agete - mafuta ya kwanza katika Mwaka wa 7;
- Etom - mafuta ya kwanza mnamo Mwaka wa 10

Mafuta yatapatikana kutoka kwa visima vya uzalishaji vilivyo kwenye maeneo mengi kwenye sehemu sita zilizotajwa awali. Lengo la kwanza litakuwa kukuza viwanja vya mafuta vilivyokomaa zaidi vya Amosing, Ngamia na Twiga.

Bomba la usambazaji wa maji litajengwa kutoka Bwawa la Mto wa Turkwel na maji ya moto yatasukumwa ndani ya mabwawa ya mafuta ya chini ya ardhi ili kudumisha shinikizo na tija ya uwanja wa mafuta wakati mafuta yanatolewa. Mafuta hayo yatasukumwa kwenye Kituo cha Usindikaji cha Kati kilicho karibu na uwanja wa Ngamia kwa maandalizi kabla ya kusafirishwa kupitia Bomba la Mafuta ghafi.

Mradi utajumuisha:

- Visima 75 kwenye sehemu sita za mafuta;
- Bomba zilizozikwa za usafirishaji wa maji na mafuta;
- Usambazaji wa umeme;
- Bomba la maji kutoka Bwawa la Turkwel Gorge;
- Eneo la Kituo cha Kati, pamoja na Kituo cha Usindikaji cha Kati, Kituo cha Usimamizi wa Taka, na makaazi ya wafanyikazi;
- Jalada la taka;
- Barabara mpya za kufikia enoe za mradi
- Vifaa vya msaada na miundombinu, pamoja na kambi za ujenzi, maeneo ya kuhifadhia vifaa.

REPORT

Project Oil Kenya

Non-Technical Summary

Project Oil Kenya

Submitted by:

Golder Associates (UK) Ltd

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July 2021

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1.0 INTRODUCTION

1.1 What is Project Oil Kenya?

Project Oil Kenya ("POK" or "the Project") is the development of six oilfields in Turkana County in north-west Kenya, with an overall oil production license duration of 25 years.

1.2 Where is the Project?

Geographically, the Project is located between Lake Turkana and the Turkwel River valley in north-west Kenya, approximately 450 km north of Nairobi. The nearest town is Lokichar.

The map below (Figure 1) shows the location of the Project "Area of Interest" (shaded). The Area of Interest has been considered as part of the environmental and social impact assessment process. The location of the Project's facilities are shown in Figure 2.

The Project's facilities are mostly located in Turkana South and Turkana East sub-counties in Turkana County. Water will be sourced from the Turkwel Gorge Reservoir (known as the "Turkwel Dam") in West Pokot County.

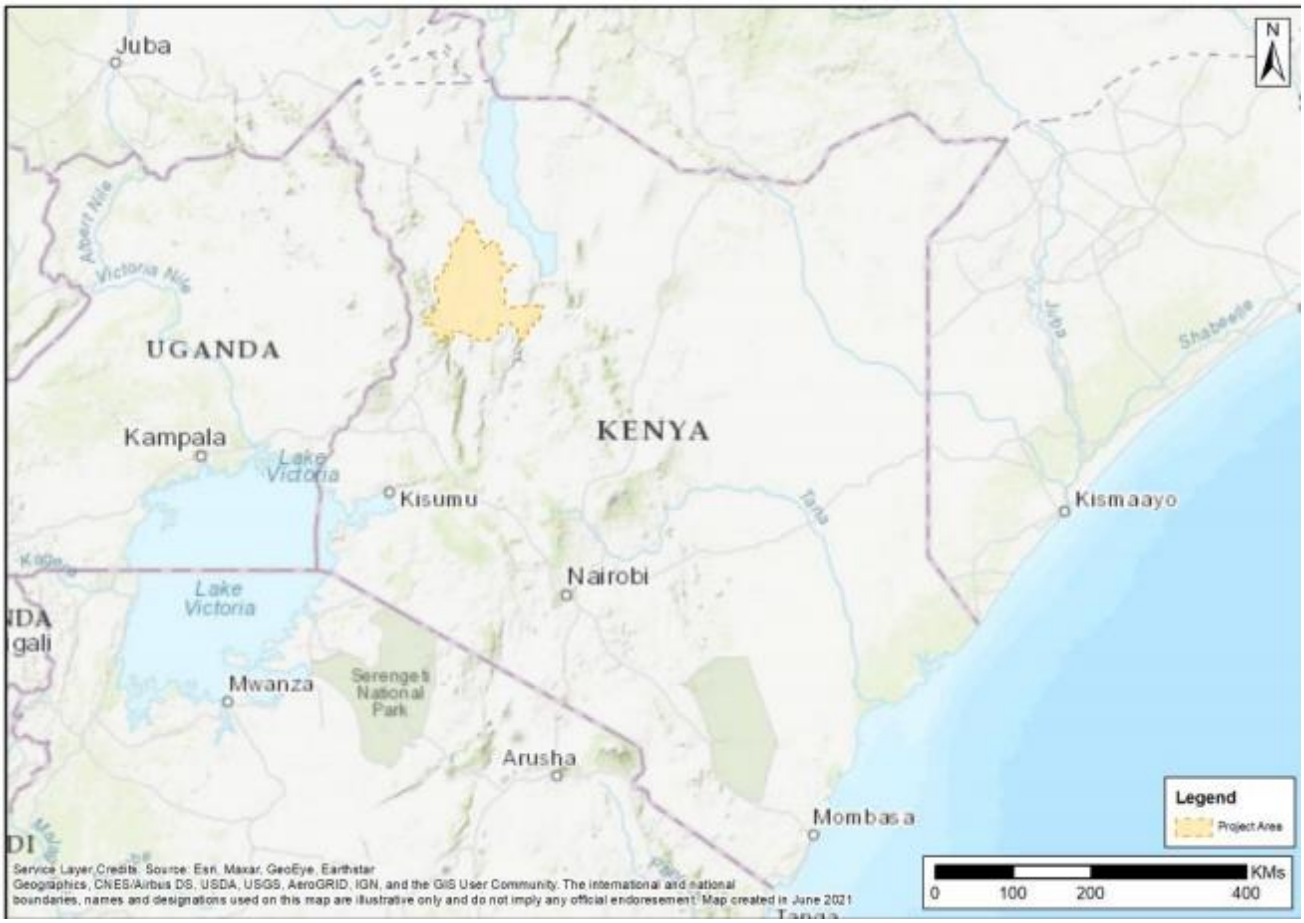


Figure 1: Project Area of Interest Location

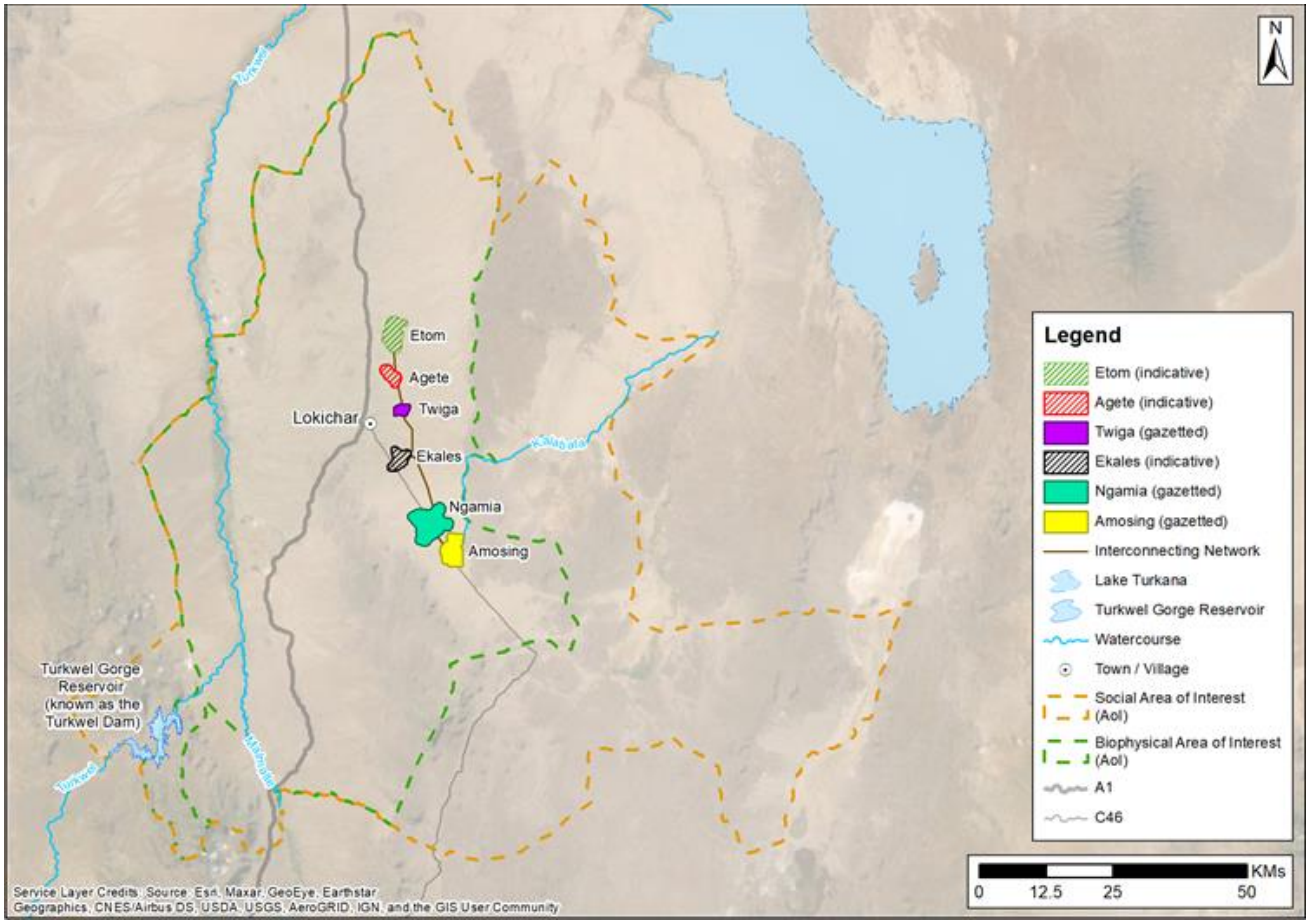


Figure 2: Project Regional Setting

1.3 What are the key aspects of the Project?

The Project is being planned and developed by a Joint Venture of international oil companies, on behalf of the Government of Kenya (represented by the Ministry of Petroleum & Mining). The Joint Venture of oil companies, also known as the Kenya Joint Venture or KJV, comprises Africa Oil Turkana Ltd, TotalEnergies EP Kenya and Tullow Oil Kenya Ltd.

Oil will be produced from production wells located on multiple wellpads across six oilfields called Agete, Amosing, Ekales, Etom, Ngamia and Twiga. The wellpads will be connected to a central processing facility (located within a central facilities area) within the Ngamia oilfield, via a network of buried flowlines. This area will also include waste management facilities and worker accommodation. An engineered landfill will be built nearby.

Once processed, the oil will be transported to Lamu for export via a separately permitted and operated buried pipeline known as the Lokichar to Lamu Crude Oil Pipeline (LLCOP).

Water will be sourced from the Turkwel Gorge Reservoir (known as the “Turkwel Dam”) and used to improve the amount of oil that can be extracted. A pipeline will transport the water from the Turkwel Dam to the processing facility within the Ngamia oilfield. The route and design of this water pipeline is being finalised and will be permitted separately with its own environmental and social impact assessment.

Project infrastructure will include new access roads and electrical distribution via overhead transmission lines between the oilfields. Support facilities include construction camps and laydown areas.

1.4 What is the history of oil development in the area?

There has been previous oil exploration in the Project area. The first exploration well was drilled in January 2012 and subsequent well testing was conducted in 2015, 2017 and 2018.

Tullow Oil Kenya Ltd (as operator for POK) was developing a previous form of this project called the Foundation Stage Development (FSD), which included a subset of the proposed oil fields, FSD has been replaced by this Project.

A project called the Early Oil Pilot Scheme (EOPS) was designed to understand the nature of the oil and make sure that infrastructure required for full field development (such as roads) was in place. This was a temporary project and involved transportation of crude oil by road to Mombasa for export and operations ceased in late 2019.

1.5 What is the Project Schedule?

The initial development focuses on the Amosing, Ngamia and Twiga oilfields with first oil from these fields produced) three years after project after a final investment decision has been made for the Project. Ekales, Agete and Etom will be developed over the following five to seven years.

The central facilities area and central processing facility are required at first oil and will be constructed by year three. Production operations (including construction) are expected to last approximately 25 years.

1.6 What environmental and social studies have been undertaken?

A national environmental and social impact assessment (often shortened to “ESIA”) has been prepared for the Project as part of the Kenyan permitting process.

The objectives of the environmental and social impact assessment were to:

- Understand how the Project may positively or negatively impact the existing environment and people who live nearby; and
- Find solutions to reduce negative effects to acceptable levels and enhance positive effects.

The environmental and social impact assessment process started in 2016 when the topics and types of studies required were discussed with the National Environment Management Authority (the regulator). It was agreed that the environmental and social impact assessment would focus on:

- The existing physical environment:
  - surface water (rivers, reservoirs, luggas);
  - groundwater (what water is available from underground aquifers);
  - the quality of the air;
  - whether it is quiet or noisy;
  - geology and soils;
  - mammals, birds, insects and plants;
- The existing social environment:
  - who lives nearby and how they live and work;
  - local services and infrastructure;

- archaeology;
- local culture;
- what the local landscape looks like.

Studies to understand the existing physical and social environment were carried out between 2016 and 2021 by Kenyan experts in each subject. These studies were then used to assess whether the Project had the potential to cause any impacts that would have a significant positive or negative effect on the physical and social environment. If any effects were identified, then mitigation measures to avoid, minimise, restore, compensate or improve these have been committed to by POK to reduce impacts to acceptable levels. The outcome of this process is summarised in Section 4 of this non-technical summary.

1.7 What is the purpose of this document?

This document is a non-technical summary of the findings from the environmental and social impact assessment completed for the Project. It aims to describe the Project, the assessment process, key findings and POK's commitments to the management and monitoring of any identified environmental and social issues.

This version of the non-technical summary has been prepared to support the Project's consultation process as part of the environmental and social impact assessment. After consultation, it will be updated to factor in any relevant feedback received, and a final version will be included as part of the full environmental and social impact assessment which will be submitted to the National Environment Management Authority for approval.

1.8 Who approves the environmental and social impact assessment?

In Kenya, major development projects require an environmental and social impact assessment to be prepared under the Environment Management and Co-Ordination Act (1999) and the Environmental Management and Coordination (Impact Assessment and Audit) Regulations (2003), and its 2016 and 2019 amendments.

The National Environment Management Authority is the administrative body responsible for the coordination of environmental management activities in Kenya. The National Environment Management Authority is also responsible for the implementation of all governmental environmental policies, as well reviewing and approving environmental and social impact assessments.

1.9 Who has written this document for POK?

This non-technical summary has been prepared for POK by Golder Associates (UK) Ltd and its Kenyan counterpart Ecoscience and Engineering (Ltd) (NEMA Expert Registration No: 11492).

1.10 Can I make comments on this document?

This document will be made available for public review and comment prior to submission of the environmental and social impact assessment to the National Environment Management Authority. Comments can be provided before 16 August 2021 to POK, at the following:

Tel/WhatsApp: +254 702 956331

Email: POK@africaoilkenya.com

Comments can also be provided to local Chiefs and Deputy County Commissioners who will forward comments to POK.

2.0 PROJECT DESCRIPTION

2.1 Who found the oil?

Africa Oil and Tullow Oil drilled the first well in the South Lokichar Basin (Ngamia-1 in Block 10BB), in January 2012. This has been followed by several further discoveries.

2.2 What is the licensing status of the Project?

Under Production Sharing Contracts between the Government of Kenya and the KJV, the Project has exploration licences for Blocks 10BB and 13T. Following submission of the Field Development Plan, once approved by the Government, a production licence for 25 years will be issued.

2.3 What other permits does POK need?

The Project needs a wide range of other technical permits and approvals in addition to the Environmental Impact Assessment licence which will be granted subject to satisfactory review of the environmental and social impact assessment report by the National Environmental Management Authority. A plan has been prepared to ensure that other necessary permits and approvals are in place in a timely manner to support construction and operations.

2.4 What standards will be applied to the Project?

The Project will comply with all Kenyan environmental and social laws and standards.

In addition, POK will design and manage its activities in line with good industry practice, including International Finance Corporation Environmental, Health and Safety Guidelines and Performance Standards. Compliance with these non-statutory guidelines and standards will be documented in a Supplemental Assessment to be prepared in addition to the environmental and social impact assessment.

2.5 Will POK pay taxes and royalties?

Yes, POK will pay taxes and royalties, in line with its License Agreements with the Kenyan Government.

2.6 How much oil is there?

Following review of the exploration and appraisal data the Kenya Joint Venture (KJV) believe 560 million barrels of oil are technically recoverable. The KJV and the Government of Kenya are working together to agree on what volumes might be economically recoverable.

2.7 What is the oil like? What are its characteristics?

The oil is of good quality and has the consistency of shoe polish. The “waxy” nature of the crude oil means that it will solidify at room temperature. The Project has been designed to keep the oil above the temperature at which it begins to solidify, so that it can be processed and flow through the system.

2.8 How will the wellpads be constructed?

Over 60 well pads will be constructed (or rehabilitated from the previous development) over ten years. The standard wellpad area is 250 m x 200 m.

For each wellpad, the following process will be undertaken:

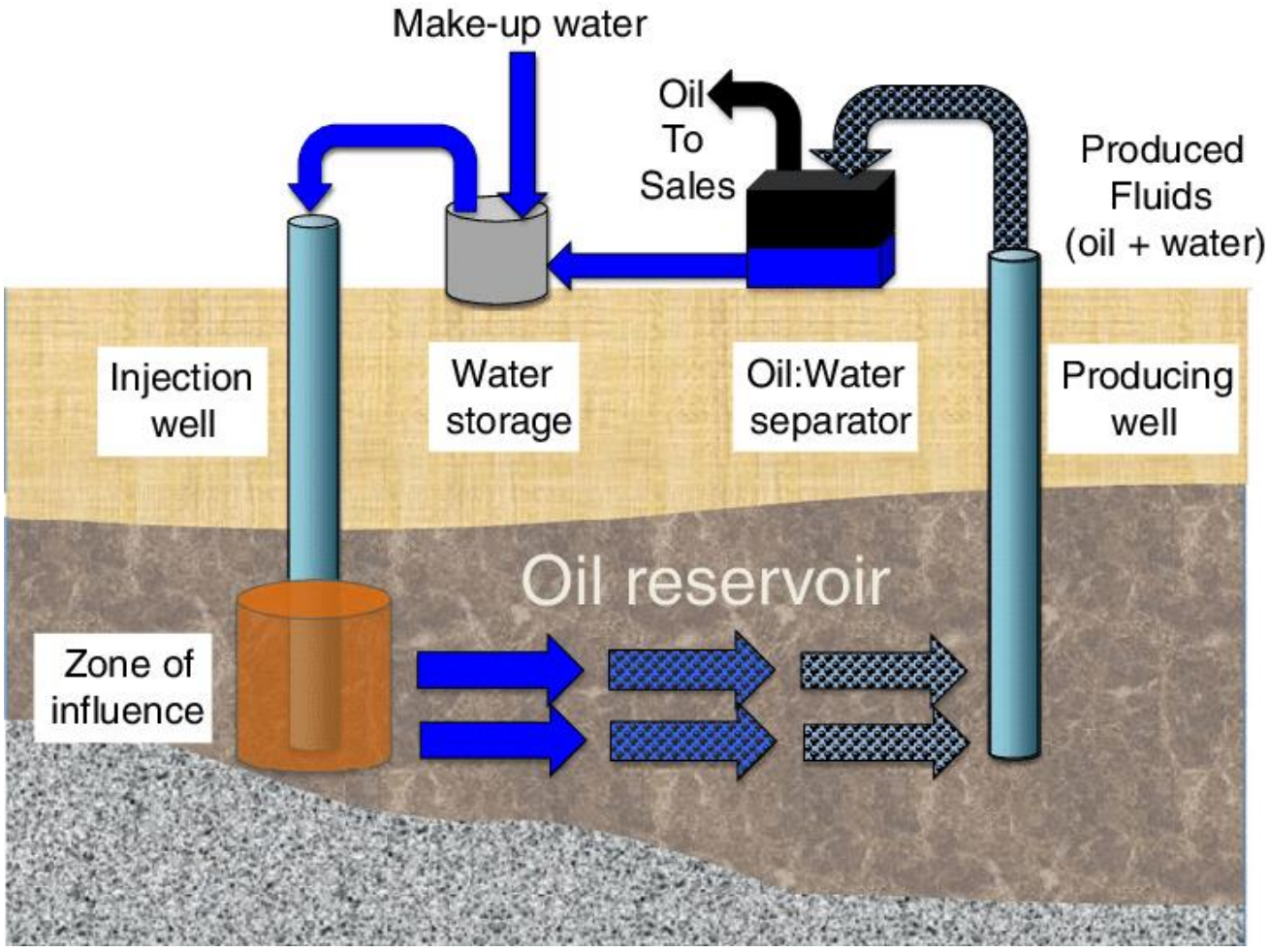
- The site will be cleared and levelled. Drainage and flood defences will be installed. Some pits will be dug. Access roads will be built, and a perimeter fence will be installed;
- Wells will be drilled;

- Above ground site facilities will be constructed; and
- Wells and equipment will be commissioned.

Figure 3: An Oil Well with a Drilling Rig in Place

2.9 How will the oil be extracted from the ground?

Each oil well will consist of a drilled-out bore which is lined with metal tubing. The oil will flow to the surface and this process will be helped by the injection of water into the oil reservoir to improve the recovery from the oil reservoirs.



Source: Gieg et al, 2011

Figure 4: The Oil Production Process

2.10 What will happen to the oil once it has been extracted from the ground?

A system of buried flowlines will be connected to the wellpads to transfer the oil to a central processing facility within the Ngamia oilfield.

At the processing facility, the produced fluids will be separated into crude oil, gas and water:

- The crude oil will be stabilised to be ready for export via the buried pipeline to Lamu;
- The gas will be used for heat and power generation or compressed and reinjected to the oil reservoir; and
- The water will be treated, heated and injected back into the oil reservoir to help maintain pressure.

2.11 What is the layout of the Project?

In total, approximately 60 wellpads will be developed (or rehabilitated) as part of the Project. There are also 12 contingent wellpad locations that have been identified. The contingent wellpads do not need to be developed as part of the current Project but may be required in the future.

On these wellpads, the Project plans to install approximately 1,200 wells, with each wellpad containing 12 to 24 wells. The layout of the Project within its local setting is shown in the map below (Figure 5).

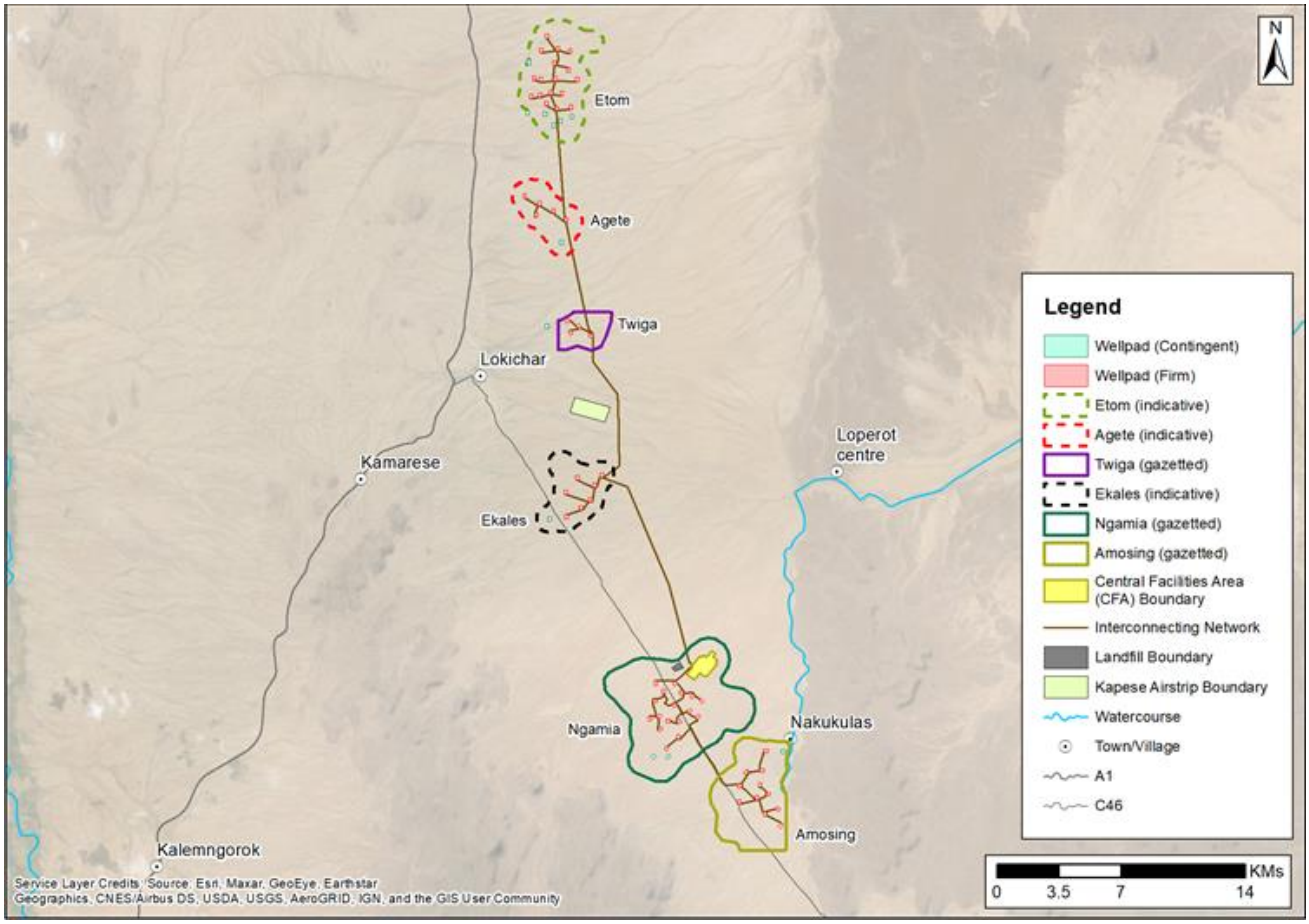


Figure 5: Project Layout within local setting

2.12 From where will the Project get its water?

During the early part of the construction phase, the Project will temporarily source water from a network of existing boreholes which use the local shallow groundwater aquifers.

Operational water supply for the Project is the Turkwel Gorge Reservoir (known as the “Turkwel Dam”), to the south-west (Figure 2). A pipeline will transport the water from the Turkwel Dam to the processing facility within the Ngamia oilfield. The route of the water pipeline is currently being evaluated and it will be permitted separately with its own environmental and social impact assessment.

2.13 How much water will be required?

During the construction phase the estimated water demand from boreholes will average at approximately 1,500 m^3/day for a period of 22 months.

During operations there will be a peak demand of approximately 26,000 m^3/day in Year 4 of operations, the water demand will reduce thereafter. For context, this is less than 2% of the average annual inflow to the Turkwel Gorge Reservoir (known as the "Turkwel Dam").

2.14 What new roads will be built to reach the oilfields?

The Project will construct access roads as required to access the wellpads and other facilities at each oilfield.

2.15 From where will the Project get its power supply?

During construction the power supply to construction camps, work areas, warehouses and drill rigs will be provided by temporary diesel generators.

Once the wells are operational, the Project will be able to generate all of its power using gas that is produced with the oil.

There is also a planned connection to the Kenyan grid, constructed by the Kenya Electricity Transmission Company (KETRACO), who are constructing the Turkwel to Lokichoggio transmission line expansion project, which is passing near to the central processing area at Ngamia.

2.16 How will the Project get a power supply to the oilfields?

Overhead transmission lines will be routed from the central processing area within the Ngamia oilfield, to a substation at each oilfield.

2.17 How will waste be managed?

A waste management and processing facility will be built at the central facilities area within the Ngamia oilfield. This facility will act as a waste reception, handling, volume minimisation, treatment and storage facility during operations.

An engineered landfill will be constructed early in the construction process, which will accept construction waste and drilling waste whilst the main facility is being constructed. Once the main facility has been constructed, the landfill will accept some operations wastes that cannot be handled at the main facility.

There will be a separate facility near to the engineered landfill which will treat any contaminated drilling muds from the wellpads, to make the muds safe for disposal in the landfill.

2.18 How will odour be managed?

All facilities are being constructed in line with good international practice in order to minimise odour emissions at source. POK will monitor odour and take action if unacceptable odours are identified or if complaints are made.

2.19 How will construction materials be brought to the Project site?

The Project will require significant quantities of material to be brought to site to construct the Project. The logistics and transportation required will include all modes of transport, including sea, air, road and rail. POK will establish a robust transport management system to ensure that goods are transported safely to the Project site.

2.20 What land does the Project need and how will it acquire it?

The National Land Commission, on behalf of the Ministry of Petroleum and Mining, are in the process of acquiring gazetted "polygons" of land across the different oilfields.

In the map below, the polygons of land for each oilfield are shown with the gazetted status and the footprint of the facilities shown within the polygon.

The Project has identified a defined footprint of approximately 1,500 hectares within the polygon land area. Land outside fenced-off areas will continue to be available for grazing.

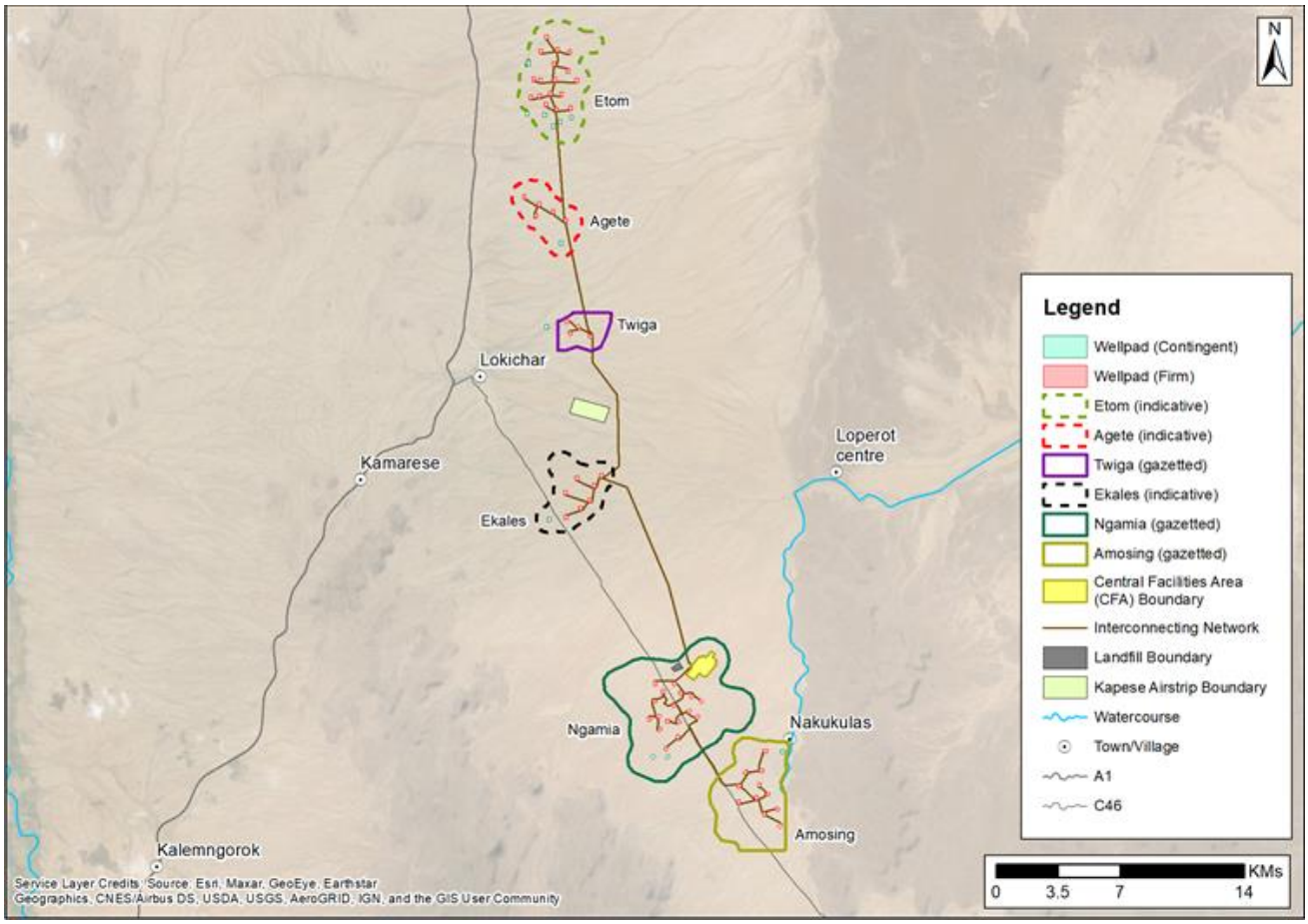


Figure 6: Land "polygons" being acquired by National Land Commission

Land acquisition for the Project will follow the statutory process to be undertaken by the Government of Kenya to make land available for the Project. In support of the statutory land acquisition process, the Project will undertake additional livelihood support activities to ensure that the livelihoods of affected households are not adversely affected by the Project. These may include supporting pastureland management and animal husbandry initiatives.

2.21 How many people will work on the Project?

It is estimated that there will be a peak of approximately 2,400 workers during construction, and approximately 500 workers during operations. This will be a combination of skilled, semi- skilled and unskilled positions.

2.22 Where will the workers stay?

During construction, there will be three temporary construction camps and one permanent camp. These will be located at the central facilities area within the Ngamia oilfield, with satellite camps on the wellpads and elsewhere as required.

For operations, the residential area at Ngamia used for construction will be converted into a permanent camp.

2.23 Will POK create opportunities for local employment?

The jobs associated with the Project will require varying skill sets and will offer employment opportunities for unskilled, semi-skilled and skilled workers. Final job requirements will be determined during detailed project design. The Project will implement a local recruitment plan to provide opportunities for local employment.

2.24 What opportunities will be created for local suppliers?

POK will provide opportunities for local providers of goods and services to participate in Project activities, including working closely with the selected construction contractor.

2.25 How will the oilfields be closed when the Project ends?

Assuming there is no other use for Project facilities, all structures and related infrastructure will be dismantled for recycling, sold for scrap, or disposed of at a suitably licensed facility that has been approved by the National Environment Management Authority. Disturbed areas will be appropriately rehabilitated.

3.0 STAKEHOLDER ENGAGEMENT

3.1 What is the Project approach to stakeholder engagement?

The POK environmental and social impact assessment has been prepared for the multiple stakeholders of Kenya, at community, County and National levels.

Stakeholder engagement for the Project started in December 2015. In 2021, there will be consultation with stakeholders on this non-technical summary and the outcomes of the draft environmental and social impact assessment. The objectives of this consultation are to ensure that stakeholders understand the project (project disclosure) and the environmental and social issues which it could cause, plus stakeholder concerns are registered, responded to and addressed in the final environmental and social impact assessment. The consultation provides an opportunity for stakeholders to discuss potential significant effects and proposed mitigation and monitoring measures.

Stakeholders including local communities, government, civil society organisations and non-government organisations will be invited to participate in consultation on the draft environmental and social impact assessment.

The Project has prepared a stakeholder engagement plan which is publicly available on the website of the Ministry of Petroleum and Mining:

https://www.petroleumandmining.go.ke

3.2 What to do if you have a Project-related complaint?

POK has developed a system to ensure that questions or complaints are managed in a transparent and timely manner. Stakeholders can either address issues to POK representatives, relevant County administrative offices, or via the Project email. All issues will be addressed at a field level in the first instance with the aim to resolve issues within a 30 day period. If issues cannot be resolved locally, they will be escalated to ensure timely resolution.

Complaints can be logged via:

Tel: +254 702 956331

Email: POK@africaoilkenya.com

Complaints can also be provided to local Chiefs and Deputy County Commissioners who will forward them to POK for resolution.

4.0 POTENTIAL IMPACTS AND MITIGATION

4.1 What benefits will the Project bring?

The Project will bring both social and economic benefits. education services the Community Development Plans.

The Project will create employment opportunities both directly and indirectly through contractors and suppliers. Business opportunities will be created in the local, regional and national economy relating to the procurement of services. Taxes and other payments which will be paid to National and County governments will also have a positive influence on the continuation of economic growth in Kenya.

4.2 What is POK doing to help the local community benefit from the Project?

POK will provide social investment, building on existing community projects and initiatives (for example education, healthcare, road improvements, community Health and livestock grazing programmes and maintenance of water supplies, working with County and National governments.

4.3 How will the Project affect those living and using the land?

The land in Turkana where the Project is located is community land. The National Land Commission, on behalf of Ministry of Petroleum and Mines, have and will acquire gazetted “polygons” of land across the different oilfields. Within those polygons, the Project has identified a defined footprint of approximately 1,500 hectares. In order to minimise the impacts of land acquisition, land not required by the Project within the polygons will continue to be available for grazing.

During construction, some land will be fenced temporarily for safety. During operations there will be permanent restrictions to land in the central facilities area, wellpad areas and landfill, where land will be fenced and there will be no pastoral grazing or settlement access. Where land is no longer available for pastureland use, this will be factored into the Project’s livelihood restoration activities. In instances where households have to be moved, this will be undertaken in accordance with Kenyan law and the Project will provide additional assistance particularly for vulnerable households.

4.4 How will the project protect local water resources?

During construction and prior to water being available from the Turkwel Gorge Reservoir (known as the “Turkwel Dam”), the Project plans to use water abstracted from existing wells in the local area. Preliminary studies indicate that this could temporarily reduce the water levels in shallow aquifers, which are used by the community for water supply, through hand dug wells and similar) and provide groundwater that supports vegetation growth. To understand this further and prior to construction, POK will complete extensive studies to understand the local water environment. POK will monitor water levels throughout construction and will ensure continuity of water supply if any community water supplies are affected.

Any construction work undertaken near watercourses will be planned to take place when water levels are low or when no flow is expected. There are specific procedures for how watercourses (including luggas) should be crossed by Project roads and pipelines or flowlines to manage both water quality and quantity.

Wastes generated by the Project will be stored in a way that no contaminants are disturbed or released into local water courses. Monitoring of groundwater quality (and surface water/ hand dug wells where possible) will be undertaken during construction and operation to ensure water quality is within acceptable limits and

groundwater levels will be monitored to ensure that there is sufficient water for both the Project and local water users.

POK will work with Kerio Valley Development Authority (KVDA) responsible for the Turkwel Dam to ensure the water supply to other water users of the reservoir is not affected by abstraction by the Project.

Water used to test the integrity of flowlines, which may be contaminated, will be reused where possible and will be disposed of via evaporation ponds or discharged in line with Kenyan permitting requirements.

4.5 What will happen to the oil if there is an accident and it spills or leaks?

All flowlines transporting the oil will be buried. Due to the waxy properties of the oil, if there are any breaks to the flowlines the oil will solidify (the crude is solid at ambient temperatures). Spill response kits will be available at well-pads and the central facilities area and will be used as soon as possible if a spillage or leak occurs.

The Project will have an Emergency Response Plan and necessary equipment in place to respond to emergencies and to call for specialist support if that is required.

4.6 How will the Project affect air quality?

Some changes to existing air quality are expected during construction and operation. During construction, the main effect will be from deposited dust, which can cause a nuisance. Dust levels will be monitored during construction and additional management actions will be taken if needed to reduce generated dust. Traffic numbers are not expected to be above levels where air quality issues are anticipated.

During operations, activities at the central processing facility may cause localised exceedances of air quality standards or areas of predicted high magnitude. Short-term exposure is not harmful but long-term exposure can cause health impacts such as respiratory issues. In these areas, the construction of structures will be prohibited although pastoralists and animals may safely pass through.

POK will ensure that these areas are clearly marked out, and that an engagement system is put in place so that all people who could be affected are appropriately informed.

4.7 How will the Project affect noise and vibration levels?

Some changes to existing noise levels are anticipated during construction and operation due to POK activities.

During construction, noise will be generated by the construction of the infrastructure and facilities and the drilling of the wells. If noise during construction is considered likely to be temporarily above acceptable limits, the National Environment Management Authority will be informed. Traffic is not predicted to cause significant noise.

During operations, sources of noise will include the central processing facility, wellpads, the landfill and flights to and from the airstrip.

During both construction and operation, there will be a process to inform people who could be affected by noisy activities. This will include information about when, where and how long the works will take place, and areas to be avoided for both settlement and grazing. Signage will be put in place.

No vibration impacts are expected to affect the local community from either construction or operation.

4.8 How will the project support community health and safety, livelihoods and well-being?

POK will work with National Government, County Administration and key stakeholders to build on existing community health, community safety and pastureland management programmes.

4.9 How will the influx of workers be managed by the Project?

Influx of speculative migrants seeking employment will be managed through a combination of monitoring, incentives for reducing uncontrolled migration, management of worker integration with local communities, and public communication.

POK will work with National Government, County Administration and key stakeholders to develop an influx working group to review, monitor and support actions to manage Project-induced influx.

There will be a recruitment procedure which will include no informal (“at the gate”) recruitment.

4.10 How will the Project affect inflation?

During construction, increased demand for local goods and services may cause a short- term increase in inflation. During operations, the demand for goods and services is expected to reduce due to the decrease in workforce numbers. POK will use local and national suppliers to ensure the best market price for goods is sought, which will help to manage local inflation.

4.11 How will security be maintained in the region?

The National Police and other Government agencies are responsible for public security and law and order. The project will coordinate with these bodies and raise any security concerns to the appropriate authorities.

4.12 How will cultural heritage (e.g. archaeology, sacred trees, cultural practices) be protected?

Multiple measures will be used to protect cultural heritage. An archaeological investigation will be completed prior to construction to see if the remains of past settlement are present where the central facilities area is going to be located. A procedure will be set up to log any archaeological finds during construction in coordination with the National Museum of Kenya.

Graves will be protected through realignment of project infrastructure or, if required, relocation of the burial, in consultation with affected communities. All staff will be educated on cultural practices and the types of sites that need to be protected including why they are important and where they are located.

4.13 How will biodiversity be preserved?

The Project will avoid sensitive habitats and species wherever possible. Surveys for plants, mammals, birds, reptiles, amphibians, fish and invertebrates have been completed by local expert teams.

If any potential harm or damage to habitats or species has been identified, and it is not possible to avoid it, POK has committed to a series of measures to restore habitats and species and monitor progress. Some construction activities can be timed appropriately to minimise effects. If required, there is the option of moving species to a new area (translocation) in collaboration with the Kenya Wildlife Service.

During construction any impacts on biodiversity due to groundwater abstraction will be monitored and, if required, POK will implement plans to provide alternative water supplies to maintain affected sensitive habitats.

A biodiversity supervisor will be employed by the Project to ensure that all mitigation commitments are delivered. Key sensitive species will be monitored throughout the life of the project and action, in coordination with the Kenya Wildlife Service, will be taken to protect them should impacts be identified.

4.14 What will be the visual impact of the Project?

Visual impacts during the construction and operational phase are mainly related to the presence of buildings, construction equipment, artificial lighting and dust plumes at wellpads, the central facilities area and overhead transmission lines.

During construction, impacts are generally expected to be short- lived with more long- term impacts anticipated during operations. Existing natural planting will be retained where possible to provide and maintain natural screening of infrastructure, the use of artificial lighting will be minimised and managed, traffic speed limits will be managed to reduce dust.

5.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT

5.1 How will POK manage its environmental and social commitments?

POK will prepare and implement an environmental and social management system which will meet the requirements of the Organization for Standardization (ISO) 14001:2015 and the International Finance Corporation Sustainability Framework Performance Standard 1.

Within this management system will be an *Environmental Performance Plan* and a *Social Performance Plan.* These plans will describe how POK ensures that environmental and social risks and commitments set out in the environmental and social impact assessment are managed and provide a transparent means of ensuring these things happen, and they can be audited. It makes clear who is responsible for each activity, when tasks need to be completed and how they will be monitored and reviewed.

5.2 What environmental and social information will be publicly available?

The environmental and social impact assessment will be publicly available after consultation is complete and it has been submitted to the National Environment Management Authority.

As part of the environmental and social management system, POK will develop a range of mechanisms to allow stakeholders to be informed about POK performance in managing environmental and social impacts. These will include involving local stakeholders in participatory environmental monitoring, preparation of an annual environmental and social performance report, regular meetings and audits with the National Environment Management Authority and regular meetings with local community members, representatives and County administrators.

5.3 Who is responsible for managing environmental and social issues throughout the life of the Project?

POK is responsible for the performance of itself and its contractors. During construction, POK will supervise the performance of its construction contractors. During operations, POK will take direct operational control. POK will work closely with the National Environment Management Authority and the County Environmental Committee to ensure issues are managed on a transparent and cooperative basis.

5.4 How will POK monitor its activities?

As part of its *Environmental* and *Social Performance Plans* and based on the requirements outlined in the environmental and social impact assessment, POK will develop and implement detailed monitoring measures to ensure that it can check that environmental and social management measures and commitments are working, and that it is fulfilling its regulatory requirements and other commitments.

POK will continue to monitor environmental and social risks throughout all phases of the project, including during decommissioning, and after the Project is closed.

5.5 How will POK react in an emergency?

POK will establish an overall emergency response plan that will define procedures to be following in the event of an accident, incident or other emergency. This will cover a wide range of scenarios and will be coordinated with the Police service and County administration. Appropriate POK emergency response and medical facilities will be in place to work with the Police and County Administration.

5.6 How will POK manage the health and safety of its employees and the local community?

Worker health and safety management systems and operating procedures will be prepared and will meet the requirements of International Organization for Standardization (ISO) 45001:2018.

POK and its contractors will comply with all applicable Kenyan worker health and safety legislation during all phases of the Project.

All POK employees and contractors will be given awareness training on community health, safety and security and a Code of Conduct will be in place to ensure respectful relations are maintained with local communities.

5.7 How will POK ensure that its employees are treated fairly?

POK will be an equal opportunity and non-discrimination employer. All employees will have access to a confidential service to help them in the event of workplace grievances.

POK will prepare and implement a Code of Conduct which will apply to POK employees and contractors. It will outline procedures and requirements to ensure that POK and its contractors respect and protect the fundamental principles and rights of workers through promoting personal respect and a safe workplace. This includes:

- fair treatment, non-discrimination and equal opportunities for all workers;
- establishing, maintaining and improving a sound worker-management relationship;
- compliance with applicable national labour and employment laws;
- protecting and promoting the safety and health of workers, especially by promoting safe and healthy working conditions; and
- preventing the use of forced labour and child labour.

Signature Page

Golder Associates (UK) Ltd

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RL/AM/mb

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RIPOTI

Mradi wa Mafuta wa Kenya (Project Oil Kenya)

Muhtasari Usio wa Kiufundi

Project Oil Kenya

Imewasilishwa na:

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Julai 2021

Yaliyomo

MAJEDWALI

MICHORO

1.0 UTANGULIZI

1.1 Mradi wa Mafuta wa Kenya ni nini?

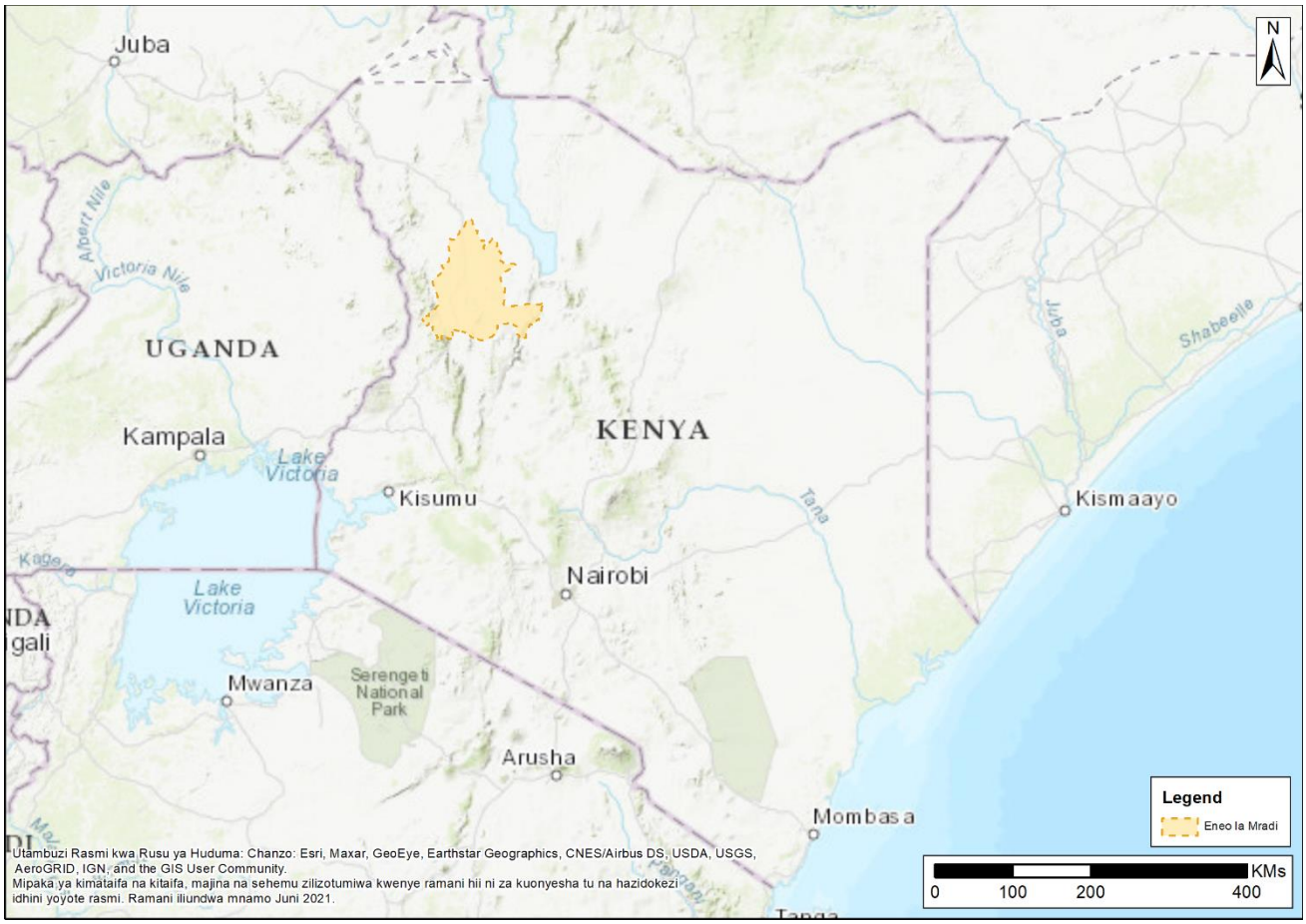
Mradi wa Mafuta wa Kenya ("POK" au "Mradi") ni kiwanja cha machimbo sita ya mafuta katika Kaunti ya Turkana iliyo kaskazini magharibi mwa Kenya, kilicho na leseni ya uzalishaji wa jumla wa mafuta ya kipindi cha miaka 25.

1.2 Mradi huu unapatikana wapi?

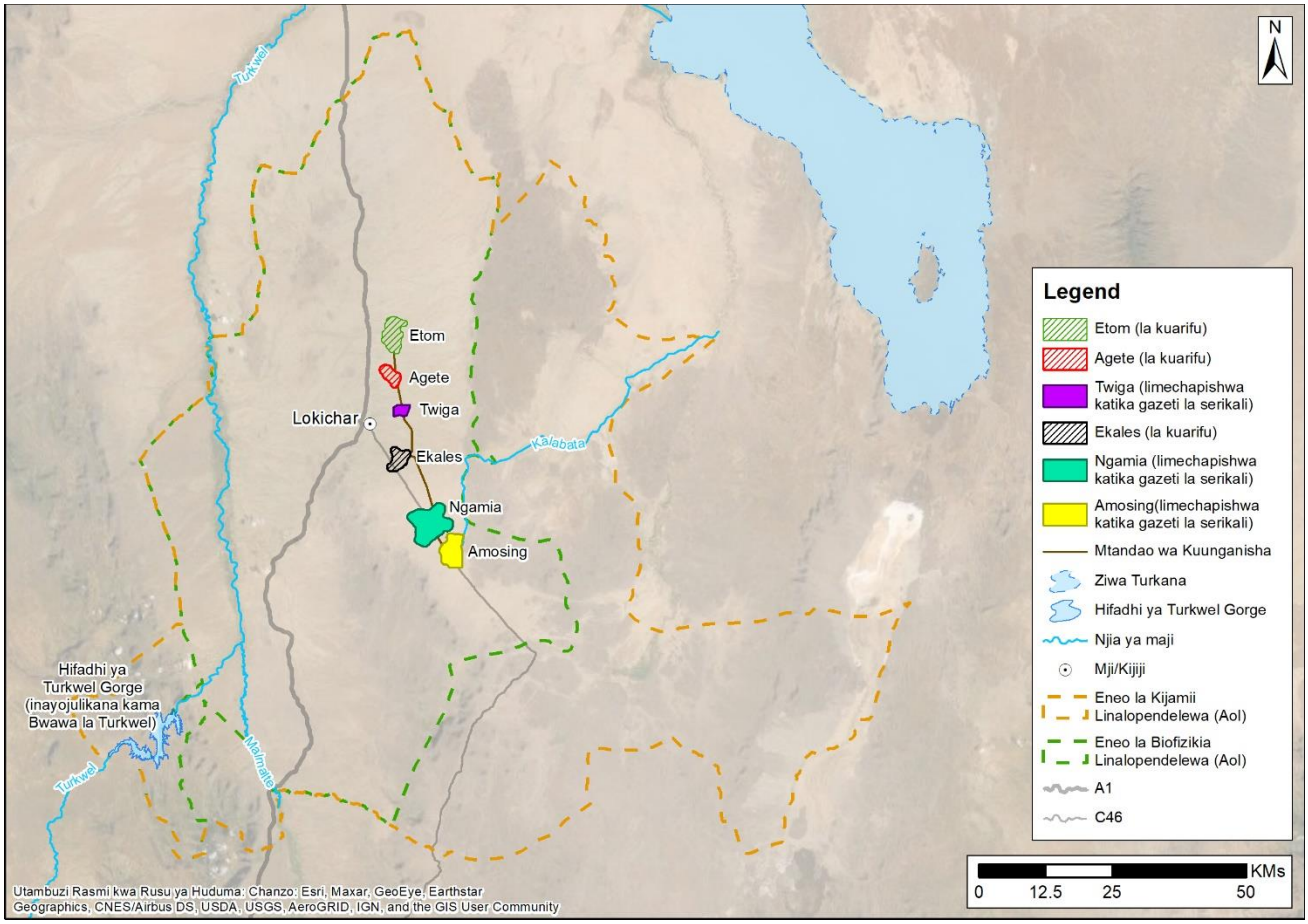
Kijiografia, mradi huu unapatikana katikati ya Ziwa Turkana na bonde la Mto Turkwel kaskazini magharibi mwa Kenya, takribani kilomita 450 kaskazini mwa Nairobi. Mji ulio karibu zaidi unaitwa Lokichar.

Ramani iliyo hapa chini (Mchoro 1) inaonyesha eneo la Mradi "Eneo Linalopendelewa" (lililotiwa rangi). Eneo Linalopendelewa limefanywa kuwa sehemu ya mchakato wa kutathmini athari za mazingira na kijamii. Eneo la vituo vya Mradi limeonyeshwa katika Mchoro 2.

Vituo vya Mradi vinapatikana Turkana Kusini na Turkana Mashariki hasa, kaunti ndogo za Kaunti ya Turkana. Maji yatatolewa katika Hifadhi ya Turkwel Gorge (inayojulikana kama "Bwawa la Turkwel") katika Kaunti ya Pokot Magharibi.



Mchoro 1: Sehemu ya Mradi ya Eneo Linalopendelewa



Mchoro 2: Mazingira ya Eneo la Mradi

1.3 Sehemu kuu za Mradi ni zipi?

Mradi unapangwa na kujengwa na Ushirikiano wa kampuni za kimataifa za mafuta, kwa niaba ya Serikali ya Kenya (inayowakilishwa na Wizara ya Petroli na Uchimbaji Madini). Ushirikiano wa kampuni za mafuta, unaojulikana pia kama Kenya Joint Venture au KJV unajumuisha Africa Oil Turkana Ltd, TotalEnergies EP Kenya na Tullow Oil Kenya Ltd.

Mafuta yatazalishwa kutoka kwa visima vya uzalishaji vilivyo katika maeneo mengi ya visima katika machimbo sita ya mafuta yanayoitwa Agete, Amosing, Ekales, Etom, Ngamia na Twiga. Maeneo ya visima yataunganishwa katika kituo kikuu cha usindikaji (kilicho katika eneo la kituo kikuu) ndani ya chimbo la mafuta la Ngamia, kupitia kwa mtandao wa laini za kusafirisha za ardhini. Eneo hili pia litajumuisha kituo cha kudhibiti taka na makazi ya wafanyakazi. Dampo la uhandisi litajengwa hapo karibu.

Pindi yakisindikwa, mafuta yatasafirishwa hadi Lamu ili kusafirishwa hadi nchi za nje ili kuuzwa kupitia bomba la kuzikwa linaloruhusiwa na kuendeshwa kando linalojulikana kama Bomba la Kusafirisha Mafuta Ghafi kutoka Lokichar hadi Lamu (LLCOP).

Maji yatatolewa katika Hifadhi ya Turkwel Gorge (inayojulikana kama “Bwawa la Turkwel”) na kutumiwa kuboresha kiasi cha mafuta kinachoweza kusindikwa. Bomba litasafirisha maji kutoka kwa Bwawa la Turkwel hadi katika kituo cha usindikaji kilicho ndani ya chimbo la mafuta la Ngamia. Njia na muundo wa bomba hili la maji unakamilishwa na litapewa idhini tofauti na tathmini yake ya athari za mazingira na kijamii.

Miundombinu ya Mradi pia itajumuisha njia mpya za ufikiaji na usambazaji wa umeme kupitia kwa laini za juu za usambazaji kati ya machimbo ya mafuta. Vituo tegemezi vinajumuisha kambi za ujenzi na maeneo ya kupokea na kuhifadhi vifaa kwa muda.

1.4 Historia ya usafishaji wa mafuta katika eneo hili ni ipi?

Kumekuwa na uchunguzi wa awali wa mafuta katika eneo la Mradi. Kisima cha kwanza cha uchunguzi kilichimbwa Januari 2012 na upimaji wa visima uliofuata ulifanywa mnamo 2015, 2017 na 2018.

Tullow Oil Kenya Ltd (kama mwendeshaji wa POK) ilikuwa ikitengeneza aina ya awali ya mradi huu iliyoitwa Foundation Stage Development (FSD), ambayo ilijumuisha sehemu ndogo ya machimbo yaliyopendekezwa ya mafuta, nafasi ya FSD imechukuliwa na Mradi huu.

Mradi unaoitwa Early Oil Pilot Scheme (EOPS) ulibuniwa ili kuelewa hali ya mafuta na kuhakikisha kuwa miundombinu inayohitajika ili kujenga kiwanja kizima (kama barabara) ilikuwepo. Huu ulikuwa mradi wa muda mfupi na ulijumuisha usafirishaji wa mafuta yasiyosafishwa kwa magari hadi Mombasa kwa usafirishaji hadi nchi za nje ili kuuzwa na shughuli zake zilikamilika mwishoni mwa 2019.

1.5 Ratiba ya Mradi ni ipi?

Ujenzi wa kwanza unalenga machimbo ya mafuta ya Amosing, Ngamia na Twiga na mafuta ya kwanza yanayozalishwa kutoka kwa machimbo haya) miaka mitatu baada ya mradi baada ya uamuzi wa mwisho wa uwekezaji kufanywa kuhusu Mradi. Ekales, Agete na Etom itajengwa katika miaka mitano hadi saba inayofuata.

Eneo la kituo kikuu na kituo kikuu cha usindikaji kinahitajika katika mafuta ya kwanza na kitajengwa kufikia mwaka wa tatu. Shughuli za uzalishaji (pamoja na ujenzi) zinatarajiwa kudumu kwa takribani miaka 25.

1.6 Ni utafiti upi wa mazingira na kijamii umefanywa?

Tathmini ya kitaifa ya athari za mazingira na kijamii (mara nyingi hufupishwa kuwa “ESIA”) imeandaliwa kwa ajili ya Mradi kama sehemu ya mchakato wa kutoa idhini wa Kenya.

Malengo ya kutathmini athari za mazingira na kijamii yalikuwa ili:

- Kuelewa jinsi Mradi unaweza kuathiri mazingira yaliyopo vyema au vibaya na watu wanaoishi karibu; na
- Kupata masuluhisho ya kupunguza athari mbaya hadi kwa viwango vinavyokubalika na kuongeza athari nzuri.

Mchakato wa tathmini ya athari za mazingira na kijamii ulianza mnamo 2016 wakati mada na aina za utafiti unaohitajika zilipojadiliwa na Mamlaka ya Taifa ya Usimamizi wa Mazingira (mdhibiti). Ilikubaliwa kuwa tathmini ya athari za mazingira na kijamii itazingatia:

- Mazingira ya kiasili yaliyopo:
  - maji ya juu (mito, mabwawa, lugga);
  - maji ya chini ya ardhi (ni maji yapi yanayopatikana kutoka kwa chemichemi za chini ya ardhi);
  - ubora wa hewa;
  - ikiwa ni kunyamavu au kuna kelele;
  - jiolojia na udongo;
  - mamalia, ndege, wadudu na mimea;
- Mazingira ya kijamii yaliyopo:

- ni nani anaishi karibu na huishi na kufanya kazi vipi;
- huduma za eneo husika na miundombinu;
- akiolojia;
- utamaduni wa eneo husika;
- jinsi mandhari ya eneo husika yanavyoonekana.

Utafiti wa kuelewa mazingira ya kiasili na kijamii yaliyopo ulifanywa kati ya 2016 na 2021 na wataalamu wa Kenya katika kila mada. Utafiti huu ulitumiwa ili kutathmini kama Mradi huu ulikuwa na uwezo wa kusababisha athari zozote ambazo zingekuwa na athari kuu zilizo nzuri au mbaya kwa mazingira ya kiasili na kijamii. Ikiwa athari zozote ziligunduliwa, basi hatua za kupunguza athari ili kuepuka, kupunguza kabisa, kurejesha, kulipa fidia au kuboresha haya zimetolewa na POK ili kupunguza athari hadi kwa viwango vinavyokubalika. Matokeo ya mchakato huu yamefupishwa katika Sehemu ya 4 ya muhtasari huu usio wa kiufundi.

1.7 Kusudi la waraka huu ni lipi?

Waraka huu ni muhtasari usio wa kiufundi wa matokeo kutoka kwa tathmini ya athari za mazingira na kijamii iliyokamilishwa kwa ajili ya Mradi. Unalenga kufafanua Mradi, mchakato wa tathmini, matokeo muhimu na ahadi za POK za kudhibiti na kufuatilia masuala yoyote yaliyotambuliwa ya mazingira na kijamii.

Toleo hili la muhtasari ambao sio wa kiufundi limeandaliwa kusaidia mchakato wa mashauriano wa Mradi kama sehemu ya tathmini ya athari za mazingira na kijamii. Baada ya mashauriano, litasasishwa ili kuzingatia maoni yoyote yanayofaa yatakayopokewa, na toleo la mwisho litajumuishwa kama sehemu ya tathmini kamili ya athari za mazingira na kijamii ambayo itawasilishwa kwa Mamlaka ya Usimamizi wa Mazingira ya Taifa kwa idhini.

1.8 Ni nani anayeidhinisha tathmini ya athari za mazingira na kijamii?

Nchini Kenya, miradi mikubwa ya maendeleo inahitaji tathmini ya athari za mazingira na kijamii kutayarishwa chini ya Sheria ya Usimamizi na Udhibiti wa Mazingira (1999) na Kanuni za Usimamizi na Uratibu wa Mazingira (Tathmini ya Athari na Ukaguzi) (2003), na marekebisho yake ya 2016 na 2019.

Mamlaka ya Usimamizi wa Mazingira ya Taifa ni shirika la utawala linalohusika katika uratibu wa shughuli za usimamizi wa mazingira nchini Kenya. Mamlaka ya Taifa ya Usimamizi wa Mazingira pia inawajibikia utekelezaji wa sera zote za serikali za mazingira, na pia kukagua na kupitisha tathmini za athari za mazingira na kijamii.

1.9 Ni nani ameandikia POK waraka huu?

Muhtasari huu ambao sio wa kiufundi umeandaliwa kwa ajili ya POK na Golder Associates (UK) Ltd na mwenzi wake wa Kenya Ecoscience and Engineering (Ltd) (Nambari ya Usajili wa Ustadi ya NEMA: 11492).

1.10 Ninaweza kutoa maoni kuhusu waraka huu?

Waraka huu utapatikana kwa ukaguzi wa umma na kutoa maoni kabla ya kuwasilisha tathmini ya athari za mazingira na kijamii kwa Mamlaka ya Taifa ya Usimamizi wa Mazingira. Maoni yanaweza kutolewa kabla ya 16 Agosti 2021 kwa POK, kupitia kwa:

Simu/WhatsApp: +254 702 956331

Barua pepe: POK@africaoilkenya.com

Maoni pia yanaweza kutolewa kwa Machifu wa eneo husika na Naibu Makamishna wa Kaunti ambao watawasilisha maoni kwa POK.

2.0 UFAFANUZI WA MRADI

2.1 Ni nani alipata mafuta?

Africa Oil na Tullow Oil walichimba kisima cha kwanza huko South Lokichar Basin (Ngamia-1 katika Block 10BB), mnamo Januari 2012. Hili limefuatwa na uvumbuzi kadhaa zaidi.

2.2 Hali ya kupewa leseni ya Mradi ikoje?

Chini ya Mikataba ya Kushiriki Uzalishaji kati ya Serikali ya Kenya na KJV, Mradi una leseni za uchunguzi za 10BB na 13T. Kufuatia kuwasilisha kwa Mpango wa Kujenga Kiwanja, pindi ukiidhinishwa na Serikali, leseni ya uzalishaji ya miaka 25 itatolewa.

2.3 POK inahitaji vibali vipi vingine?

Mradi unahitaji vibali na idhini anuwai za kiufundi pamoja na leseni ya Tathmini ya Athari za Mazingira ambayo itatolewa baada ya ukaguzi wa kuridhisha wa ripoti ya tathmini ya athari za mazingira na kijamii wa Mamlaka ya Usimamizi wa Mazingira ya Taifa. Mpango umeandaliwa ili kuhakikisha kuwa vibali na idhini zingine muhimu zinakuwa tayari kwa wakati unaofaa ili kusaidia ujenzi na utendaji.

2.4 Ni viwango vipi vitatumika kwa Mradi?

Mradi utazingatia sheria na viwango vyote vya mazingira na kijamii vya Kenya.

Aidha, POK itabuni na kusimamia shughuli zake kulingana na utendaji unaokubaliwa wa tasnia, ikiwa ni pamoja na Miongozo ya Mazingira ya Shirika la Kimataifa la Fedha, Miongozo ya Afya na Usalama na Viwango vya Utendaji. Kuzingatia miongozo na viwango hivi visivyo vya kisheria kutaandikwa katika Tathmini ya Ziada itakayotayarishwa kando na tathmini ya athari za mazingira na kijamii.

2.5 POK italipa ushuru na mirabaha?

Ndiyo, POK italipa ushuru na mirabaha, kulingana na Mikataba yake ya Leseni na Serikali ya Kenya.

2.6 Ni kiasi kipi cha mafuta kinapatikana?

Kufuatia kukaguliwa kwa data ya uchunguzi na tathmini, Kenya Joint Venture (KJV) inaamini mapipa milioni 560 ya mafuta yanaweza kupatikana kulingana na data iliyopo. KJV na Serikali ya Kenya wanashirikiana ili kukubaliana kuhusu ni kiasi gani kinachoweza kupatikana kiuchumi.

2.7 Mafuta yakoje? Sifa zake ni zipi?

Mafuta yana ubora mzuri na yana uzito wa rangi ya viatu. Asili ya “kuwa kama nta” ya mafuta yasiyosafishwa inamaanisha kuwa yatashikamana katika joto la kawaida. Mradi umebuniwa ili kuweka mafuta juu ya joto ambalo kwalo huanza kushikamana, ili yaweze kusindikwa na kutiririka kwa mfumo.

2.8 Maeneo ya visima yatajengwa vipi?

Zaidi ya maeneo 60 ya visima yatajengwa (au kurekebishwa kutoka kwa ujenzi wa awali) kwa zaidi ya miaka kumi. Kiwango cha kawaida cha eneo la kisima ni 250 m x 200 m.

Kwa kila eneo la kisima, mchakato ufuatao utatekelezwa:

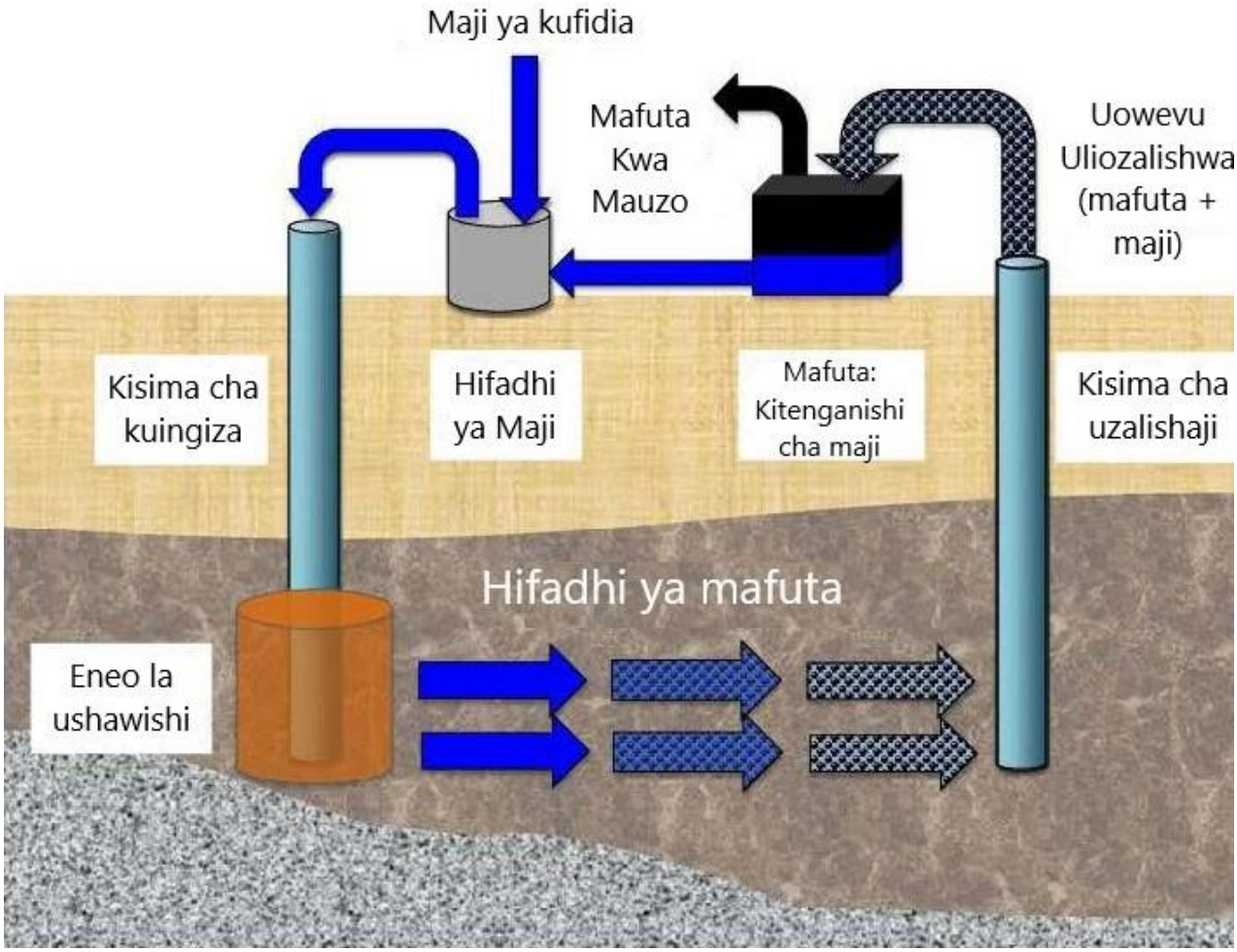
- Eneo litasafishwa na kusawazishwa. Mifereji ya maji na kinga dhidi ya mafuriko itawekwa. Baadhi ya mashimo yatachimbwa. Barabara za ufikiaji zitajengwa, na uzio wa mzunguko utawekwa;
- Visima vitachimbwa;
- Vifaa vya juu ya ardhi vya kituo vitajengwa; na

- Visima na vifaa vitazinduliwa.

Mchoro 3: Kisima cha Mafuta kilicho na Mfumo wa Kuchimba

2.9 Mafuta yatatolewa ardhini vipi?

Kila kisima cha mafuta kitakuwa na shimo lililochimbwa lililo na neli ya chuma. Mafuta yatatiririka hadi kwa ardhi na mchakato huu utasaidiwa kwa kuingizwa kwa maji ndani ya hifadhi ya mafuta ili kuboresha kupata mafuta kutoka kwa hifadhi za mafuta.



chanzo: Gieg na wenzake, 2011

Mchoro 4: Mchakato wa Kuzalisha Mafuta

2.10 Nini kitafanyikia mafuta baada ya kutolewa ardhini?

Mfumo wa laini za kusafirisha za ardhini utaunganishwa kwenye visima ili kupitishia mafuta hadi kwa kituo kikuu cha usindikaji ndani ya chimbo la mafuta la Ngamia.

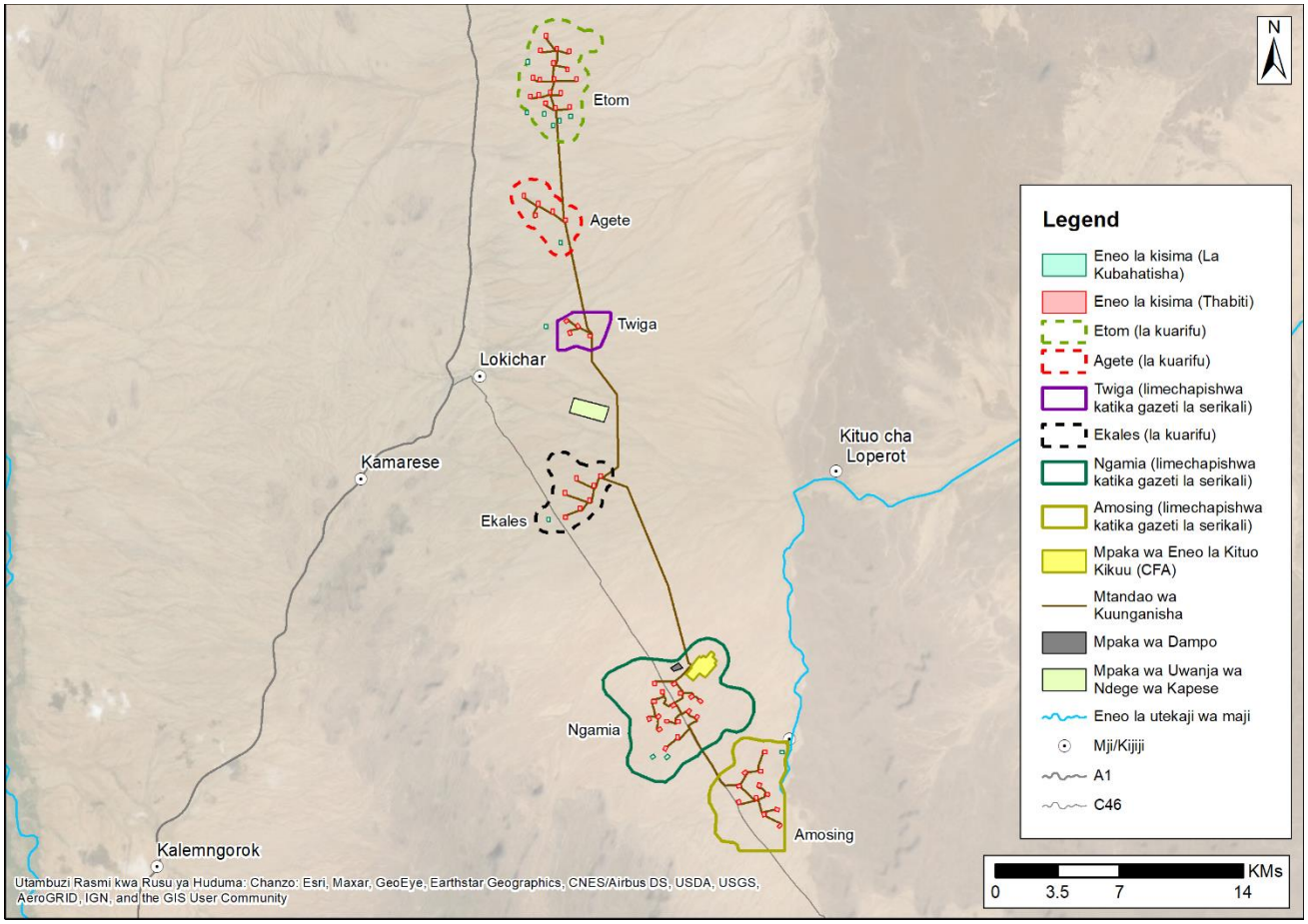
Katika kituo cha usindikaji, uowevu uliozalishwa utatenganishwa kuwa mafuta yasiyosafishwa, gesi na maji:

- Mafuta yasiyosafishwa yatafanywa kuwa thabiti ili kuwa tayari kusafirishwa hadi nchi za nje ili kuuzwa kupitia bomba la ardhini hadi Lamu;
- Gesi hiyo itatumika kwa uzalishaji wa joto na umeme au kubanwa na kuingizwa kwenye hifadhi ya mafuta tena; na
- Maji yatatibiwa, kupashwa moto na kuingizwa ndani ya hifadhi ya mafuta tena ili kusaidia kudumisha shinikizo.

2.11 Muundo wa Mradi ni upi?

Kwa jumla, takribani maeneo 60 ya visima yatajengwa (au kukarabatiwa) kama sehemu ya Mradi. Pia kuna maeneo 12 ya visima vinavyotarajiwa ambayo yametambuliwa. Maeneo ya visima vinavyotarajiwa hayahitaji kujengwa kama sehemu ya Mradi wa sasa lakini yanaweza kuhitajika katika siku zijazo.

Katika maeneo haya ya visima, Mradi una mpango wa kusakinisha takribani visima 1,200, na kila eneo la kisima likiwa na visima 12 hadi 24. Muundo wa Mradi ndani ya mazingira yake ya ndani unaonyeshwa kwenye ramani iliyo hapa chini (Mchoro 5).



Mchoro 5: Muundo wa Mradi ndani ya mazingira ya ndani

2.12 Mradi utapata maji yake wapi?

Katika sehemu ya mapema ya awamu ya ujenzi, Mradi utatoa maji kwa mtandao wa visima vilivyopo kwa muda mfupi ambavyo hutumia chemichemi za kina kifupi za maji ya chini ya ardhi za eneo husika.

Eneo la usambazaji wa maji linalotumika kwa Mradi ni Hifadhi ya Turkwel Gorge (inayojulikana kama “Bwawa la Turkwel”), hadi kusini magharibi (Mchoro 2). Bomba litasafirisha maji kutoka kwa Bwawa la Turkwel hadi katika kituo cha usindikaji kilicho ndani ya chimbo la mafuta la Ngamia. Njia ya bomba la maji inafanyiwa utathmini kwa sasa na itaruhusiwa kando na tathmini yake ya athari za mazingira na kijamii.

2.13 Ni kiasi kipi cha maji kitahitajika?

Wakati wa awamu ya ujenzi, makadirio ya mahitaji ya maji kutoka kwenye visima yatakuwa wastani wa takribani1,500 m3/siku kwa kipindi cha miezi 22.

Wakati wa utendaji, kutakuwa na mahitaji ya juu zaidi ya takribani 26,000 m3/siku katika Mwaka wa 4 wa utendaji, mahitaji ya maji yatapungua baadaye. Kwa muktadha, hii ni chini ya 2% ya maji ya wastani yanayotiririka hadi kwenye Hifadhi ya Turkwel Gorge (inayojulikana kama “Bwawa la Turkwel”) kila mwaka.

2.14 Ni barabara zipi mpya zitajengwa ili kufikia machimbo ya mafuta?

Mradi utajenga barabara za ufikiaji kama inavyotakiwa ili kufikia maeneo ya visima na vituo vingine kwenye kila chimbo la mafuta.

2.15 Mradi utapata usambazaji wake wa umeme kutoka wapi?

Wakati wa ujenzi usambazaji wa umeme kwa kambi za ujenzi, maeneo ya kazi, maghala na vifaa vya kuchimba visima utatolewa na jenereta za dizeli kwa muda mfupi.

Punde tu visima vitakapoanza kufanya kazi, Mradi utaweza kuzalisha umeme wake wote kwa kutumia gesi inayozalishwa pamoja na mafuta.

Pia kuna muunganisho uliopangwa kwa gridi ya Kenya, uliojengwa na Kampuni ya Usambazaji wa Umeme ya Kenya (KETRACO), ambao wanaunda mradi wa upanuzi wa njia ya usambazaji ya Turkwel hadi Lokichoggio, ambayo inapita karibu na eneo kuu la usindikaji huko Ngamia.

2.16 Mradi utapata usambazaji wa umeme katika machimbo ya mafuta vipi?

Laini za usambazaji za juu zitaelekezwa kutoka kwa eneo kuu la usindikaji ndani ya chimbo la mafuta la Ngamia, hadi kituo kidogo kwenye kila chimbo la mafuta.

2.17 Taka itadhibitiwa vipi?

Kituo cha kudhibiti na kusafisha taka kitajengwa katika eneo la kituo kikuu ndani ya chimbo la mafuta la Ngamia. Kituo hiki kitatumika kama kituo cha kupokea taka, kutunza, kupunguza kiasi, kushughulikia na kuhifadhi wakati wa utendaji.

Dampo la uhandisi litajengwa mapema katika mchakato wa ujenzi, ambalo litakubali taka za ujenzi na uchimbaji wakati kituo kikuu kinajengwa. Mara kituo kikuu kikijengwa, dampo hilo litakubali taka kadhaa za utendaji ambazo haziwezi kushughulikiwa katika kituo kikuu.

Kutakuwa na kituo tofauti karibu na dampo la uhandisi ambacho kitashughulikia matope yoyote yaliyochafuliwa ya kuchimba kutoka maeneo ya visima, ili kufanya matope kuwa salama ili kutupwa kwenye dampo.

2.18 Harufu itadhibitiwa vipi?

Vituo vyote vinajengwa kulingana na utendaji mzuri wa kimataifa ili kupunguza kusambaa kwa harufu kuanzia mwanzoni. POK itafuatilia harufu na itachukua hatua ikiwa harufu isiyokubalika itatambuliwa au ikiwa malalamishi yatatolewa.

2.19 Vifaa vya ujenzi vitaletwa kwenye eneo la Mradi vipi?

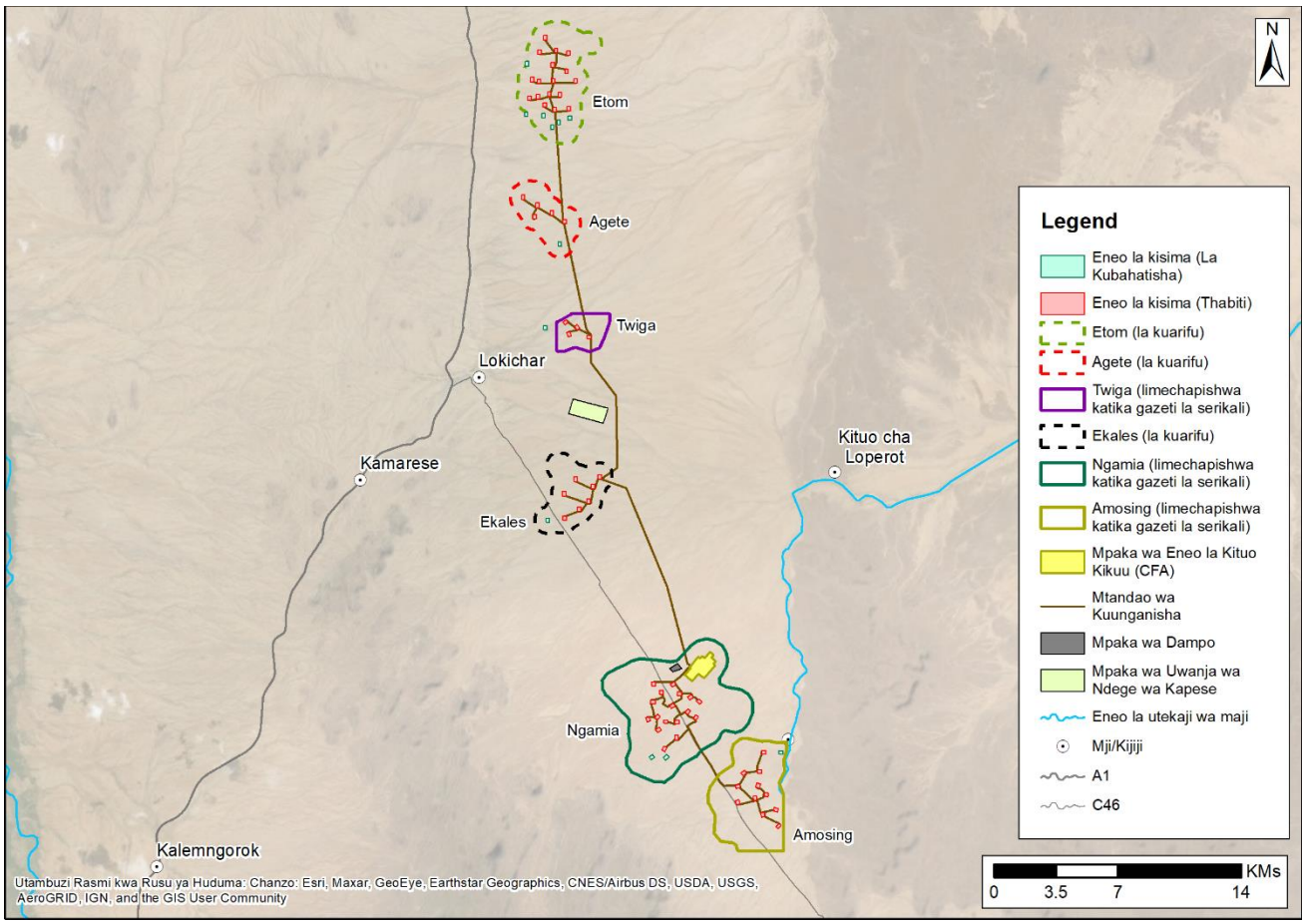
Mradi utahitaji vifaa vingi vya kujenga kuletwa kwenye eneo la ujenzi ili kujenga Mradi. utaratibu wa ugavi na usafirishaji unaohitajika utajumuisha njia zote za usafirishaji, ikiwa ni pamoja na bahari, hewa, barabara na reli. POK itaanzisha mfumo madhubuti wa usimamizi wa uchukuzi ili kuhakikisha kuwa bidhaa zinasafirishwa salama hadi kwenye eneo la Mradi.

2.20 Mradi unahitaji ardhi gani na utaipataje?

Tume ya Taifa ya Ardhi, kwa niaba ya Wizara ya Petroli na Uchimbaji Madini, iko katika mchakato wa kupata “poligoni” za ardhi zilizochapishwa katika gazeti la serikali katika maeneo tofauti ya machimbo ya mafuta.

Katika ramani iliyo hapa chini, poligoni za ardhi kwa kila chimbo la mafuta zinaonyeshwa na hali ya kuchapishwa kwenye gazeti la serikali na eneo la vituo linaonyeshwa ndani ya poligoni.

Mradi umebainisha eneo la takribani hekta 1,500 ndani ya eneo la ardhi ya poligoni. Ardhi iliyo nje ya maeneo yenye uzio itaendelea kupatikana kwa malisho.



Mchoro 6: "Poligani" za ardhi zinazotafutwa na Tume ya Taifa ya Ardhi

Kupata ardhi kwa ajili ya Mradi kutafuata mchakato wa kisheria utakaofanywa na Serikali ya Kenya ili kufanya ardhi ipatikane kwa ajili ya Mradi. Ili kuunga mkono mchakato wa kisheria wa kupata ardhi, Mradi utafanya shughuli za ziada za kusaidia riziki ili kuhakikisha kuwa riziki za kaya zilizoathirika haziathiriwi vibaya na Mradi. Hii inaweza kujumuisha kusaidia udhibiti wa malisho na mipango ya ufugaji.

2.21 Ni watu wangapi watafanya kazi katika Mradi?

Inakadiriwa kuwa kutakuwa na kilele cha takribani wafanyakazi 2,400 wakati wa ujenzi, na takribani wafanyakazi 500 wakati wa utendaji. Huu utakuwa mchanganyiko wa nafasi za walio na ujuzi, walio na ujuzi wa wastani na wasio na ujuzi.

2.22 Wafanyakazi wataishi wapi?

Wakati wa ujenzi, kutakuwa na kambi tatu za ujenzi za muda na kambi moja ya kudumu. Hizi zitapatikana katika kituo kikuu ndani ya chimbo la mafuta la Ngamia, na kambi tegemezi kwenye maeneo ya visima na mahali pengine inavyohitajika.

Katika utendaji, eneo la makazi huko Ngamia linalotumika kwa ujenzi litabadilishwa kuwa kambi ya kudumu.

2.23 POK itaunda fursa za ndani za ajira?

Kazi zinazohusishwa na Mradi zitahitaji ustadi anuwai na zitatoa fursa za ajira kwa wafanyakazi wasio na ujuzi, wenye ujuzi wa wastani na wenye ujuzi. Mahitaji ya mwisho ya kazi yatabainishwa wakati wa muundo wa kina wa mradi. Mradi utatekeleza mpango wa kuajiri wa ndani ili kutoa fursa za ndani za ajira.

2.24 Ni fursa gani zitabuniwa kwa ajili ya wauzaji wa ndani?

POK itatoa fursa kwa watoaji wa ndani wa bidhaa na huduma ili kushiriki katika shughuli za Mradi, ikiwa ni pamoja na kushirikiana kwa karibu na mwanakandarasi wa ujenzi aliyechaguliwa.

2.25 Machimbo ya mafuta yatafungwaje Mradi ukikamilika?

Ikichukuliwa kuwa hakutakuwa na matumizi mengine ya vituo vya Mradi, majengo yote na miundombinu inayohusiana itabomolewa na kutolewa ili kutumiwa tena, kuuzwa kwa mabaki, au kutupwa katika kituo kinachofaa chenye leseni ambacho kimeidhinishwa na Mamlaka ya Usimamizi wa Mazingira ya Taifa. Maeneo yaliyoharibika yatakarabatiwa ipasavyo.

3.0 KUWAHUSISHA WASHIKADAU

3.1 Mtazamo wa Mradi kuhusu kuwahusisha washikadau ni upi?

Tathmini ya athari za mazingira na kijamii ya POK imeandaliwa kwa washikadau wengi wa Kenya, katika ngazi za jamii, Kaunti na Taifa.

Kuwahusisha washikadau wa Mradi kulianza mnamo Disemba 2015. Mnamo 2021, kutakuwa na mashauriano na washikadau kuhusu muhtasari huu usio wa kiufundi na matokeo ya rasimu ya tathmini ya athari za mazingira na kijamii. Malengo ya mashauriano haya ni kuhakikisha kuwa washikadau wanaelewa mradi (ufunuo wa mradi) na masuala ya mazingira na kijamii ambayo unaweza kusababisha, pamoja na kuwa wasiwasi wa washikadau unaandikishwa, kujibiwa na kushughulikiwa katika tathmini ya mwisho ya athari za mazingira na kijamii. Mashauriano hayo yanatoa fursa kwa washikadau kujadili athari kuu zinazotarajiwa na hatua zinazopendekezwa za kupunguza athari na kufuatilia.

Washikadau ikiwa ni pamoja na jamii za eneo husika, serikali, asasi za kiraia na mashirika yasiyo ya serikali wataalikwa kushiriki katika mashauriano kuhusu rasimu ya tathmini ya athari za mazingira na kijamii.

Mradi umeandaa mpango wa kuwahusisha washikadau ambao unapatikana kwa umma kwenye tovuti ya Wizara ya Petroli na Uchimbaji Madini:

https://www.petroleumandmining.go.ke

3.2 Unapaswa kufanya nini ikiwa una lalamishi linalohusiana na Mradi?

POK imeunda mfumo wa kuhakikisha kuwa maswali au malalamishi yanashughulikiwa kwa uwazi na kwa wakati unaofaa. Washikadau wanaweza kuelekeza masuala ama kwa wawakilishi wa POK, ofisi zinazohusika za utawala wa Kaunti, au kupitia barua pepe ya Mradi. Masuala yote yatashughulikiwa katika kiwango cha chimbo kwa mara ya kwanza kwa lengo la kutatua masuala ndani ya kipindi cha siku 30. Ikiwa masuala hayawezi kutatuliwa katika eneo husika, yataelekezwa kwa daraja la juu ili kuhakikisha utatuzi kwa wakati unaofaa.

Malalamishi yanaweza kutolewa kupitia kwa:

Simu: +254 702 956331

Barua pepe: POK@africaoilkenya.com

Malalamishi pia yanaweza kutolewa kwa Machifu na Naibu Makamishna wa Kaunti ambao watayaelekeza kwa POK kwa utatuzi.

4.0 ATHARI ZINAZOWEZA KUTOKEA NA KUZIPUNGUZA

4.1 Mradi utaleta manufaa yapi?

Mradi utaleta manufaa ya kijamii na kiuchumi, huduma za elimu na Mipango ya Ustawi wa Jamii.

Mradi utaunda fursa za ajira za moja kwa moja na zisizo za moja kwa moja kupitia kwa wanakandarasi na wauzaji. Fursa za biashara zitaundwa katika uchumi wa eneo husika, sehemu na taifa unaohusiana na ununuzi wa huduma. Ushuru na malipo mengine ambayo yatalipwa kwa serikali za Kitaifa na Kaunti pia yatakuwa na ushawishi mzuri kwa mwendelezo wa ukuaji wa uchumi nchini Kenya.

4.2 POK inafanya nini ili kusaidia jamii ya eneo husika kunufaika kutoka kwa Mradi?

POK itatoa uwekezaji wa kijamii, kujenga kwenye miradi na mipango ya jamii iliyopo (kwa mfano elimu, huduma ya afya, uboreshaji wa barabara, mipango ya Afya ya jamii na kulisha mifugo na utunzaji wa usambazaji wa maji, kwa kushirikiana na serikali za Kaunti na Taifa.

4.3 Mradi utawaathiri vipi wanaoishi katika ardhi na wanaoitumia?

Ardhi iliyo Turkana ambako Mradi unapatikana ni ardhi ya umma. Tume ya Taifa ya Ardhi, kwa niaba ya Wizara ya Petroli na Kuchimba Madini, imepata na itapata “poligoni” za ardhi zilizochapishwa katika gazeti la serikali katika machimbo tofauti ya mafuta. Ndani ya poligoni hizo, Mradi umebainisha ardhi ya takribani hekta 1,500. Ili kupunguza athari za upatikanaji wa ardhi, ardhi isiyohitajika na Mradi ndani ya poligoni itaendelea kupatikana kwa malisho.

Wakati wa ujenzi, baadhi ya ardhi itawekewa uzio kwa muda kwa usalama. Wakati wa utendaji kutakuwa na vizuizi vya kudumu kwenye ardhi katika eneo la vituo vikuu, maeneo ya visima na dampo, ambapo ardhi itawekewa uzio na hakutakuwa na ufikiaji kwa malisho ya mifugo au makazi.Mahali ambapo ardhi haipatikani tena kwa matumizi ya malisho, hili litaangizwa katika shughuli za kurudisha riziki za Mradi. Katika hali ambazo kaya zinapaswa kuhamishwa, hili litafanywa kwa mujibu wa sheria za Kenya na Mradi utatoa msaada wa ziada haswa kwa kaya zinazoweza kudhuriwa.

4.4 Mradi utalinda vipi rasilimali za maji za eneo husika?

Wakati wa ujenzi na kabla ya maji kupatikana kutoka kwa Hifadhi ya Turkwel Gorge (inayojulikana kama “Bwawa la Turkwel”), Mradi unapanga kutumia maji yatakayotolewa katika visima vilivyopo katika eneo husika. Utafiti wa awali unaonyesha kuwa hili linaweza kupunguza kwa muda kiwango cha maji katika chemichemi za kina kifupi, ambazo hutumiwa na jamii kwa usambazaji wa maji, kupitia visima vya kuchimbwa kwa mikono na vinavyofanana) na kutoa maji ya chini ya ardhi ambayo yanasaidia ukuaji wa mimea. Ili kuelewa hili zaidi na kabla ya ujenzi, POK itakamilisha utafiti wa kina ili kuelewa mazingira ya maji ya eneo husika. POK itafuatilia viwango vya maji wakati wote wa ujenzi na itahakikisha mwendelezo wa usambazaji wa maji ikiwa huduma zozote za usambazaji wa maji za jamii zitaathiriwa.

Kazi yoyote ya ujenzi inayofanyika karibu na njia za maji itapangwa kufanyika wakati viwango vya maji viko chini au wakati hakuna mtiririko unaotarajiwa. Kuna taratibu maalumu za jinsi njia za maji (ikiwa ni pamoja na lugga) zinapaswa kupitwa na barabara za Mradi na mabomba au laini za kusafirisha ili kudhibiti ubora wa maji na wingi.

Taka zinazozalishwa na Mradi zitahifadhiwa kwa njia ambayo hakuna uchafu utafuja au kutolewa kwa nja za maji za eneo husika. Ufuatiliaji wa ubora wa maji ya chini ya ardhi (na maji ya juu/visima vya kuchimba kwa mkono inapowezekana) utafanyika wakati wa ujenzi na utendaji ili kuhakikisha ubora wa maji uko katika vipimo vinavyokubalika na viwango vya maji ya chini ya ardhi vitafuatiliwa ili kuhakikisha kuwa kuna maji ya kutosha kwa Mradi na watumiaji wa maji wa eneo husika.

POK itashirikiana na Mamlaka ya Maendeleo ya Bonde la Kerio (KVDA) inayowajibikia Bwawa la Turkwel ili kuhakikisha usambazaji wa maji kwa watumiaji wengine wa maji ya hifadhi hiyo hauathiriwi na Mradi.

Maji yanayotumiwa kupima ukamilifu wa laini za kusafirisha, ambayo yanaweza kuchafuliwa, yatatumika tena inapowezekana na yataondolewa kupitia kwa mabwawa ya uvukizi au kutolewa kulingana na mahitaji ya idhini ya Kenya.

4.5 Nini kitafanyikia mafuta ikiwa kuna ajali na yamwagike au kuvuja?

Laini zote za kusafirisha zinazosafirisha mafuta zitazikwa. Kutokana na sifa ya kuwa kama nta ya mafuta, ikiwa kuna kupasuka kwokwote katika laini za kusafirisha, mafuta yatashikamana (mafuta yasiyosafishwa hushikamana katika joto la kawaida). Vifaa vya kukabiliana na kumwagika vitapatikana kwenye maeneo ya visima na vituo vikuu na vitatumika haraka iwezekanavyo ikiwa kumwagika au kuvuja kutatokea.

Mradi utakuwa na Mpango wa Kukabiliana na Dharura na vifaa muhimu ili kukabiliana na dharura na kuomba msaada wa wataalamu ikiwa itahitajika.

4.6 Mradi utaathiri ubora wa hewa vipi?

Baadhi ya mabadiliko kwa ubora wa hewa uliopo yanatarajiwa wakati wa ujenzi na utendaji. Wakati wa ujenzi, athari kuu itatoka kwa vumbi itakayotolewa, ambayo inaweza kusababisha kero. Viwango vya vumbi vitafuatiliwa wakati wa ujenzi na hatua zaidi za kudhibiti zitachukuliwa ikiwa inahitajika ili kupunguza vumbi inayozalishwa. Idadi ya magari haitarajiwi kuwa juu ya viwango ambavyo masuala ya ubora wa hewa yanatarajiwa.

Wakati wa utendaji, shughuli katika kituo kikuu cha usindikaji zinaweza kusababisha kuzidi kwa viwango vya ubora wa hewa katika eneo maaalumu au maeneo ya ukubwa wa juu unaobashiriwa. Kuwa karibu kwa muda mfupi sio hatari lakini kuwa karibu kwa muda mrefu kunaweza kusababisha athari za kiafya kama matatizo ya kupumua. Katika maeneo haya, ujenzi wa majengo utapigwa marufuku ingawa wafugaji wanaweza kupita salama.

POK itahakikisha kuwa maeneo haya yametiwa alama bayana, na kwamba mfumo wa kushiriki umewekwa ili watu wote ambao wanaweza kuathiriwa wapokee habari inavyostahili.

4.7 Mradi utaathiri viwango vya kelele na mtetemo vipi?

Baadhi ya mabadiliko kwa viwango vilivyopo vya kelele yanatarajiwa wakati wa ujenzi na utendaji kutokana na shughuli za POK.

Wakati wa ujenzi, kelele itazalishwa na ujenzi wa miundombinu na vituo vya kazi na uchimbaji wa visima. Ikiwa kelele wakati wa ujenzi inazingatiwa kuwa inaweza kuwa juu ya viwango vinavyokubalika kwa muda mfupi, Mamlaka ya Usimamizi wa Mazingira ya Taifa itaarifiwa. Magari hayatarajiwi kusababisha kelele kubwa.

Wakati wa utendaji, vyanzo vya kelele vitajumuisha kituo kikuu cha usindikaji, maeneo ya visima, dampo na safari za ndege kuelekea na kutoka kwa uwanja wa ndege.

Wakati wa ujenzi na utendaji, kutakuwa na utaratibu wa kuwaarifu watu wanaoweza kuathiriwa na shughuli za kelele. Hii itajumuisha maelezo kuhusu wakati, mahali na kipindi ambacho kazi itafanyika, na maeneo ya kuepukwa kwa makazi na malisho. Ishara zitawekwa.

Hakuna athari za mtetemo zinazotarajiwa kuathiri jamii za eneo husika kutoka kwa ama ujenzi au utendaji.

4.8 Mradi utaunga mkono afya ya jamii na usalama, riziki na ustawi vipi?

POK itashirikiana na Serikali ya Taifa, Utawala wa Kaunti na washikadau wakuu ili kujenga huduma za afya kwa jamii zilizopo, usalama wa jamii na mipango ya kudhibiti ardhi ya malisho.

4.9 Kuingia kwa wafanyakazi kwa wingi kutadhibitiwa vipi na Mradi?

Kuingia kwa wingi kwa wahamiaji wa kubahatisha wanaotafuta ajira kutadhibitiwa kupitia mchanganyiko wa ufuatiliaji, kutoa motisha ya kupunguza uhamiaji usiodhibitiwa, usimamizi wa ujumuishaji wa wafanyakazi na jamii za wenyeji, na mawasiliano ya umma.

POK itashirikiana na Serikali ya Taifa, Utawala wa Kaunti na washikadau wakuu ili kuunda kikundi cha kushughulikia kuingia kwa watu wengi ili kukagua, kufuatilia na kusaidia hatua za kudhibiti kuingia kwa watu wengi kutokana na Mradi.

Kutakuwa na utaratibu wa kuajiri ambao hautajumuisha kuajiri kusiko rasmi (“langoni”).

4.10 Mradi utaathiri kupanda kwa gharama ya maisha vipi?

Wakati wa ujenzi, kuongezeka kwa hitaji la bidhaa na huduma za ndani kunaweza kusababisha kuongezeka kwa muda mfupi kwa gharama ya maisha. Wakati wa utendaji, hitaji la bidhaa na huduma linatarajiwa kupungua kutokana na kuongezeka kwa idadi ya wafanyakazi. POK itatumia wauzaji wa eneo husika na wa kitaifa ili kuhakikisha bei bora zaidi ya soko kwa bidhaa inapatikana, jambo litakalosaidia kudhibiti kuongezeka kwa gharama ya maisha katika eneo husika.

4.11 Usalama utadhibitiwa vipi katika eneo hilo?

Polisi wa Taifa na mamlaka nyingine za Serikali zinawajibikia usalama wa umma na sheria na utulivu. Mradi utaratibu kwa kushirikiana na mamlaka hizi na kuwasilisha masuala yoyote ya usalama kwa mamlaka zinazofaa.

4.12 Urithi wa kitamaduni (kama vile akiolojia, miti mitakatifu, destruri za kitamaduni) utalindwa vipi?

Hatua nyingi zitatumika ili kulinda urithi wa kitamaduni. Uchunguzi wa akiolojia utakamilishwa kabla ya ujenzi kuona ikiwa mabaki ya makazi ya zamani yapo katika eneo ambalo kituo kikuu kitapatikana. Utaratibu utawekwa ili kuweka rekodi za ugunduzi wowote wa akiolojia wakati wa ujenzi kwa kushirikiana na Jumba la Kumbukumbu la Kitaifa la Kenya.

Makaburi yatalindwa kupitia kwa upangaji upya wa miundombinu ya mradi au, ikiwa itahitajika, kuhamishwa kwa maziko, kwa kushauriana na jamii zilizoathiriwa. Wafanyakazi wote wataelimishwa kuhusu desturi za kitamaduni na aina za maeneo ambayo yanahitaji kulindwa ikiwa ni pamoja na kwa nini ni muhimu na yanakopatikana.

4.13 Mimea na wanyama watalindwa vipi?

Mradi utaepuka makazi nyeti na spishi kila inapowezekana. Utafiti wa mimea, mamalia, ndege, wanyama watambaao, amfibia, samaki na wanyama wasio na uti wa mgongo umekamilishwa na timu za wataalamu wa ndani.

Ikiwa kuna madhara yoyote au uharibifu unaowezekana wa makazi au spishi, na haiwezekani kuuzuia, POK imejitolea kwa hatua kadhaa za kurudisha makazi na spishi na kufuatilia maendeleo. Wakati wa baadhi ya ujenzi unaweza kupangwa inavyofaa ili kupunguza athari. Ikiwa itahitajika, kuna chaguo la kuhamisha spishi kwenda kwa eneo jipya (uhamishaji) kwa kushirikiana na Huduma ya Wanyamapori ya Kenya.

Wakati wa ujenzi, athari zozote kwa mimea na wanyama kutokana na utoaji wa maji chini ya ardhi zitafuatiliwa na, ikiwa inahitajika, POK itatekeleza mipango ya kutoa usambazaji mbadala wa maji ili kudumisha makazi nyeti yaliyoathiriwa.

Msimamizi wa mimea na wanyama ataajiriwa na Mradi ili kuhakikisha kuwa ahadi zote za kupunguza athari zinatekelezwa. Speshi kuu nyeti zitafuatiliwa katika kipindi chote cha kuwepo kwa mradi na hatua, kwa kushirikiana na Huduma ya Wanyamapori ya Kenya, itachukuliwa kuzilinda endapo athari zitagunduliwa.

4.14 Athari ya kuonekana ya Mradi itakuwa ipi?

Athari za kuonekana wakati wa awamu ya ujenzi na utendaji zinahusiana pakubwa na uwepo wa majengo, vifaa vya ujenzi, mwangaza bandia na vumbi kwenye maeneo ya visima, eneo la kituo kikuu na laini za juu za usafirishaji.

Wakati wa ujenzi, athari kwa ujumla zinatarajiwa kuwepo kwa muda mfupi na athari za muda mrefu zinatarajiwa wakati wa utendaji. Mimea asili iliyopo itahifadhiwa pale inapowezekana ili kutoa na kudumisha mazingira asili ya miundombinu, matumizi ya mwangaza bandia yatapunguzwa na kudhibitiwa, viwango vya kasi za magari vitadhibitiwa ili kupunguza vumbi.

5.0 UDHIBITI WA MAZINGIRA NA KIJAMII

5.1 POK itadhibiti ahadi zake za mazingira na kijamii vipi?

POK itaandaa na kutekeleza mfumo wa udhibiti wa mazingira na kijamii ambao utakidhi mahitaji ya Shirika la Viwango (ISO) 14001: 2015 na Kiwango cha Utendaji cha 1 cha Shirika la Kimataifa la Fedha.

Ndani ya mfumo huu wa udhibiti kutakuwa na *Mpango wa Utendaji wa Mazingira* na *Mpango wa Utendaji wa Jamii.* Mipango hii itaeleza jinsi POK inahakikisha kwamba hatari za mazingira na kijamii na ahadi zilizowekwa katika tathmini ya athari za mazingira na kijamii zinadhibitiwa na kutoa njia wazi ya kuhakikisha mambo haya yanafanyika, na yanaweza kukaguliwa. Inaweka wazi ni nani anayewajibikiwa kila shughuli, wakati kazi zinahitaji kukamilishwa na jinsi zitakavyofuatiliwa na kukaguliwa.

5.2 Ni maelezo yapi ya mazingira na kijamii yatakuwa yanapatikana kwa umma?

Tathmini ya athari za mazingira na kijamii itapatikana kwa umma baada ya mashauriano kukamilika na kuwasilishwa kwa Mamlaka ya Usimamizi wa Mazingira ya Taifa.

Kama sehemu ya mfumo wa udhibiti wa mazingira na kijamii, POK itaunda njia anuwai za kuruhusu washikadau kufahamishwa kuhusu utendaji wa POK katika kudhibiti athari za mazingira na kijamii. Hii itajumuisha kushirikisha washikadau wa eneo husika katika ufuatiliaji wa kushiriki wa mazingira, kuandaa ripoti ya kila mwaka ya utendaji wa mazingira na kijamii, mikutano ya mara kwa mara na ukaguzi na Mamlaka ya Usimamizi wa Mazingira ya Taifa na mikutano ya mara kwa mara na wanajamii wa eneo husika, wawakilishi na wasimamizi wa Kaunti.

5.3 Ni nani anawajibikia kudhibiti masuala ya mazingira na kijamii wakati wote wa kuwepo kwa Mradi?

POK inawajibikia utendaji wake na wanakandarasi wake. Wakati wa ujenzi, POK itasimamia utendaji wa wanakandarasi wake wa ujenzi. Wakati wa utendaji, POK itachukua udhibiti wa moja kwa moja wa utendaji. POK itashirikiana kwa karibu na Mamlaka ya Taifa ya Usimamizi wa Mazingira na Kamati ya Mazingira ya Kaunti ili kuhakikisha kuwa masuala yanadhibitiwa kwa uwazi na ushirikiano.

5.4 POK itafuatilia shughuli zake vipi?

Kama sehemu ya *Mipango* yake ya *Utendaji wa Mazingira na Kijamii* na kulingana na mahitaji yaliyoainishwa katika tathmini ya athari za mazingira na kijamii, POK itaunda na kutekeleza hatua za kina za ufuatiliaji ili kuhakikisha kuwa inaweza kuangalia kuwa hatua na ahadi za udhibiti wa mazingira na kijamii zinafanya kazi, na kwamba inatimiza mahitaji yake ya kisheria na ahadi zingine.

POK itaendelea kufuatilia hatari za mazingira na kijamii katika awamu zote za mradi, ikiwa ni pamoja na wakati wa kumaliza kazi, na baada ya Mradi kufungwa.

5.5 POK itafanya nini wakati wa dharura?

POK itaanzisha mpango wa jumla wa kukabiliana na dharura ambao utafafanua taratibu za kufuata wakati wa ajali, tukio au dharura nyingine. Huu utashughulikia hali anuwai na utaratibiwa na huduma ya Polisi na utawala wa Kaunti. Kukabiliana na dharura kunakofaa kwa POK na vituo vya matibabu vitakuwepo kushirikiana na Polisi na Utawala wa Kaunti.

5.6 POK itadhibiti afya na usalama wa wafanyakazi wake na jamii za eneo husika vipi?

Mifumo ya kudhibiti afya na usalama wa wafanyakazi na taratibu za uendeshaji wa shughuli zitaandaliwa na zitakidhi mahitaji ya Shirika la Kimataifa la Viwango (ISO) 45001: 2018.

POK na wanakandarasi wake watatii sheria zote zinazofaa za afya na usalama wa wafanyakazi za Kenya wakati wa awamu zote za Mradi.

Wafanyakazi wote wa POK na wanakandarasi watapewa mafunzo ya uhamasishaji kuhusu afya ya jamii, usalama na ulinzi na Kanuni za Maadili zitapatikana ili kuhakikisha uhusiano wa heshima unadumishwa na jamii za eneo husika.

5.7 POK itahakikishaje kuwa wafanyakazi wake wanatendewa haki?

POK itakuwa mwajiri anayetoa fursa sawa kwa wote na asiye na ubaguzi. Wafanyakazi wote watapata huduma ya siri ili kuwasaidia iwapo kuna malalamishi kuhusu mahali pa kazi.

POK itaandaa na kutekeleza Kanuni za Maadili ambazo zitatumika kwa wafanyakazi wa POK na wanakandarasi. Itaeleza taratibu na mahitaji ili kuhakikisha kuwa POK na wakandarasi wake wanaheshimu na kulinda kanuni za msingi na haki za wafanyakazi kupitia kwa kukuza heshima ya kibinafsi na mahali salama pa kazi. Hii ni pamoja na:

- kutendewa haki, kutobaguliwa na fursa sawa kwa wafanyakazi wote;
- kuanzisha, kudumisha na kuboresha uhusiano mzuri wa usimamizi wa wafanyakazi;
- kufuata sheria za taifa za kazi na ajira;
- kulinda na kukuza usalama na afya ya wafanyakazi, haswa kwa kukuza hali salama na nzuri ya kufanya kazi; na
- kuzuia matumizi ya kazi ya kulazimishwa na ajira kwa watoto.

Julai 2021

Ukurasa wa Sahihi

Golder Associates (UK) Ltd

Andrew Morsley
Msimamizi wa Mradi

Rachel Lansley
Msimamizi wa Mradi

Kampuni imesajiliwa Wingereza Nambari.1125149
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GOLDER

MEMBER OF WSP

ecoscience ENGINEERING LTD

Project Oil Kenya – Upstream Oil Production

ESIA CONSULTATION WORKSHOP

July - August 2021

1. INTRODUCTIONS

AGENDA

ESIA CONSULTATION:
Project Oil Kenya – Upstream Oil Production

- **Project Sponsor –** The Government of Kenya – represented by the Ministry of Petroleum & Mining is the Project Sponsor

- **Contractor** - The Kenya Joint Venture (KJV), comprising the International Oil Companies, is the Government's Contractor to implement the Porgramme under the terms of the Production Sharing Contract

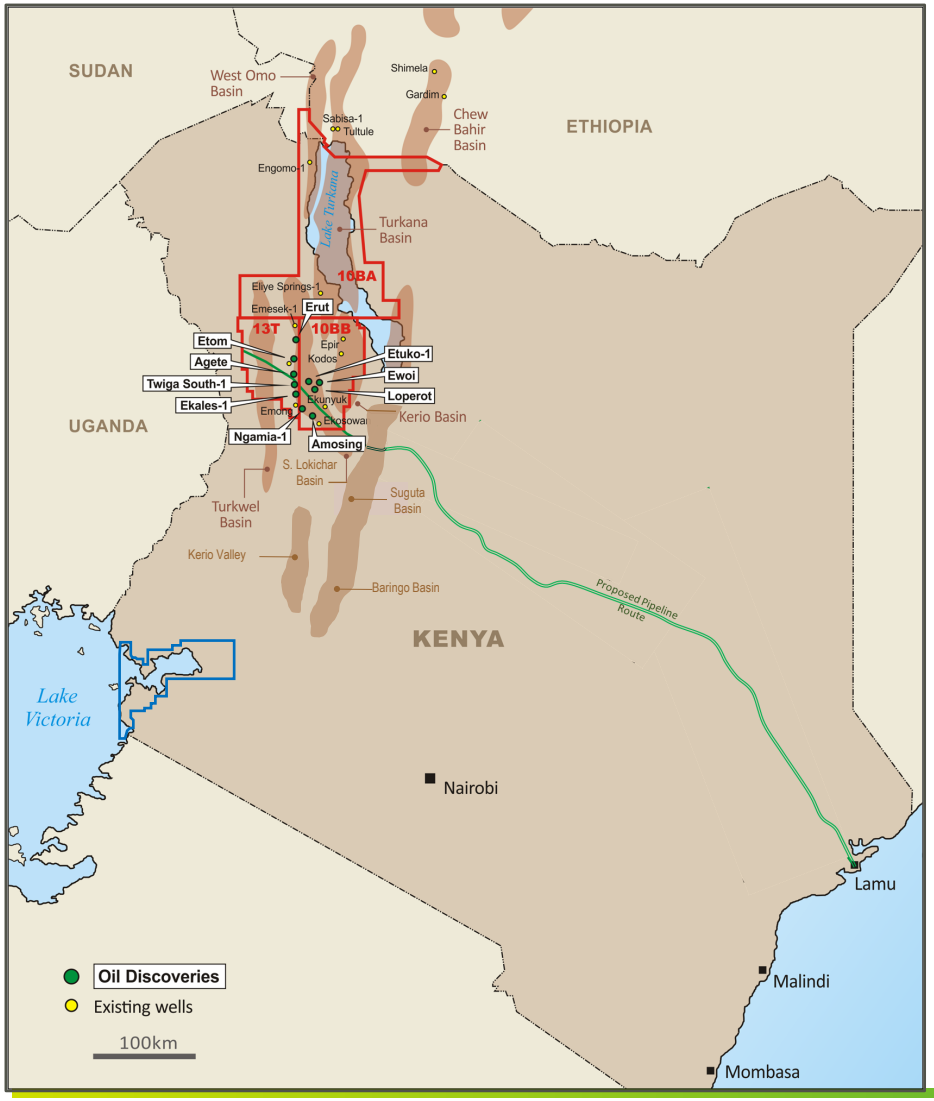
- **Project Proponent** - The KJV is the Project Proponent for the ESIA

- **ESIA Consultants** - Independent consultants appointed to undertake the ESIA are Golder and EcoScience

- **Project Oil Kenya (POK)** - The name used to refer to the overall Programme

2. PURPOSE OF MEETING

3. PROJECT OVERVIEW



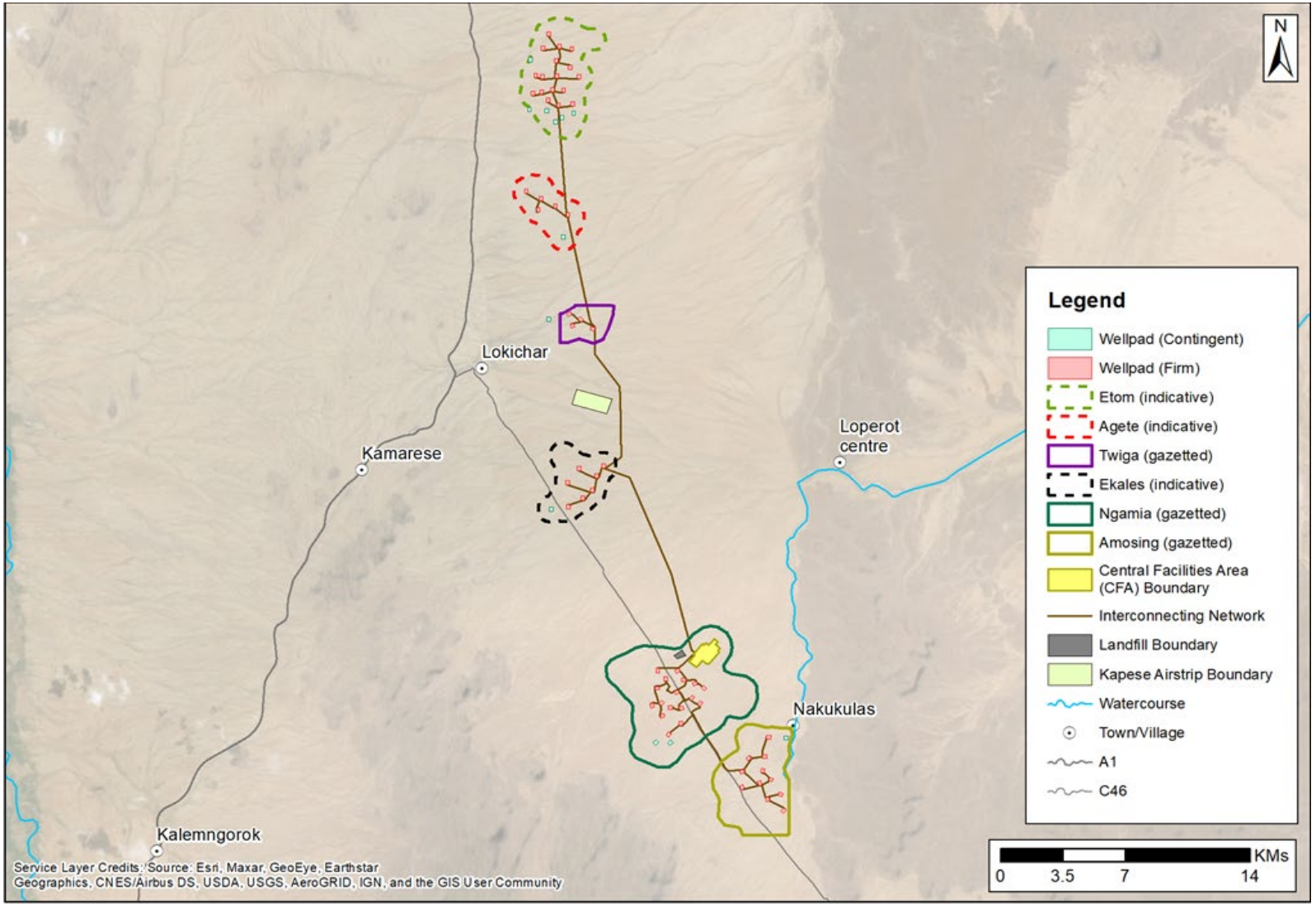
Project Oil Kenya – Upstream Oil Production

Develops total of 6 fields located in blocks 10BB and 13T.

Oil developed in phases from the six fields over 10 years

- Amosing, Ngamia & Twiga
- Ekales
- Agete
- Etom

3. PROJECT OVERVIEW: FIELD LAYOUT



CENTRAL PROCESSING FACILITY

- Oil **130,000 bbls/d**
- Water 330,000 bbls/d
- Oil storage 390,000bbls
- Power gen 75 MW
- Emergency flare

TWIGA

- **54 wells**

NORTHERN/ETOM FIELDS

- **434 wells**

NGAMIA

- **246 wells**

AMOSING

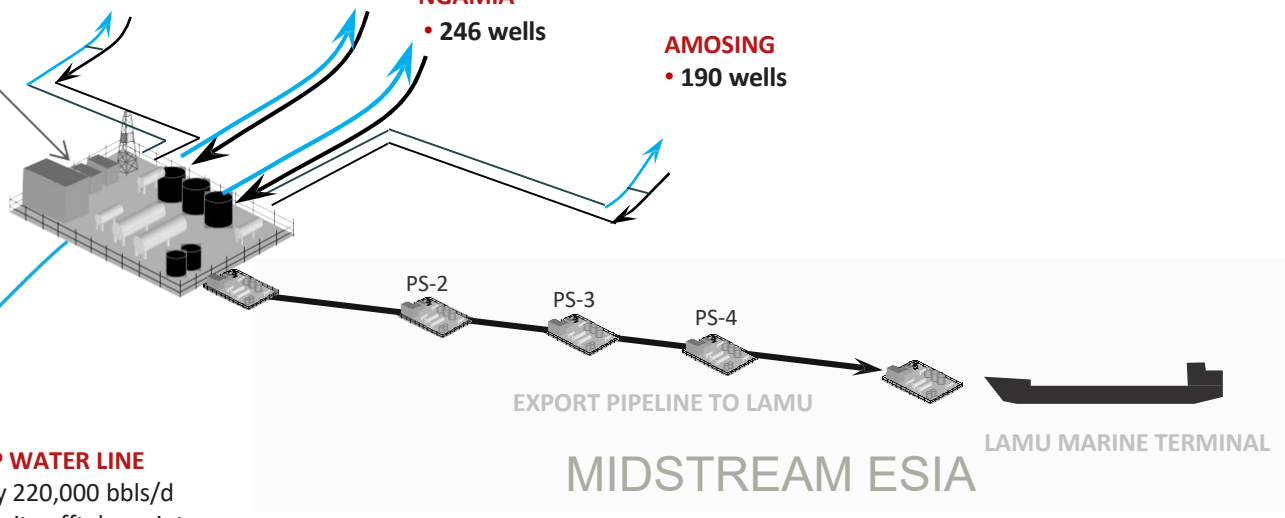
- **190 wells**

LAND

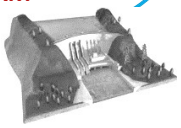
- ~1,500 Ha total
- Land usage mostly unimpacted

CENTRAL FACILITIES AREA

- Waste Management
- Warehousing & Offices
- Construction & Permanent Camps
- Logistics Laydown & Storage



TURKWEL DAM



MAKE UP WATER LINE

- Capacity 220,000 bbls/d
- Community offtake points

- Well pads connected via flowlines to the Central Processing Facility (CPF) for oil treatment
- Water is injected to maintain reservoir pressure and improve the overall oil recovery.
- Water source is Turkwel Gorge reservoir with supply to the CPF via a pipeline.
- Oil will be transported via the Lokichar to Lamu Crude Oil Pipeline for export via sea tankers (separate ESIA in process)

3. PROJECT OVERVIEW: LAND ACQUISITION

Land component	Specific land	Estimated Land Requirement (ha)
CFA	CFA Outer	250
	Well pads	550
Landfill	Landfill Ngamia	50
Infield interconnecting Network	Pipeline, infield- OHTL and Road network	650

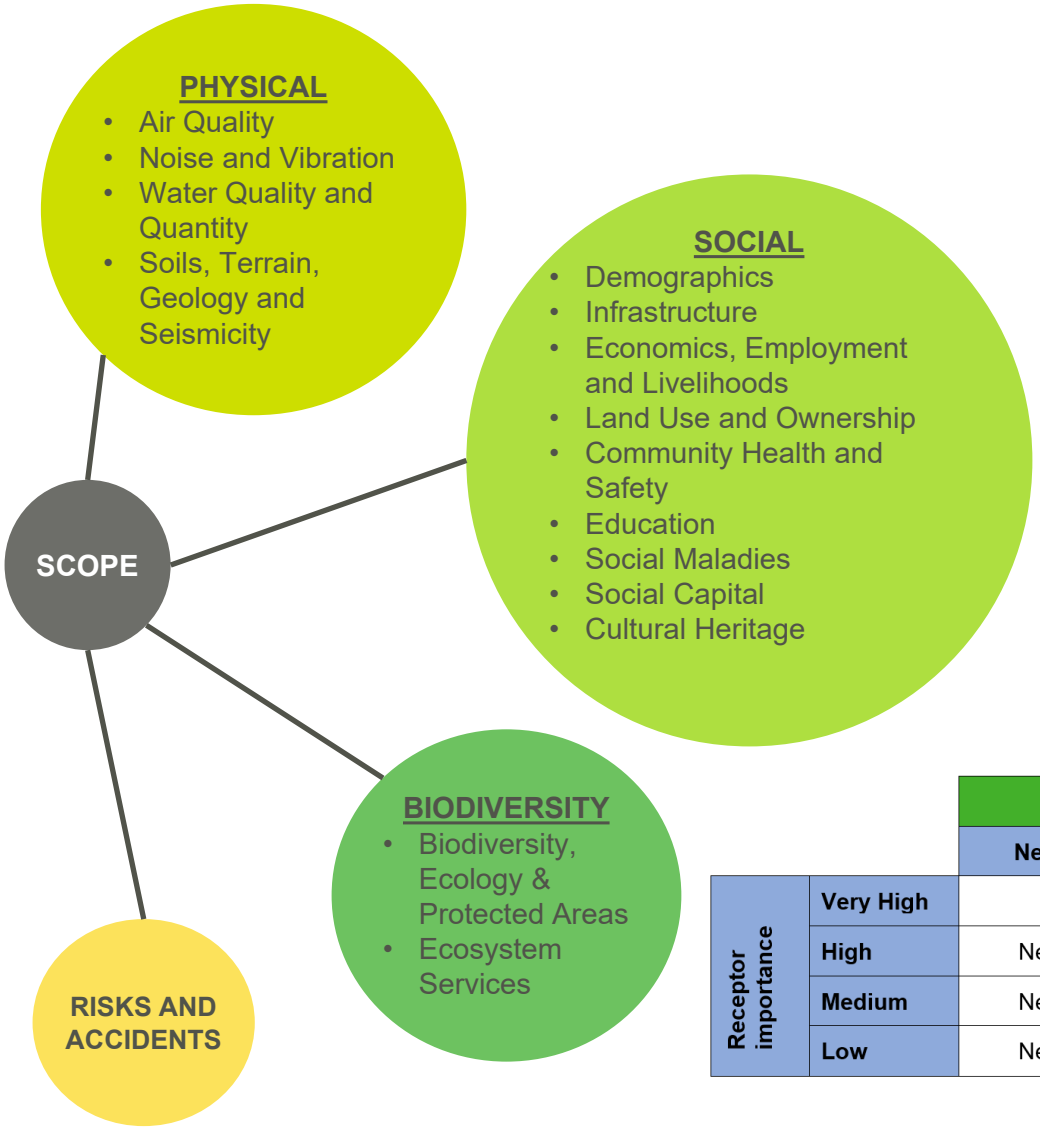
3. PROJECT OVERVIEW: EMPLOYMENT

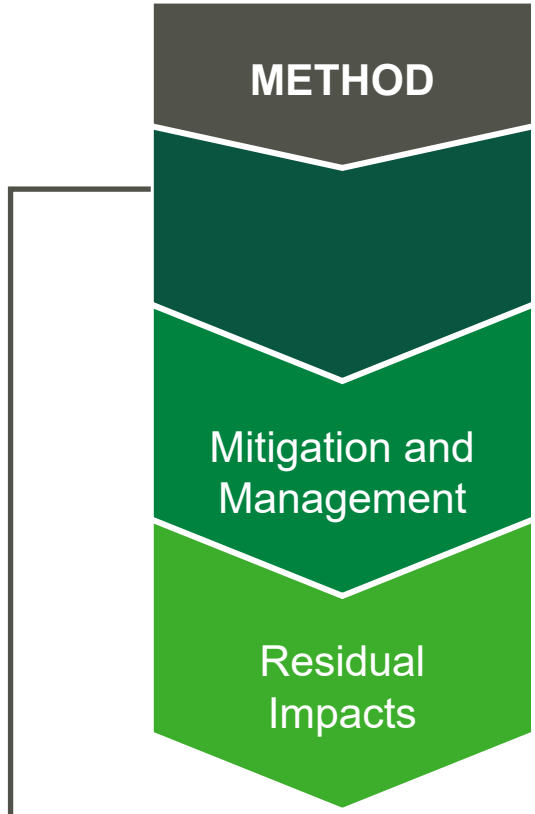
November 2015	Scoping Consultations
December 2015	Project report and Terms of Reference submitted
March 2016	Terms of Reference approved by NEMA
July 2016 to May 2021	Baseline data collection and continued engagement with key project stakeholders
July/ August 2021	Draft ESIA to be made publicly available
July/August 2021	**ESIA Stakeholder Consultation**
Q3 2021	*ESIA to be submitted to NEMA*

Key Stakeholders for Engagement

National Government Elected and Appointed Officials	County Government Elected and Appointed Officials	Community Stakeholders
• Members of Parliament • County Commissioner, Deputy County Commissioners and Assistant County Commissioners • Location Chiefs and Sub-location Assistant Chiefs • Chief's Elders	• Governor and other officials in the administration • County Executive Committee (i.e., all Ministries (Turkana) and Departments (West Pokot) • Members of County Assembly (MCAs); • Sub-county Administrators • Ward Administrators • Village Administrators	• Traditional Elders, and other traditional governance leaders • Community members where Project infrastructure is located

5. ESIA Method





		Magnitude of Impact			
		Negligible	**Low**	**Medium**	**High**
Receptor importance	**Very High**	Minor	Moderate	Major	Major
	High	Negligible	Minor	Moderate	Major
	Medium	Negligible	Minor	Minor	Moderate
	Low	Negligible	Negligible	Minor	Minor

Air Quality

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Dust from construction of all Project infrastructure	Dust management procedures, transport management, inform local stakeholders of what when where construction activities will occur. Daily dust monitoring, netting / barriers if required, signage.	Minor (negative)
Development of Borrow pits	Pre construction survey to identify receptors, engagement with Regulator and stakeholders about location	Minor (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Operational emissions ($PM_{2.5}$) from CFA	During detailed design, the CFA fenceline will be amended to include areas where it is unsafe to reside or stay for extended periods, monitoring, signage	Minor (negative)
Odour around facilities	Odour Abatement technologies, storage of odorous materials in sealed tanks, equipment maintenance, inspections, training, monitoring	Negligible

Noise and Vibration


Noise monitoring

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Construction of all Project infrastructure	Regular noise monitoring, NEMA will be notified where statutory limits exceeded, information and signage about when, where and how long the works will take place, areas to be avoided for settlement and grazing, regular monitoring for homestead development	Minor (negative)
Well drilling		Minor (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
CFA Operation, Wellpad operation	Regular noise monitoring, information and signage about when, where and how long the works will take place, areas to be avoided for settlement and grazing, regular monitoring for homestead development	Minor (negative)

Water Resources (Surface & Groundwater)

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Sediment loading due to construction activities	Regular monitoring, Trigger values for action, limit the potential for erosion	Minor (negative)
Waste management discharges	Regular monitoring, Trigger values for action procedures relating to disposal of hydrotest water, leachate and water management at waste facility	Minor (negative)
Key Potential Impact (Operations)	**Key Mitigations**	**Residual Impact**
Waste management discharges	Regular monitoring, Trigger values for action, leachate and water management at waste facility	Minor (negative)

Water Resources (Surface & Groundwater)

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Abstraction of groundwater during construction affecting water users	Hydrogelogical investigations, trigger values for action, alternative water supplies when required, monitoring downgradient of activities and in abstraction zone	Minor (negative)
security of water supply from Turkwel Gorge Reservoir	Turkwel Gorge Reservoir and contingency plans if water demand unavailable	Minor (negative)
Flood risk downstream of infrastructure	further flood risk analysis on current layout	Minor (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
security of water supply from Turkwel Gorge Reservoir	Turkwel Gorge Reservoir monitoring and contingency plans if water demand unavailable	Minor (negative)

Soils, Geology and Geohazards

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Ground disturbance leading to potential soil erosion	Avoid extreme events, Soil erosion management measures, Salvage topsoils, Natural revegetation following construction	Negligible

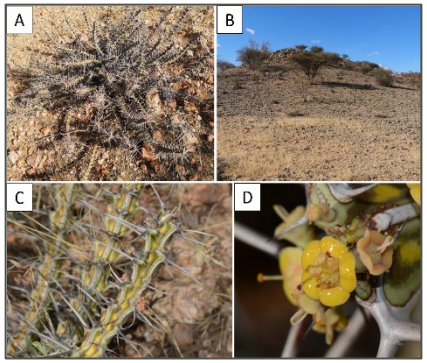
Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Ground disturbance leading to continued soil erosion potential	Erosion and sediment control procedures	Negligible

Biodiversity

Baseline data:

Numerous baseline field surveys for seasonal data between 2016 and 2021 for the following:

- Vegetation communities
- Flora
- Reptiles and amphibians
- Insects
- Birds
- Mammals



Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Sensory disturbance (light and noise) of fauna	Lighting control, appointment of a Biodiversity Supervisor, Transport management	Minor (negative)
Direct mortality of fauna from construction traffic	demarcation of sensitive areas, monitoring support to KWS, Transport management, inductions for biodiversity	Minor (negative)
Temporary loss of habitat during construction of Project infrastructure	demarcation of sensitive areas, monitoring support to KWS, revegetation/remediation procedures, appointment of a Biodiversity Supervisor, inductions for biodiversity and invasive species management	Minor (negative)
Impacts on birds due to overhead transmission lines	bird friendly infield OHTL design measures, monitoring support to KWS,	Moderate (negative)
Construction water abstraction impact on water supply to Critical Habitats	monitoring species (Turkana toad and Omophron beetle) and critical habitats during construction water abstraction	Moderate (negative)
Spread of alien invasive species	revegetation/remediation procedures, management of invasive species, appointment of a Biodiversity Supervisor, inductions for biodiversity and invasive species management	Minor (negative)
Increased access potentially resulting in poaching	monitoring support to KWS, revegetation/remediation procedures	Minor (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Sensory disturbance (light and noise) of fauna	Lighting control	Minor (negative)
Impacts on birds due to overhead transmission lines	bird friendly infield OHTL design measures	Moderate (negative)
Spread of alien invasive species	appointment of a Biodiversity Supervisor, management of invasive species,inductions for biodiversity and invasive species management,	Minor (negative)
Increased access potentially resulting in poaching	monitoring support to KWS	Minor (negative)

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Changes to land cover affecting cultivated foods	Avoidance, management and rehabilitation of cultivation areas, bee keeping enterprises will be avoided by micro alignment or relocation	Negligible
Changes to land cover affecting grazing / browsing for livestock	Investigate existing grazing patterns and provide livelihood restoration support aimed at improving livestock grazing, Influx management	Minor (negative)
Reduced wild food plant and medicinal plant availability	Identify vulnerable people dependent on wild foods/ medicinal plants and measures to maintain current wild food availability. Zero tolerance for employees hunting, foraging, unpermitted use of natural resources	Minor (negative)
Availability and quality of fresh water for drinking	Management of water availability and temporary alternative water supplies to affected water users	Minor (negative)
The loss or disturbance of sacred sites	Micro alignment to avoid direct impacts to known graves, consult with Project Affected Communities, Cultural Awareness Training	Minor (negative)
Construction-phase changes in the visual, noise aesthetics of the landscape	information campaign to inform of the construction activity dates and the potential for increased noise	Moderate (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Changes to land cover affecting cultivated foods	Influx management procedures and monitoring,	Minor (negative)
Changes to land cover affecting grazing / browsing for livestock	culturally appropriate livelihood restoration support aimed at improving livestock grazing livelihoods	Moderate (negative)
Reduced wild food plant and medicinal plant availability due to reductions in woodland/ bush land cover	Zero tolerance for employees hunting, foraging, unpermitted use of natural resources	Minor (negative)
Changes to biomass fuel, wood and fibre	Influx management procedures and monitoring	Minor (negative)
Changes to spiritual values	Cultural Awareness Training	Moderate (negative)
Changes in the visual aesthetics and sense of place	Cultural Awareness Training	Moderate (negative)

Emergency, Accidental and Non-Routine Events

- Laboratory tests show waxy nature of the crude means it will solidify on exposure to air or water

Landscape and Visual

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Changes to views for local communities, dust generation	Existing natural planting retained to provide and maintain natural screening, artificial lighting minimised, traffic speed limits managed to reduce dust, Earth bunding around well pads, metal surfaces will be matt (non-reflective finish) and painted surfaces will be muted with natural colours	Minor

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Changes to views for local communities	Existing natural planting maintained, artificial lighting minimised, traffic speed limits will be managed to reduce dust, Earth bunding around wellpads	Minor

Cultural Heritage

identified at the CFA

past settlement

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Loss of cultural heritage sites (e.g. grave sites) due to vegetation clearing, ground disturbance, surface stripping	Staff training will include awareness of cultural practices and the types of sites, Chance Finds Procedure, NMK archaeological investigation at central facilities area, graves avoided through micro-alignment or if not relocated in line in Kenyan law,	Minor (negative)
Dust and visual disturbance to Sacred Trees	Staff training will include awareness of cultural practices and the types of sites, continued community consultation on cultural heritage	Minor (negative)
Infield OHTL changes visual setting for Sacred Trees	continued community consultation on cultural heritage	Minor (negative)
Socio-economic changes to Pastoralists (intangible)	Staff training will include awareness of cultural practices and the types of sites, continued community consultation on cultural heritage	Moderate (negative)

Cultural Heritage

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Dust and visual disturbance to Sacred Trees	Staff training will include awareness of cultural practices and the types of sites, continued community consultation on cultural heritage	Minor (negative)
Infield OHTL changes visual setting for Sacred Trees	continued community consultation on cultural heritage	Minor (negative)
Socio-economic changes (intangible)	Staff training will include awareness of cultural practices and the types of sites, continued community consultation on cultural heritage	Moderate (negative)

Social Baseline

- Administrative divisions and government structure
- Population demographics
- Infrastructure and services
- Economics and livelihoods
- Land use and ownership
- Community health and safety
- Education
- Social maladies
- Social capital, security and conflict
- Land survey – wellpads and CPF

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Project-induced influx and in-migration	Influx management procedures, support monitoring of population changes and to influx working group, no at the gate recruitment, Code of Conduct, UN principles on Human Rights, Local Content process to explain job opportunities, managed contractor demobilisation	Moderate (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Project-induced influx and in-migration	maintain influx management procedures, maintain support monitoring of population changes and to influx working group, Code of Conduct, UN principles on Human Rights, campaign to communicate job opportunities	Moderate (negative)

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Project related impacts on infrastructure and activities	Mechanisms for community investment, building on existing initiatives, implementation of community development plans	Positive
Change in access to education	strategy for future social investment in education for project affected people, monitoring and evaluation for effectiveness	Positive

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Project related impacts on infrastructure and activities	Maintenance of community development plans	Positive
Change in access to education	Maintain strategy for future social investment in education for project affected people, monitoring and evaluation for effectiveness	Positive

Economics & Employment - Impact Assessment

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Contractor construction and employment opportunities	National and Local Content Development Plan to define contractor responsibilities, workforce training, communication of opportunities and criteria for local recruitment, managed contractor demobilisation, Code of Conduct, UN principles on Human Rights	Positive
local business opportunities	National and Local Content Development Plan to define supplier responsibilities, communication of opportunities and criteria for suppliers and procurement, monitoring of changes in business opportunities using performance indicators	Positive
Project induced inflation due to increased salaried employment and procurement	Strategy for best market price, to help manage local inflation, POK to supplement NDMA data collection, quarterly review	Positive

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Contractor employment	maintain procedures and requirements related to contractor employment and procurement, communication of opportunities and criteria for local recruitment	Positive
local business opportunities	Maintain National and Local Content Development Plan, communication of opportunities in operations, monitoring of changes in business opportunities using performance indicators	Positive
Project induced inflation due to increased salaried employment and procurement	review inflation monitoring established during construction, POK to supplement NDMA data collection,	Positive

Land and Livelihoods - Impact Assessment

Key Potential Impact (Construction)	Key Mitigations	Residual Impact
Long term loss of community land	Government-led statutory land acquisition process, with supplementary assistance addressed with POK Resettlement and Livelihood Restoration Plan, land take minimized and existing land users able to continue use of gazetted land	Minor (negative)
Temporary restriction on land use (pastoral grazing)		
Loss of occupied homesteads		
Loss of household and business structures		
Loss of access or increased distance to community water points	Equivalent water supplies will be provided, monitoring and evaluation process to assess the effectiveness of measures to maintain water supplies	Minor (negative)
loss of communal land (livelihoods)	Government-led statutory land acquisition process, with supplementary assistance addressed with POK Resettlement and Livelihood Restoration Plan, including culturally appropriate livelihood restoration support for improving livestock grazing livelihoods in Project Affected Areas	Negligible
Impacts on graves	Micro-alignment of infrastructure to avoid where possible, demarcation of graves, relocation in line with Kenyan law as needed	Minor (negative)

Key Potential Impact (Operations)	Key Mitigations	Residual Impact
Loss of occupied homesteads	continue monitoring and evaluation of the implementation of the RLRP, audit to confirm that livelihoods have been restored	Negligible
loss of communal land (livelihoods)	Continued livelihood restoration support for improving livestock grazing livelihoods in Project Affected Areas	Negligible

Community Health, Safety and Security: Impact Assessment

Key Potential Impact (Construction and Operations)	Key Mitigations	Residual Impact
Introduction of outside workforce leading to changes to Sexually transmitted infections	Community Health Information System and HIV Policy and Programme, Strategy to set targets for awareness, treatment and demonstrating performance in viral suppression to combat HIV/AIDs, *closed camps,* POK Code of Conduct , build on existing social investment in areas at higher risk due to Project impacts	Minor (negative)
Alteration of the physical environment, leading to Vector related diseases	Community Health Information System, Malaria Management procedures**,** monitoring	Minor (negative)
Introduction of outside workforce leading to Communicable diseases	Project-related workers accommodated in camps, *closed camps,* POK Code of Conduct, Infectious Disease Health Policy and Programme, Pandemic Preparedness Plan (including Covid), monitoring, social investment in areas at higher risk due to Project impacts	Minor (negative)
Accidents and injuries due to construction traffic	Transport management, POK Code of Conduct, driver and vehicle standards and training, safety audits, night time driving and off road driving controls, speed controls, Outreach programme for community, monitoring	Moderate (negative)
Changes in crime, commercial sex work	investment to support information programmes that seek to identify and provide support for key social maladies, POK Code of Conduct, Influx management procedures to manage speculative influx, monitoring	Minor (negative)

Community Health, Safety and Security: Impact Assessment

Key Potential Impact (Construction and Operations)	Key Mitigations	Residual Impact
Project related changes to Inter ethnic conflict	Weekly liaison with National Police, all transportation activities will be undertaken under the advice of the Police, monitoring of security incidents, use of suitably licenced and experienced security company, All guards un-armed	Minor (negative)
Project related changes to Community cohesion within Turkana and West Pokot County	Messaging on project employment, recruitment and hiring procedures, outreach to address rumour and other misunderstandings identified through regular engagement, community relations training in traditional leadership and cultural sensitivities	Minor (negative)

8. DISCUSSION

and related issues addressed by NLC

9. WAY FORWARD

- Communication and updated information provided to County Administration and local Chiefs so they can inform their communities
- Communities and stakeholders can then raise questions and concerns with POK via their local chiefs, County Administration or using the contact details below

PROJECT OIL KENYA

Comments can also be provided direct to:

- Telephone/WhatsApp - +254 702 956 331
- Email – POK@africaoilkenya.com

Any Questions?

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Hali ya Hewa


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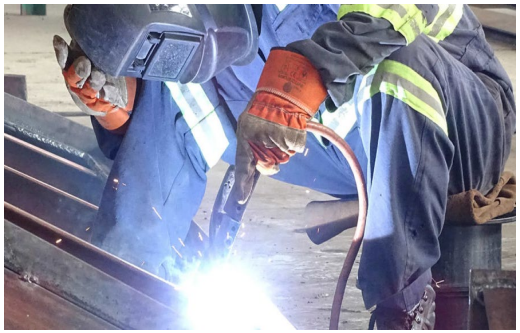
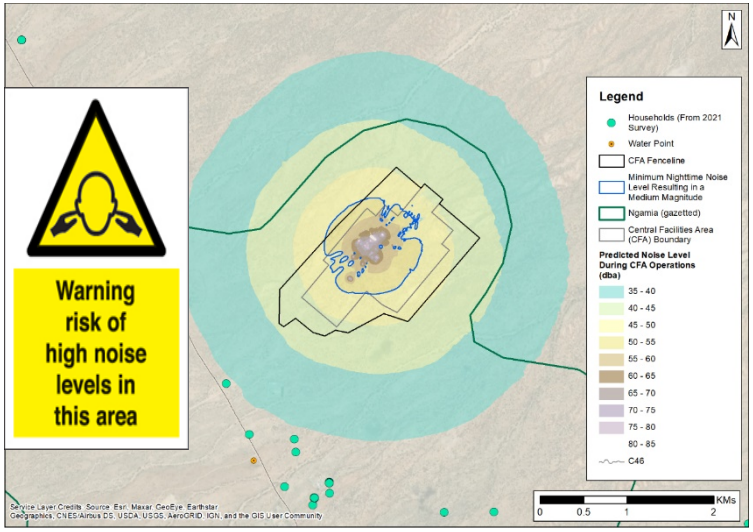
Makelele ya ujenzi na shughuli ya kazi





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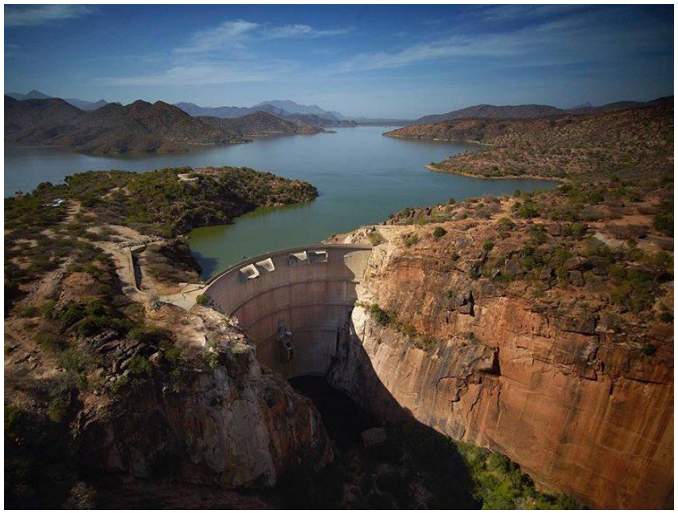

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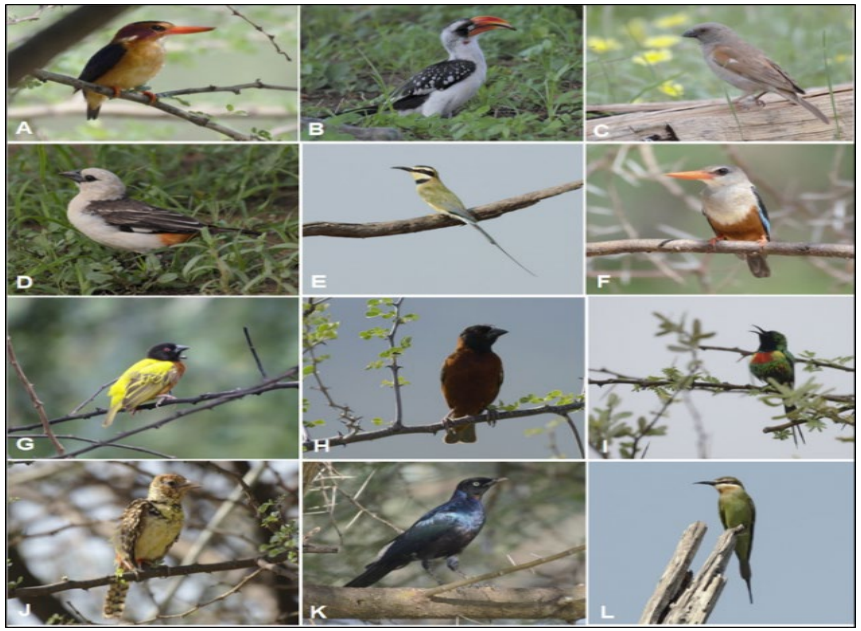

Jamii na Utamaduni

Hifadhi za akiolojia

APPENDIX B

Project Disclosure Meeting Minutes

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **30th June 2021**

Meeting: **Disclosure – Turkana County Government and National Government Representatives at County Level.**

Venue: **Cradle Tented Camp - Lodwar.**

Start time: **1054 Hrs** **End time: 1458 Hrs**

Preliminary:

The meeting was called to order by Mr. James Kambo at 10:54 am. [redacted] volunteered and offered the opening prayer.

Introductions were done whereby senior officers introduced their colleagues as follows:

1. [redacted] (County Chief Officer for Water Services, Environment and Mineral Resources, TCG) introduced Turkana County Government staff.
2. [redacted] the Deputy County Commissioner for Loima introduced the team representing National Government Administration under the Turkana County Commissioner's office.
3. [redacted] introduced the Ministry of Petroleum and Mining officials and other KJV partners in Project Oil Kenya.

Opening Remarks:

[redacted] who was also representing the County Secretary for Turkana County Government made his opening remarks as follows:

- Thanked all for making time to attend the disclosure session.
- Mentioned that TCG has been looking forward to such a meeting considering how things went silent and slow since the Corona Virus pandemic paralysed most activities.
- He added that he expects the discussions to be on full disclosure of information regarding the full field development.
- He appreciated the resilience of the Joint Venture Partners in Project Oil Kenya (PoK) and mentioned that the County Government had become

pessimistic when they saw Tullow's activities in Turkana South Basin diminishing. This session was therefore important because it served as an assurance that the project is still on.

- He added that TCG would like to see the oil out of the ground and sold to generate revenue that will in turn help the communities and Kenya at large.
- He mentioned that going forward, sustainability should be a guiding principle in PoK.
- He stated that the major concern for TCG is the potential environmental impacts of the project.
- He mentioned that EOPS had its fair share of challenges including waste management. He referred to the drilling waste being held at Twiga 1 and 2 as the main issue of concern that TCG and the local community had with Tullow.
- He argued that through such forums of disclosure and consultations, a lot is shared in terms of information and such can help pre-empt challenges and provide possible solutions.

[redacted] the Director for Administration in the Ministry of Petroleum and Mining (MoPM) appreciated the opening remarks from the County Chief Officer, [redacted] and gave a brief history of the journey of oil exploration in Kenya. He explained a bit more on the reasoning behind EOPS, how it was executed, the challenges that were experienced and the important information acquired and [redacted]ns learnt through the pilot scheme (EOPS).

[redacted] then handed over to Linda Were and James Kambo who, together with [redacted] took the participants through the PowerPoint presentations. A lot of information was disclosed to the participants through the presentations. After the presentations, the participants were allowed to ask questions, raise concerns and make general comments regarding the content of the presentations and the project in totality.

Below is a summary of the questions asked, concerns raised and comments made together with the feedback/ responses provided.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **County Chief Officer for Agriculture, TCG**	Acknowledged that there is immense knowledge within the KJV partners as exhibited through the presentations. He was glad the presentations were done by Kenyans which means to him that Kenyans have now a deeper understanding of the oil exploration activities. He asked if it is possible to utilise such knowledge and incorporate it in the education curriculum for Kenyan institutions. He mentioned that he is a lecturer at a certain institution and would like to see such courses offered there.	Mr. Mahaga, the General Manager for Africa Oil responded by appreciating the Chief Officer for asking that question and informed the participants that the KJV partners are open for information and knowledge sharing. He however made it clear that the mandate of curriculum development and/ or amendment is the mandate of the National Government, Ministry of Education. The participants were further informed that some institutions such as Kenyatta University, University of Nairobi and Eldoret University already have students pursuing Petroleum Engineering related courses.
	The Chief Officer also inquired on the potential employment opportunities for the local community members.	The presentation had indicated that various employment opportunities will be available to the local community members as well as Kenyan nationals. These opportunities will be for non-skilled, semi-skilled and the skilled labour force.

Commentator	Issue/Question/Comments	Response
	He was concerned that the oil activities, due to external funding may turn out to be some sort of way to colonize the country. He asked what is the contribution of the Kenyan government towards PoK.	[redacted] and [redacted] both answered this question. It was explained that investors spend their own money/ resources during exploration. This is the practice globally. If the investors discover sufficient amounts of hydrocarbons, then a Production Sharing Contract is drafted and the concerned parties actively engage and come to an agreement. - It was added that Governments can at this point choose to have a certain percentage of the shares and agree with the investors on how the Government will cater for its contribution.
	Suggested that the roles of both National and County Governments should be enumerated in the design of Project Oil Kenya.	Comment noted
	Land is an emotive issue in Kenya. How is NLC programming to conduct the land acquisition? What if there will be no more land when the project starts?	Land is being acquired as per the stipulated law and this will be followed to the later.
	Making reference to other countries that have explored oil and are currently exporting crude, he	

Commentator	Issue/Question/Comments	Response
	asked how will Kenya ensure that this oil does not become a “curse”.	
	He asked how reliable is water from Turkwel dam. Is it sufficient for the project or we may experience shortage at a later time? He suggested that the water shortage in Turkana County (mostly in the interior parts) should be solved first before drawing the water for the oil project.	Studies have been done both from the KJV and National government and Turkwel was the most viable option however designs are still ongoing and there will be a separate ESIA for the water pipeline to assess the impacts and mitigation measures. option
[redacted]**County Chief Officer,Ministry of Water Services, Environment and Mineral Resources,TCG.**	Appreciated the KJV partners for the “beautiful” presentation.- Mentioned that the issue of gas flaring had been of a greater concern to TCG and he was glad to see that there is a plan to re-inject produced gas into the reservoir to maintain pressure. It was unsettling for him to see provision of flaring in the presentation and therefore sought clarification on the circumstances under which such flaring can be allowed.	Mr. James Kambo clarified that under the current design, all gas produced will be utilized for heating requirements at the CPF and excess gas re-injected to the reservoir. He clarified that flaring will not be a routine activity but will only be allowed under emergency circumstances.

Commentator	Issue/Question/Comments	Response
	Inquired if Lokichar basin is the only block in Turkana where Project Oil Kenya will take place. He further asked if there are other areas under consideration.	It was explained by Linda that the South Lokichar basin is the current area where sufficient information and data has been collected and several studies undertaken that are informing the decisions to proceed ahead with PoK. However, it is not the only block where oil exploration will be undertaken. Other exploration endeavours can only be determined at a future date and based on several other factors.
	Have studies been conducted to establish the possible impacts of drawing water from Turkwel dam will have on people living downstream? - If yes, can the outcomes of these studies be shared with relevant stakeholders such as TCG?	Mr. Mahaga responded and affirmed that separate ESIA had been planned for the pipeline. Through this, the potential impacts the pipeline may have on the people living downstream shall be captured and mitigation measures proposed which will be implemented through ESMPs.
	From the presentations, National Government is set to acquire land through the National Lands Commission (NLC) and MoPM will lease this land to the investors. Land is an emotive issue and if not properly managed, it may stall the project. Why can't this be done by TCG?	It was explained that the current plan entails NLC spearheading the land acquisition. However, the County Government is not left out as the compensation money will still be channelled to the affected people through the county government. In addition, there will be ongoing

Commentator	Issue/Question/Comments	Response
		consultations between NLC and TCG concerning this process.
	Asked to what extent did the Risk Matrix that was jointly developed by both TCG and National Government informed the design as shown in the presentations?	[redacted] explained that the Risk Matrix was very important as it informed much of the discussions and content of the presentation that the participants were taken through. He thanked TCG for their valuable contributions towards the development of that particular risk matrix.
	Given that the project life-span is estimated to be approximately 25 years, what will happen at the end of the project? What is the exit plan?	It was explained that the joint venture partners had a robust exit plan. Furthermore, it is a requirement that all projects provide a detailed plan on how they intend to conduct decommisioning and restoration after the project comes to an end. This was also highlighted to have been captured by the Petroleum Act 2019 and is one of the critical components that international lenders such as the IFC look at before approving funding for such projects. Participants were

Commentator	Issue/Question/Comments	Response
		further informed that funds are usually set aside for restoration purposes and the money is safeguarded and ensured they are utilised for the said purposes.
	Sought clarity on how TCG will continue to be engaged going forward. Mentioned that TCG would like to know what shall be expected of them.	
[redacted]**Director for Environment,TCG**	Appreciated the presenters for the good information shared.	
	Argued that the information provided was too much to be internalised by TCG officers in short time such as the length of the meeting. Suggested that presentations and any relevant materials ought to be shared with TCG in advance so that the officers can have humble time in going through and internalizing the information.	Comments were noted.
	Added that his Environment Directorate expects to see an implementable ESMP through this process for easy monitoring and evaluation.	Comments noted
	He mentioned that their key priority areas are on Proper waste management, minimization of air pollution, Ecosystem conservation and restoration of well sites.	Comment was noted.

Commentator	Issue/Question/Comments	Response
	The director mentioned that TCG and the local communities would wish to get an assurance that the waste that will be produced and managed during the project life-cycle will not have negative effects on people and livestock.	
	He insisted on having clear restoration plans and ensuring the plans are fully implemented at the end of these projects.	The participants were assured that Project Oil Kenya will have a robust restoration plan which will be implemented as this is not only a commitment, but it is a legal requirement and best practice that the Joint Venture Partners will ensure is done.
	He proposed that the team considers adding the people of Lorogon village for the ESIA disclosure and consultation meetings in the current schedule. He mentioned that they are very key as Lorogon is a community near the Turkwel dam that will be affected by this project.	Comment was noted. [redacted] mentioned that such comments were welcomed and that the team will discuss further and decide on this request.
	He added that TCG has environment officers in every ward of this County and they should therefore be involved during ESIA disclosure and consultation sessions at their level.	comment was noted.
	He also asked if the waste being held in the various sites around Twiga will continue to be there for the life of the project?	It was clarified that the waste (SBM cuttings) will be treated and disposed off in accordance with the relevant legislations.

Commentator	Issue/Question/Comments	Response
[redacted] **Director for Lands, TCG**	Has public participation been done regarding land acquisition for Project Oil Kenya?	Land acquisition is being undertaken by NLC and according to the law
	There were a lot of complaints for NLC regarding land acquisition/ compensation for the A1 road construction. In relation to this and for avoidance of similar occurrence, has TCG been engaged regarding land acquisition for Project Oil Kenya (POK)?	Land acquisition is being undertaken by NLC and according to the law
[redacted] **Director Water Services, TCG**	From the presentations, it appears that some studies regarding the design of the pipeline are underway. In his opinion, TCG has not been fully engaged in these studies or rather been kept abreast on the developments of the study. Having in mind that the studies are conducted by consultants, he commented that TCG need to be engaged as they can contribute to the designs or be having details of such design knowing that at the end of the project, they may be the ones operating the pipeline for purposes of community water supply.	[redacted] clarified that the County Government has been constantly engaged in relevant discussions concerning the design of the pipeline. He gave an example that the community offtake points were even suggested by County Government officials.
	Proposed that the presentation should entail a list of the proposed community water offtake points.	Comment was noted.

Commentator	Issue/Question/Comments	Response
	Suggested that the presentation should indicate or state the estimated water usage for the community and the project. It should be clear what is expected to be utilised by the community and the project.	Comment was noted.
[redacted] **Director Mineral Resources, TCG**	Asked if the national government had developed another risk matrix other than what was jointly developed in 2019. Mentioned that if this was the case, then they should share with TCG.	[redacted] responded that the National Government had not developed another risk matrix and that they used the one that was jointly developed by County and National Government previously.
[redacted] **Economist, TCG**	Sought clarification on the exact roles of the different joint venture partners i.e. Total, Africa Oil and Tullow Kenya BV regarding Project Oil Kenya.	It was explained that Tullow is the operating partner in the Kenya joint venture partners and that the rest liaise with Tullow to ensure the project is a success. It was pointed out that discussions are taken among the partners and changes can be agreed upon regarding the duties of each partner as long as it is geared towards achieving the main objectives of Project Oil Kenya.

Commentator	Issue/Question/Comments	Response
	Mentioned that TKBV had made certain commitments with the communities in Turkana South and East. He asked if Tullow has a mechanism of tracking all the commitments it made with the communities and whether they are going to fulfil any that may not have been accomplished.	Mr. Bethwell responded that TKBV has a list of all commitments it has ever made to the communities. He added that all commitments that Tullow has ever done has been documented and it has so far accomplished all except for the construction of classroom at Ng'imuriae.
[redacted] **Director Public Health, TCG**	Argued that many community members do not have sufficient information regarding Project Oil Kenya. He suggested that KJV partners should consider developing a robust communication strategy to ensure proper information flow to the local communities.	Comments noted
	Raised a concern that there are fears within the communities and public health officers that there could be long-term health impacts as a result of exposure to heavy metals like mercury, lead and chromium. According to him, oil exploration activities are likely to result in diseases like different forms of cancer. He asked if there are mitigation measures to ensure people's safety is guaranteed.	He was notified that there was a robust mitigation measures put in place and this will be disclosed during the ESIA consultations
	Commented that he believes nothing will go wrong if the laws are followed to the latter.	

Commentator	Issue/Question/Comments	Response
[redacted] **Deputy County Commissioner, Loima sub-county**.	Highlighted the need for County and National Governments to constantly engage on matters of Project Oil Kenya and in doing so, he believes, all challenges will be resolved.	Comments was noted.
	He mentioned that communities are most likely going to persistently be asking on what types of CSR or benefits they are going to get as a result of Project Oil Kenya.	
	He added that misinformation has always been the greatest challenge for communities' members. He mentioned that proper communication channels and information flow should be established to avoid misinformation.	
[redacted] **Deputy County Commissioner, Turkana South,**	Mentioned that he is relatively new in the area and is still acquainting himself with the project details.	
	He asked if there is a robust security plan for the Project Oil Kenya. He added that the security personnel need to know their roles in this project.	Comments noted
[redacted] **Kenya Wildlife Service.**	Mentioned that the proposed designs and routes for the pipeline from Turkwel dam to the CPF should be shared so that they may advise pertaining wildlife restricted areas or areas gazetted to be of conservation concern or endangered species.	Mr. Bethwell responded by informing the participants that KWS officals from the Turkana South Wildlife Reserve had been engaged and provided valuable information concerning the boundaries of the wildlife park and areas that may contain sensitive

Commentator	Issue/Question/Comments	Response
		habitats. All these information is used to identify the best pipeline route.
	He added that CSR should also encompass aspects of wildlife conservation.	Comment was noted.
Purity Country Manager Total Kenya	Mentioned that this is basically the beginning of the journey towards realizing the objectives of Project Oil Kenya. She added that there are going to be more sessions where all the stakeholders will have opportunities to share their views regarding this project. As she was concluding, she reiterated that these disclosure sessions are requirements for NEMA to approve Licence for the project.	
		Comments were well received by the participants.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1458 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **1st July 2021**

Meeting: **Disclosure – Civil Societies Organizations.**

Venue: **Cradle Tented Camp - Lodwar.**

Start time: **0944 Hrs**

End time: **1455 Hrs**

Preliminary:

The meeting was called to order by Mr. James Kambo at 09:44 am. [redacted] [redacted] Turkana South Council of elders volunteered and offered the opening prayer.

The County Chief Officer for Water Services, Environment and Mineral Resources, TCG, [redacted] introduced himself and the Director for Mineral Resources, [redacted] Thereafter, the participants from various CSOs and Council of Elders made self-introductions.

Opening Remarks:

[redacted] being the senior TCG officer in the room gave his opening remarks as follows:

- Appreciated all the participants for availing themselves to attend the disclosure session.

- Mentioned that the main reason for today's session is for the KJV team to disclose information concerning Project Oil Kenya (POK) to the participants.
- He appreciated the history of oil exploration as explained by Mr. Elsamma during yesterday's TCG disclosure meeting. According to him, the history showed that oil exploration activities indeed takes long and it has several phases which the community need to be made aware of so as to understand and appreciate.
- He slightly narrated the journey of EOPS and acknowledged the milestones achieved through the pilot scheme.
- The Chief Officer informed the participants that the disclosure and consultation sessions are requirements as provided by EMCA Act for NEMA to approve any Licence for projects to commence. He therefore urged all the participants to actively participate in the session and feel free to ask questions, raise concerns and give comments regarding the presentations and the project as a whole.
- Mr. Natome noted that the design as captured in the presentation had incorporated some of the concerns and comments TCG had previously shared with KJV during previous sessions.
- The County Chief Officer then declared the meeting officially opened and excused himself as he had other matters to attend to.
- Before he could leave the venue, one of the participants insisted to ask some questions which he specifically wanted the Chief Officer to answer. These questions were as follows:
    i. Where have you as TCG allocated land for this project?
    ii. There was a time TCG had gone to court regarding the requirements of Land for the oil project in Kenya. He wanted to know the status of the court case. Was the case ever concluded and what were the outcomes?
    iii. He also asked if TCG has ever conducted environmental assessment on the oil sites.

- The Chief Officer responded by informing the participant that the issue of land will be handled by NLC. He affirmed that no land has so far been given to the investors by TCG for purposes of this project. He mentioned that the presentations will give the participants more information regarding land acquisition for the project.
- Immediately the Chief Officer left and [redacted] picked up the microphone and wanted to continue with the session, [redacted] raised up his hand and demanded to be heard before the meeting proceeds. He asked if there is a provision for transport and accommodation reimbursements claiming that some of the CSO members had travelled from various parts of the county such as Lokitaung and Lokori just to attend the meeting. He wanted the organizers of the meeting to clarify whether there was a provision for reimbursement or not.
- [redacted] courteously responded that it was unfortunate because there was no such provision. He further explained that EMCA Act prohibits issuance of cash to participants during ESIA disclosure and consultation meetings as this can be perceived as bribe or an inducement for participants to approve the project.
- [redacted] the Director for a CBO called TUBAE interjected and faulted the organizers of the meeting as having not given explicit information regarding transport and accommodation plans for the participants. He argued that the invitation letters should have been clearly indicated that participants shall cater for transport and accommodation costs on their own.
- Another participant, [redacted] claimed that CSOs cannot fight for the rights of the communities if their own rights are violated. He even argued that the government had budgeted for the meeting and they should be facilitated the same way the presenters are being facilitated i.e., flights and accommodation.
- [redacted] made an allegation that sometimes back, they were provided with reimbursement of Ksh. 15,000/- for attending a certain meeting.

However, he did not mention the organization that reimbursed them and the nature of meeting they had attended.

- At 1029 hrs, [redacted] marshalled the CSO representatives and walked out of the meeting.
- At 1107 hrs, the meeting resumed although with very minimal representation from the CSO. The team decided to proceed with the disclosure for the remaining participants who were eager to acquire the information concerning project oil Kenya. [redacted] Turkana Professionals Association's representative offered to pray for the meeting as they resumed.
- [redacted] Linda Were and James Kambo took the participants through the presentations.

After the presentations, the participants were encouraged to ask questions, raise concerns and make general comments regarding the content of the presentations and the project as a whole.

Below is a summary of the questions asked, concerns raised and comments made together with the feedback/ responses provided.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Chairperson, Turkana South Council of elders.**	Making reference to the first oil consignment sold through EOPS, [redacted] lamented that elders in Turkana south are asking KJV partners to share the sweetness of the crude. They are asking where is their share (5%) of the proceeds.	[redacted] from MoPM responded and explained to the participants that the EOPS project was a pilot scheme. It was meant to test how the Kenyan crude would perform in the international market. He added that the issue of community's share of the oil revenues is a pertinent issue. He mentioned that the government did not generate any revenue from the sale of the consignment because commercial production has not been done. He said that the money that was received for sale of EOPS crude went to National Treasury
	He asked if it is possible for the community to sign MoU's once operations resume.	[redacted] said that the national government is open for discussions and that if there is any issue that the community feels there is need to sign an MOU about, they are welcomed to discuss with the government.
	He commented that the local community in Turkana South consider the entry of Tullow to the South Lokichar basin as excellent. They argue that Tullow consulted every category of stakeholders including the seers as they sought social acceptance of the project. He stated that the seers are claiming that they were not	Mr. Bethwell Sang and Franklin Juma clarified that Tullow has not left Project Oil Kenya. They affirmed that Tullow is still the operating partner of POK. They explained that the changes the community is experiencing is a manifestation of how the KJV partners have rearranged to harness synergies among them. There are going to be some

Commentator	Issue/Question/Comments	Response
	informed when Tullow “left” thus consider this as a bad way to leave.	changes on how operations will be managed by the KJV partners but that should not be perceived as Tullow has left.
	[redacted] alleges that Tullow withdrew some generators and solar panels it had installed at some community water boreholes once they started “exiting”. He claimed that this was considered act of bad faith and an intention to deny the local community access to water.	Mr. Bethwell stated that Tullow has not withdrawn any generator or solar panels that were attached to any of the borehole that they drilled for community use.
	He also accused Tullow of not replacing vandalized water tank at kalouchelem community water point which has made the locals at that place not have access to water.	Mr. Bethwell explained that Tullow had previously been replacing community water tanks vandalized by some community members. For this instance, some individuals from the community developed a habit of vandalizing the water tank whenever they are disgruntled. Therefore, Tullow did not vandalize any water tank.
	He argued that NEMA has never shared any report with them concerning the potential positive and negative impacts that the project may have on them despite their views always being collected on the same subject matter.	Mr. James Kambo explained to the participants that the ESIA is a process that involves various steps. He made it clear that NEMA plays a coordination role. It ensures disclosures and extensive consultations are conducted by project proponents that can occur through consultants. Once a report is prepared detailing the potential impacts and proposed mitigation measures, NEMA avails this information to the public by putting notice to the national daily

Commentator	Issue/Question/Comments	Response
		newspaper and allow stakeholders to critically go through and comment. NEMA will then conduct public hearing and it is at this point that the community and other stakeholders will determine whether their contributions were considered and incorporated in the report. He therefore informed the participants that we are not yet at this step and they will participate when we reach there.
	He argued that they were told that there will be approximately 4,000 job opportunities during the entry discussions of LAPSSET project. He was wondering why the presentation indicated approximately 2,400 employment opportunities during the construction phase. He asked why the opportunities have reduced.	It was made clear that the 2,400 employment opportunities are the estimated direct employment opportunities that PoK will have during the construction phase. There will be more business opportunities that the locals can venture into which will create more employment opportunities. The 4,000 opportunities are believed to be the estimated employment opportunities from the pipeline project.
	With reference to the presentation, he asked why land requirement is estimated at 1500Ha yet he thought it was a stretch of 500m?	He was informed that PoK total land requirements are estimated at 1500ha. The 500m corridor he was referring to is the LAPSSET land requirement. The participant had confused LAPSSET with Project Oil Kenya land requirements.

Commentator	Issue/Question/Comments	Response
	[redacted] also mentioned that they have information that compensation was going to be based on provision of title deed as proof of land ownership. He even alleged that some Turkana leaders have registered some parcels of the community land and feared they may end up being the beneficiaries instead of the local community member. He wanted to be made aware on how exactly land compensation will be done.	[redacted] responded and informed the participants that matters of land acquisition and compensation were going to be handled by the National Lands Commission. However, they are going to be fully guided by existing laws and regulations especially the land act 2012 among others.
	[redacted] further stated that the Turkana community members are concerned and worried that due to the historical conflicts between Turkana and Pokot, the Pokot may decide to put poison in water coming from Turkwel dam and kill all the Turkana people.	
	[redacted] asked if there is a way that drilling operations can be done from far away to avoid displacing people.	He was answered by [redacted] that indeed it is possible to have directional drilling. However, such decisions will be determined by other factors such as distance from where the rig will be positioned and where drilling is intended to occur.
[redacted] **Representing Kapese Trust Fund**	Mentioned that the community members have not understood how the land acquisition will be conducted and the KJV partners should expect more questions regarding this from the community.	Comment noted.

Commentator	Issue/Question/Comments	Response
	He added that there is a feeling among community members that the issue of land acquisition should be handled first.	
	He further mentioned that from the presentations, all matters land acquisitions are said will be handled by NLC. Why are there no NLC representatives in the meeting?	[redacted] responded and mentioned that an invitation letter was sent to NLC representative in Turkana but for some reasons, he has not managed to attend.
	He faulted the other CSO members who walked out of the meeting saying they could have benefitted from the presentations and perhaps could have made valuable contributions to the discussions through comments and questions.	
	He added that he would like the presentation to have more details on how the local communities could access this water from Turkwel Dam for their basic needs.	[redacted] responded and informed the participant that the project will have six community off take points where they will have access to the water.
	He expressed that there is fear among community members that flaring would have negative effect on their health in the long term.	He was assured by [redacted] that the intention of the project is not to have any flaring at all. However, the provision for flaring is provided in the design of the project to cater for emergency situations only.
	He challenged the chairperson for Turkana South Council of elders to pass positive message when he gets back to the communities that “the project is back”	

Commentator	Issue/Question/Comments	Response
	He mentioned that LAPSSET project has an office in Lodwar which has helped in disseminating information regarding their project. He asked MoPM to establish offices in Lodwar, Lokichar to provide the relevant information to members of the public.	
	[redacted] mentioned that there is another accusation that Tullow had in the recent past attempted to take away its assets out of Kapese camp at night. He mentioned that one of the trucks developed a mechanical problem and therefore could not leave at night and this is what made the community aware of the activity that had taken place at night.	Mr. Bethwell responded by informing the participants that Tullow had not attempted to take away any asset at night. He mentioned that he was made aware that it was ACS which was carrying away some of their assets. He added that from what he gathered, ACS had not even intended to conduct loading at night but the circumstances were necessitated by the Equipment that was to load the assets to the trucks as it was operating at the Chinese Road construction during the day and could therefore only be available at night. So, this had nothing to do with Tullow.
	He proposed that communities should be allowed to list their priority needs and develop programs that will be entrenched in Community Benefit Sharing Agreements.	

Commentator	Issue/Question/Comments	Response
	He was concerned if the project will result in fencing off the entire oil fields i.e.Ngamia, Amosing, Etom and Twiga etc. According to him, this will reduce the grazing land and may negatively impact on the livelihood of the community members.	It was explained to him that fencing will only be done for the well sites and not for the entire oil fields (polygon). There will be open spaces between the well sites as well as above ground where pipelines will pass. All these will be available for livestock grazing.
	[redacted] mentioned that there is need for KJV partners to make clear the roles and responsibilities of each and every partner towards project oil Kenya.	Comment noted.
	In case of any grievance, who should the community go to for assistance?	Mr. Bethwell responded by acknowledging that there used to be a robust strategy and team dedicated to handling community grievances. Considering the adjustments that have taken place between the KJV partners, he mentioned that the team will leverage on the existing government structures. He urged members to report to their area chief any grievance they may have and the chief will escalate to the KJV partners. The grievance will then be handled at that point.
	[redacted] urged the team to consider Lorogon village during their community disclosure sessions. He argued that the village was not featured in the programme and yet it will be among the affected villages by the water pipeline.	Mr. Bethwell responded and informed the participants that invitations have been extended to cover community members living in Lorogon village.

Adjournment: There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1500 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **2nd July 2021**

Meeting: **Disclosure – National and County Government Administrators.**

Venue: **Black Gold Hotel - Lokichar.**

Start time: **1111 Hrs**

End time: **1441 Hrs**

Preliminary:

The meeting was called to order by Linda Were at 11:11 am. Thereafter, [redacted] opened the meeting with word of prayer.

Opening Remarks:

Linda then welcomed [redacted] to give opening remarks.

[redacted] welcomed all the participants to the meeting. He then welcomed DCC Turkana South, as the host senior member of national government to lead in introductions which was done as follows:

1. DCC Turkana South introduced his team including ACCs, Chiefs and Assistant Chiefs.
2. Sub-County Administrator for Turkana South, [redacted] introduced TCG representatives present;

3. DCC Turkana East, [redacted] introduced his team which comprised of Chiefs and Assistant chiefs;
4. Sub-County Administrator for Turkana East introduced his colleagues from TCG;
5. [redacted] introduced all MoPM officers and;
6. Linda Were introduced KJV partners present.

After the introductions, Linda Were and James Kambo took the participants through the presentations. At the end of the presentations, the participants were encouraged to comment, raise concerns or ask questions on the content of the presentation or anything else they wanted to know about the project.

Below is a summary of the questions asked, concerns raised and comments made together with the feedback/ responses provided.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
DCC Turkana East Sub-County	Can the excess gas produced through the drilling activities be utilized for LPGs to be used by neighbouring communities?	[redacted] responded by informing the participants that the amount of gas produced is not sufficient to start commercial production of LPG. He added that this business idea was critically examined and it was found to be economically not viable.
	Making reference to the 75MW power requirements of the project, the DCC commented that this was a lot of power and he expressed that at some point, there could be unutilized or excess power. He wanted to know if this excess power can be channeled to the local communities.	
[redacted] **ACC Katilu Division.**	Is there a way crude from Project Oil Kenya can be refined at Changamwe instead of shipping it abroad?	[redacted] responded and informed him that every Kenyan wish is to have that crude being refined in-country. However, the equipment at Changamwe are outdated and it will be very expensive to restore the refinery. It is not economically viable.
[redacted] **Sub-county lands administrator, TCG**	How far has project oil Kenya gone in terms of land acquisition and compensation?	[redacted] responded and informed the participants that the NLC will come and expound on this as they are the department mandated to conduct land acquisition and compensation for PoK.

Commentator	Issue/Question/Comments	Response
	What is expected of TCG's ministry of lands in reference to land acquisition for this project? Where can he come in as TCG's representative to play an active role in the land acquisition matter for the project?	[redacted] advised that NLC is best placed to answer that question. However, its representative is not in the meeting despite having been officially invited to attend. He however mentioned that NLC will thereafter come to conduct awareness sessions on the land acquisition framework and explain on how compensation will be done. The bottom line is that all land acquisition and compensation will be done according to the laws and regulations of Kenya.
[redacted] **Environment Officer, TCG**	He wanted to know if there are plans to plant trees considering that there will be some trees that will be cut down to pave way for construction activities of the project.	Mr. Bethwel Sang responded and informed him that Tullow had set up tree nurseries at in Lokichar to supply seedlings for restoration purposes. He added that Tullow had even planted indigenous trees on some sites that were decommissioned. He added that KJV will definitely have a robust restoration plan that will explain how trees affected by the project will be catered for.
[redacted] **Ward Administrator, Lokori-Kochodin ward.**	He claimed that seven raids have occurred in Turkana East in the recent past none of which was responded to by the National Government Security apparatus. He added that he recalls President Uhuru Kenyatta promised to strengthen security in this region during EOPS flag off. According to him, this has not been achieved. He asked if KJV partners are sure the project will continue considering the area is insecure.	[redacted] responded to this question by saying that the national government is aware of the security situation in Turkana East Sub-County. He added that the government has formed a police unit that will look after oil and gas operations and it's currently headed by [redacted] (In-attendance). He added that plans are underway to upgrade Nakukulas Police post to a police station and it will be equipped with the necessary manpower and resources to beef up security in the area.

Commentator	Issue/Question/Comments	Response
	The ward administrator alleged that there is a KENHA project ongoing around Lokori and it has been disrupted by insecurity incidences.	The DCC Turkana East responded and mentioned that there are police installations along that construction and they are providing security to the project.
	[redacted] mentioned that they are currently trucking water to Lopii village which is an expensive endeavor. He asked if KJV can drill a water borehole in the area to serve as a sustainable solution.	
[redacted] **Chief, Kalemngorok.**	Are there new wells that will be drilled?	
	He mentioned that there have always been water problems in the villages from Turkwel to Lokichar especially in Kalemng'orok. He wanted to know if these villages will get water as a result of the water pipeline passing through their villages.	He was informed that there are 6 community water off-take points where communities will be able to draw some water for their use. Some of these water points will be installed along these mentioned villages.
	He mentioned that the local community members have constantly been asking about the 5% revenue share. They would like to know how they will be able to access their benefits.	
	He wanted the team to simplify the term barrel to enhance his understanding.	He was informed that the term barrel is commonly used in the oil and gas sector and it is an equivalent of 160 Litres or 42 gallons.

Commentator	Issue/Question/Comments	Response
[redacted] **Assistant Chief Nakukulas sub-location.**	Asked why Chiefs and Assistant Chiefs are asked to work as CLOs for the project? He argued that the chiefs may work now because the project has not gained momentum but once everything gets in place, they will be put aside and other people will be employed and enjoy some good packages.	[redacted] explained to him that the former CLOs employed by MoPM were on contract and they were being paid by the World Bank. The other team of CLOs was being paid by KJV through Tullow but due to the challenges that faced the investors, they were laid off. He expressed that the project is for the government of Kenya and that the only available staff are county and national government administrators. Therefore, there is no other option at the moment than for the two levels of governments to utilize their staff in working for the project.
[redacted] **Chief Lochwa Location.**	Mentioned that the Chinese company currently constructing the A1 road donates some assets including container offices and furniture among others. He asked if the project will donate some materials perhaps from the construction camp once the construction phase is completed and camp is being decommissioned.	Linda responded and informed the chief that, that will depend on some things. She explained that it is a NEMA requirement that project proponents restore the land they use to near its original state. This means that proponents are supposed to remove everything they brought to site. However, she mentioned that the proponent can write a letter to NEMA stating clearly what it intends to donate to the community and NEMA will come back to the community to confirm. It is only thereafter that they may accept or reject the proposal based on whether the donations may be good or harmful to the communities. [redacted] added that there are some assets or equipment that are exempted from tax simply because they are going to be used for oil and gas related activities. The agreement with KRA is that the equipment should leave the country once it has

Commentator	Issue/Question/Comments	Response
		completed its task. The only way it can be donated is by the recipient or project proponent paying the earlier exempted taxes.
[redacted] **Chief Kalapata.**	He reminded the other chiefs that they should always remember that they work for the national government and they must support national government projects.	
	He was concerned about setting up community meetings during this time that the corona virus cases are on the rise. He asked if it is safe to have the community meetings.	[redacted] responded by first appreciating his concern about the pandemic. He added that corona is real and that people should take it seriously. He advised all the chiefs that they should organize the community meetings and ensure strict adherence to MOH covid 19 protocols. He advised the chiefs to choose appropriate venues, preferably open spaces, ensure people wear masks, sanitize or wash hands with soap.
[redacted] **MOH, Turkana South Sub-County, TCG**	Appreciated the chief for expressing the concern over the corona pandemic. She added that, majority of the people in Turkana County still don't believe that Corona virus exists. She confirmed to the participants that corona is real and revealed that so far, there have been 14 confirmed cases and 24 corona-related deaths in Turkana County. She warned the participants that the Indian Corona virus strain that is currently spreading fast in Kenya is a dangerous strain. She urged all participants to take it upon themselves to ensure MOH protocols are strictly adhered to.	

Commentator	Issue/Question/Comments	Response
	She encouraged the participants to go for vaccination when they will be available at the sub-county hospital.	
[redacted] **Sub-County Administrator, Turkana East.**	Mentioned that some of their questions regarding land acquisition and compensation have not been answered. He however believes that there will be some forums in the future where these questions will adequately be addressed. He added that they will take the information from today disclosure session to the local communities they represent.	

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1441 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **3rd July 2021**

Meeting: **Disclosure – National and County Government Administrators.**

Venue: **Lokichar Baraza Park**

Start time: **1048 Hrs**

End time: **1445 Hrs**

Preliminary:

The meeting was called to order by the assistant chief for Lokichar sub-location at 10:48 am. Thereafter, [redacted] prayed for the meeting to get God's blessings.

Opening Remarks:

The Assistant Chief for Lokichar sub-location urged all the community members to ensure they observe MOH COVID 19 protocols. He also urged them to maintain silence during the presentations in order gather new information and better understanding of the progress of Project Oil Kenya (POK) and its future.

He added that the community members will get opportunities to ask questions, raise concerns and seek clarification on any matter regarding POK.

He urged the community members to disseminate the information they are going to acquire today regarding POK to the rest of the villagers who have not attended the meeting.

He advised the illiterate members to consider taking home POK information booklets and ask their children or literate neighbours to read and interpret to them the information contained therein.

He then welcomed [redacted] to officially open the meeting and introduce the guests.

[redacted] welcomed all the community members to the meeting. She mentioned that the disclosure sessions were not only going to be done in Lokichar location, but to all the areas that have been identified as may be impacted by the project's activities. She acknowledged the attendance of some specific groups such as the CSOs, Youth, Women, Village elders and Turkana Council of elders among others. She added that today gives the CSOs in the area an opportunity to get more information about the project and that they should ask all the questions.

Thereafter, she gave Mr. Bethwell an opportunity to introduce the team that had come to conduct the Project disclosure.

After the introductions, [redacted] took the community members through the history of oil exploration in Kenya from 1940s to 2012 when Kenya announced its first discovery. He further narrated to the community members on how EOPS came about, its achievements, the challenges it faced and the lessons learnt.

Thereafter, Linda Were took the participants through the presentations. At the end of the presentations, the participants were encouraged to comment, raise concerns or ask questions on the content of the presentation or anything else they wanted to know about the project.

Below is a summary of the questions asked, concerns raised and comments made together with the feedback/ responses provided.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Community member.**	He appreciated the team for the presentation. He argued that today is the day he has managed to get detailed information on POK.	She was informed that during development and construction there will be about 2400 who will be employed on the project both unskilled, skilled and semi-skilled and the local community will benefit.
	He claimed that people from far areas get employed and benefit more through POK at the expense of the locals living in the villages near the areas of operation.	
	He wanted to know if there are Turkana people working for MoPM and Africa Oil.	
	He feared that their children would be disadvantaged during the construction phase of the project due to minimal technical skills amongst them. He urged the government to offer scholarships for the youth in these areas to join colleges and universities in order to equip themselves with the technical skills that will be required in the future phases of the project.	
	He also requested the KJV to consider employing the disabled and elderly persons. He claimed these individuals can bring forth their children to work in their positions but they be the ones to receive payments.	
	She stated that she keenly followed [redacted] presenting on how EOPS' crude was sold in the international market. She claimed that they have not received their share (5%) of the proceeds.	

Commentator	Issue/Question/Comments	Response
	She added that they would want to see KJV offer employment opportunities to older women even if it will be road marshal positions.	
[redacted] **Community member.**	She asked if there will be compensation for the indigenous trees that will be cut down for operational reasons. She claimed that some of these indigenous trees are used during cultural functions such as the rite of passage.	
	She asked if they are going to be compensated if they will be displaced by the project.	[redacted] responded and informed the participants that the NLC will come and expound on this as they are the department mandated to conduct land acquisition and compensation for PoK.
[redacted] **Community member.**	She wanted to know if there is any MoPM office in Lokichar where they can seek information or have their grievances resolved.	[redacted] informed that MOPM had officers on the ground but there contract ended.
	She also mentioned that they would like the government to construct schools, health facilities and address the incessant water problems in their communities before proceeding with the project.	Comments noted
	She claimed that people in other parts of Kenya believe that the Turkanas are very rich now as a result of the oil discovery yet they are not. She urged the project to consider employing the young people from the impacted communities in large numbers.	From the presentations, it is clear that there will be approximately 2,400 employment opportunities for non-skilled, semi-skilled and skilled personnel. These positions are for both

Commentator	Issue/Question/Comments	Response
	They should be the main beneficiaries in terms of employment opportunities.	locals in this area and Kenyan nationals.
[redacted] **Community member.**	Appreciative that the project is back. He urged KJV partners to help solve the water problems in the area. He claimed that several villages have suffered due to lack of water since Tullow's operations went down.	
[redacted] **Community member.**	Asked where [redacted] He mentioned that they expected to see him in such meetings. They wanted him to come and explain to them in the local dialect about POK.	
[redacted] **Community member.**	He was concerned about land ownership. He wants the local community members to first be given title deeds by the County or National Government because they claim the County Government has been reluctant.	NLC to handle matters related to land.
	He also argued that Pokot people are encroaching to their land. He urged the national government to declare the boundaries between Turkana and West Pokot counties.	
[redacted]	Was concerned about land acquisition and compensation. He wanted the investors or NLC to contact them directly for land acquisition so that they get to be compensated directly and not through other channels. He also reiterated previous comments that land ownership documents (Title deeds) should first be availed to the local community members before the investors start the project.	[redacted] responded and informed the participants that the NLC will come and expound on this as they are the department mandated to conduct land acquisition and compensation for PoK.

Commentator	Issue/Question/Comments	Response
[redacted] **Community member.**	He argued that Turkana land is endowed with various mineral resources such as gold, mercury and crude oil. He mentioned that the community members are urging the national government to provide them with title deeds so that they can get proper compensation from various investors.	[redacted] responded and informed the participants that NLC will come and expound on issues of title deeds as they are the department mandated to handle matters related to land for PoK.
[redacted] **Representing Nayanae Ereng village (living near Ekales C well site)**	Have a written submission that he presented copies to KJV partners present. The Submission had their detailed expectation of benefits they anticipate to get from POK. It touched on the following aspects: 1. Sustainable water solution. 2. Construction of Health facility. 3. Construction of a school near their village. 4. Employment opportunities for the immediate communities to the well sites. 5. Business opportunities. 6. Cash transfer program for the elderly. 7. Scholarships.	Submissions received
[redacted] **Community member.**	Requested Africa Oil to consider employing the physically disabled individuals when active operations resume.	
	Urged KJV partners to consider allowing as many employees as possible to live outside the camp. He argued that once many of these employees are not accommodated on camp, they will rent houses in Lokichar and pump some money into the local economy. This will have a trickle-down effect and spur economic development in the area.	

Commentator	Issue/Question/Comments	Response
	He claimed that the community would like to have signed Community Development Agreements with KJV partners. He added that they want to sit on the table where important decisions will be made.	
	He claimed that it was wrong to have DCC as the chair of grievance committee. He is suggesting that the chair of the grievance committee should either be from a religious leader or a member of civil society.	
[redacted] **Founder Turkana Advocacy Group.**	He argued that there was an ESIA done by Golder Associates in 2019 and it had indicated that the project will require over 5,000ha of land (Ngamia 4,055, Twiga 550ha plus for Amosing which he could not recall). He wanted to understand why the presentation captured 1,500ha as the land requirements compared to what he claims Golder had indicated and was gazette in the Kenyan newspapers.	[redacted] explained that the larger land mass that he mentioned was gazetted refers to the bigger oil fields that will be used by the project. However, the presentation captures 1,500ha as this will be the actual land that will be required for the development of the six oil fields. How the remaining may be used will be determined at a later time.
	He argued that the ESIA report is a very huge document. He requested that the KJV partners consider breaking it down to make it easier for them to understand.	Comment noted.

Commentator	Issue/Question/Comments	Response
	He also asked that the KJV partners should tell the communities the exact place where the crude oil pipeline would pass so that they can prepare and look for alternative residence.	
	He added that he expected officers from NLC to be present at this meeting to answer to questions of land acquisition and compensation. He urged that NLC must organize to conduct community meetings to answer the numerous questions and concerns they have.	
	He argued that the initial plan for the water pipeline entailed having two separate pipelines for the community and the project. He wanted to be informed why the presentation indicated that the pipeline will be one.	[redacted] responded by informing the participant that the current plan entails having one water pipeline for both the project and community water off-takes.
	He wanted to be informed how long the water pipeline will be operational. Will it stop working as soon as the oil activities are over?	The water pipeline will still exists even after the project activities stop
	He asked what security measures have been put in place to ensure the Pokot people do not poison the water coming to the Turkana side considering the bad relationship between the two communities.	CIPU commander, responded by assuring the community members that the security of the water pipeline will be enhanced. Security measures will be put at the source of the water in the dam to ensure no person can contaminate the water.

Commentator	Issue/Question/Comments	Response
	He urged KJV partners to avail the following plans to the community. 1. Environment and Social Management Plan. 2. Emergency Response Plan. 3. Local Content Plan.	He was informed that the ESIA consultations will cover the environmental and social management plan
	He mentioned that Africa Oil should endeavour to operate in strict adherence to IFC performance standards.	He was informed that the IFC standards are into consideration.
	He finalized by asking the national government to accept signing Community Benefits Agreement with the locals.	
[redacted] **Businessman**	He said that the business community in Lokichar would like all business opportunities to be made open.	
[redacted] **Chairperson for IDPs.**	He claimed that some Internally Displaced Persons (IDPs) due to Kenya's post-election violence are still homeless. He urged that KJV partners remember to include them in any upcoming opportunity for POK.	
	He also asked if the oil prospects are only in Lokichar and not areas like Kalemng'orok and Turkwel.	
[redacted] **Representing Drivers' Association.**	He was glad to see the IWMF in the design. He insisted that matters of waste management should be properly managed so as not to expose the community members to effects that may affect several generations to come.	Comments noted

Commentator	Issue/Question/Comments	Response
	On behalf of drivers, he mentioned that they would prefer to be employed directly by the operating company instead of owners of hired vehicles. He claims that they were not given severance pay when they were laid off after Tullow's operations diminished.	
[redacted] **Driver.**	Wanted to inform the project proponents that there are competent and experienced drivers as well as equipment operators in Turkana County. They should therefore give them first priority when such opportunities that require their skills arise.	Comments noted
[redacted] **From CSO called KARMO**	He claimed that there used to be a plot where business advertisements were released few days to the deadline. This, according to him disadvantaged many people. He urged that all employment and business opportunities be advertised in good time and adverts to be widely circulated for fairness.	Comments noted

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1445 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **5th July 2021**

Meeting: **Disclosure – Lomokamar Community.**

Venue: **Lomokamar village**

Start time: **1028 Hrs**

End time: **1440 Hrs**

Preliminary:

The meeting was called to order by the Assistant Chief for Kapese sub-location, [redacted] at 10:28 am. Thereafter, [redacted] offered the opening prayer.

Opening Remarks:

The Assistant Chief appreciated all the community members for making time to attend the community disclosure session. He informed the members that despite the absence of the Senior Chief and the DCC, they have given him the mandate to represent them, invite the guests to Lomokamar and declare the meeting officially open.

He urged the community members to take keen interest in the presentations that the disclosure team was going to present. He advised them to look at the banners displayed around which contains pictorial information about the project.

He mentioned that there will be opportunities at the end of the presentations for the community members to comment, ask questions or seek clarification on the content of the presentation or the project at large.

The assistant chief then welcomed [redacted] the Director for administration at the Ministry of Petroleum and Mining (MoPM) to introduce his team.

[redacted] introduced himself and called upon representatives from the National Government and KJV partners present to introduce themselves.

The Director then started by apologizing to the community members for starting the meeting late. He informed them that the delay was not intentional, but it was due to unavoidable circumstances. However, he was grateful that the community members were patient and had come in good numbers.

He informed the community members that the main reason for the meeting was to disclose information regarding project oil Kenya (POK) to the people of Lomokamar. He urged the community members to make sure they pay attention to the presentation that they will be taken through and ask questions at the end. He stated that the team values their contributions and that there will be no useless question or comment.

He added that the team will strive to answer all their questions. Whatever they may not be in a position to answer, will be noted and forwarded to the right person or department for prompt response.

[redacted] narrated the history of oil exploration in Kenya from 1940s to 2012 when Kenya announced its first crude oil discovery. He further explained to the community members on how EOPS came about, its achievements, the challenges it faced and the lessons learnt.

Addressing fears that were previously raised during the Lokichar community meeting, [redacted] mentioned that the water pipeline will have community off-take points which will be in both Turkana and West Pokot sides. The fear was that somebody from West Pokot side may decide to poison the water so that people at

the Turkana side can die. He challenged them that, even if anyone from the Pokot side was to imagine of poisoning the water, they would not do so as the water shall also be used by the people from West Pokot community. In addition, there will be several measures that will be put in place that will involve regular testing as it is the same water that is used for the project (water injection) and it must meet certain criteria to be used. Security personnel will also be patrolling the water pipeline to ensure safety and security of the pipeline is maintained.

[redacted] then invited Linda Were to take the community members through the presentations.

At the end of the presentations, the participants made comments, raised concerns and asked questions as shown in the table below

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Community member**	He was concerned about land acquisition and compensation. He mentioned that he was expecting NLC officers and TCG to be part of this meeting so as to answer questions they have regarding land acquisition and compensation.	Comment noted.
	He argued that the local communities were not consulted when the national government gazetted the land for POK. He mentioned that the community members want to know why they were not consulted.	Mr. Kambo responded and informed the participants that the issue of gazettement is a procedural matter that the law requires for any project of such magnitude to be undertaken. The investor will identify the size and location of land to be used. Then, the national government will send surveyors to look at the parcel of land and survey it in accordance with the relevant laws. The land will be then gazetted. Afterwards, discussions on land acquisition and compensation will take place between the national government (through NLC) and the local community.
	He argued that for the local communities to fully understand certain things, the information must be repeated severally. Therefore, he urged the team to consider having several community sessions on certain aspects of importance for the community to understand better.	Comment noted.

Commentator	Issue/Question/Comments	Response
	Now that you have informed us that land that will be acquired for the LAPSSET corridor (500ha stretch) will be compensated through the LAPSSET, who will compensate the 1,500ha of land required for POK? Which means will be used to compensate the locals? Even for the LAPSSET compensation, which means will they use to compensate the affected persons?	Mr. Kambo responded and informed the participants that NLC is the state department that is mandated to conduct land acquisition for the LAPSSET corridor and POK. He added that NLC will come to the local communities to explain how the entire process of land acquisition and compensation will be done.
	He wanted to know who will be the operator for POK going forward?	Mr. Sang responded by informing the participants that the investors are working together as a joint venture. He added that Tullow, Total and Africa Oil are considering some adjustments on how they operated before during the exploration and appraisal phase. Therefore, how operations will be conducted will become clearer with time.
	He wanted to know where the community will direct their grievances whenever they have any?	Being alive to the fact that there are no CLOs or VSOs working for either the MoPM or KJV partners, the local administration will take this responsibility. The community members were urged to report any grievance to the nearest chief/ assistant chief or county government administrator. They will in turn reach out to the relevant party that will address the grievance.

Commentator	Issue/Question/Comments	Response
	The community used to get well site access benefits in terms of projects worth Ksh. 7 million. Now that it is indicated that several wells will be drilled in one well pad, how will the community get benefits from each well drilled?	Mr. Bethwell responded and informed the community members that initially, Tullow was doing exploration and it had approached TCG which had leased the land to them. On top of the 7 million-worth of projects offered to communities, they used to pay land rates to TCG. At the moment, the project is moving to development phase where there will be drilling of several wells. Furthermore, there will be changes in the operations as government will now be responsible for provision of water and land. Therefore, negotiations on land will be done once through NLC.
	[redacted] claimed that some individuals benefitted in the name of community. He referred to the Light Vehicle Scheme (LVS) previously administered by Tullow. He argued that some few elites and the rich in the community benefitted at their expense.	Mr. Bethwell explained that the LVS was created because there were very few vehicles belonging to the local communities that met Tullow's standards. For this reason, there were several cases of brokerage which resulted to many cases where people could not agree on payments. This project was therefore meant to provide the project with compliant vehicles and at the same time, remove brokers as the vehicles were managed by Turkana companies. Just in case the criteria used to allocate the vehicles had some short-comings, such will act as lessons for future reference.

Commentator	Issue/Question/Comments	Response
	[redacted] mentioned that Lomokamar community has been enlightened and that they had gathered all their opinions into a proposal that they are going to present to MoPM, KJV partners and other relevant parties present. He added that this proposal will form basis for future engagement towards signing a Community Development Agreement with the KJV partners. They wanted MoPM and KJV partners to sign and accept to be photographed as sign of receipt of the proposal for future reference.	Mr. Bethwell responded to this. He mentioned that MoPM and KJV partners will receive the proposals and be treated as their comments, concerns and proposals. They should therefore not mistake it as being an MOU or a commitment that KJV will implement anything in their proposal. The proposals will be forwarded to the ESIA consultant who will look at it and incorporate any relevant comment or suggestion into their report. He added that such proposals may help in designing future community projects but it should be clear to them that it is not a commitment of any sort.
[redacted] **Community member.**	He claimed that he had noticed much discussion were between the national government and the investor. He argued that he had not seen the community being involved. He exclaimed that the two parties could as well have decided to conduct their business in their offices instead of coming to the community.	Mr. Sang clarified to the participant that the disclosure session was one of the means of involving the local communities. He added that there will be no project that will be implemented in any community without their involvement.
	Apart from the youths getting employed he wanted to know how the elderly and unskilled will benefit.	Mr. Bethwell responded and explained that the construction phase of the project will present about 2,400 employment opportunities for unskilled, semi-skilled and skilled personnel. This means that even the unskilled will get opportunities to be employed. Keen to note is the triple-down effect and indirect business opportunities that will be created as a result of having these 2,400 jobs. Such may include

Commentator	Issue/Question/Comments	Response
		working in restaurants, providing meat and vegetables for the camp and those living outside the camps etc.
[redacted] **Community member.**	Appreciated Tullow for the good things they have done to them. He mentioned of the school that Tullow constructed in Lomokamar.	Comment noted.
	He believes that the project will not go well if the national government was going to take lead. He argued that the DCC will be hard while dealing with the communities and that he can easily arrest and jail anyone who may disagree with certain aspects of the project. He argued that the community members prefer that the national government takes a back seat and allow the community members to engage the investor and only reach out to the national government in case there is a problem.	[redacted] answered this using the analogy of a herdsman who uses his children or hired labourers to look after his livestock. He asked the participants if a child or labourer is allowed to sell livestock belonging to the father or master without the owner's consent. They unanimously responded that it will not be appropriate. He equated the herdsman to the national government and the labourer to the investor. In this regard, the investor will be guided by the national government the same way the labourer must follow instructions from the master. He added that the investor will at some point leave the project for whatever reason and that the government will always be there for its people. For this reason, the government will take lead and guide the contractors (KJVP).

Commentator	Issue/Question/Comments	Response
	He passionately talked about land ownership. He lamented that the Turkana people do not have title deeds and that this may disadvantage them during land acquisition and compensation. He stated that graves of parents and grandparents will act as proof of ownership as it will depict that indeed certain families lived in certain areas. This to him, will be their title deed.	[redacted] responded and informed the participants that NLC will come and expound on this as they are the department mandated to conduct land acquisition and compensation for PoK. He added that no land will be acquired without following the law.
[redacted] **Community member**	He gave an example that if a project car hits and kills a goat, who should the owner report to? Is It the police? They prefer if they were to engage the proponent directly without involving the police or national government.	The community members were urged to report such grievance to the nearest chief/ assistant chief, police station or county government administrator. Investigations will be done and a decision will be made based on the findings of the investigation.
[redacted]	Faulted the KJV partners for what he terms as deceit. He claims that the crude transported during EOPS was sold but the community has not received its share. He wanted it explained to them, where the money went to.	[redacted] responded using an analogy of a parent who borrows money from a lender to pay for school fees. He explained that the lender will put some conditions before lending the money. If the lender was a herder and you agree that if you forfeit the loan, he can take away certain number of livestock from your herd, then he will definitely take them upon default. Basically, the money received through selling of EOPS crude went to service expenses incurred during that process.
	He claimed that the community has co-existed with the waste currently at Twiga sites. He would like the community to get some benefits as a result of just having the waste at Twiga.	Comment noted.

Commentator	Issue/Question/Comments	Response
	He claimed that Tullow's provision of water to the communities through trucking is unsustainable. They need a permanent water solution.	Mr. Sang responded and informed the community that indeed the water trucking is unsustainable. He highlighted the high cost implication and possible nightmares the community may experience due to vehicle breakdown and other issues. He updated the community members that KJV had recently engaged a local water engineer to look at the prospects of Namantalem water borehole after which the results were shared with TCG. This has initiated consultations with TCG and they are now working towards finding a sustainable water solution. He also made it clear that provision of water to local communities is a county government function and therefore investors play a supplementary role.
[redacted] **Community Member.**	He wanted to know where the central facility will be located.	He was informed that it will be in Ngamia area.
	He wanted to know what plans are there for the waste at Twiga	He was informed that the integrated waste manage facility which is part of the project will manage the waste.
	He argued that he had never seen Golder Associates conducting community sessions in Lomokamar. He requested that Golder considers having meetings in the villages in order to collect	Mr. Kambo assured [redacted] that the current plan involves Golder Associates reaching to all the villages already identified for ESIA consultations. Lomokamar is one of these villages.

Commentator	Issue/Question/Comments	Response
	views from the grassroots. He discouraged any attempt that sessions may be organized in Lokichar and assumed to have covered all the areas.	
[redacted] **Community member.**	He wanted to know whether the land access compensation worth Ksh 7 million that Tullow used to allocate for every well pad will continue for the next phase of drilling.	Mr. Bethwell responded and informed the community members that initially, Tullow was doing exploration and it had approached TCG which had leased the land to them. On top of the 7 million-worth of projects offered to communities, they used to pay land rates to TCG. At the moment, the project is moving to development phase where there will be drilling of several wells. Furthermore, there will be changes in the operations as government will now be responsible for provision of water and land. Therefore, negotiations on land will be done once through NLC.
	He informed that Tullow had a very good plan for the local communities. It offered scholarships for students to study and thereafter get employment opportunities. He inquired whether such initiatives will be available especially for skills such as welding and plumbing to prepare the community to take up jobs.	Mr. Sang responded and informed the participants that the KJV partners had given their support in terms of scholarships. He urged members to also consider reaching out to other development partners to support. He suggested CDF and County Government Bursary Fund as examples of funds that may benefit the locals in this regard.

Commentator	Issue/Question/Comments	Response
[redacted] **representing Namantalem village.**	He asked if there will be compensation for the land where flow-lines will pass through as they connect the various well pads to the CPF.	NLC will handle all matters of land acquisition and compensation.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1440 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: 6th July 2021

Meeting: Disclosure Kaaroge Community.

Venue: Kaaroge village

Start time: 1020 Hrs

End time: 1503 Hrs

Preliminary:

The meeting was called to order by senior chief, [redacted] in charge of Lochwa location at 10:20 am. [redacted] offered the opening prayer.

The senior chief appreciated all the community members for making time to attend the community disclosure meeting. She started by introducing the local community members according to their villages.

She urged the community members to be keen during the presentations as the disclosure team had a lot of information to pass to them about POK. She then invited Mr. Bethwell Sang to introduce his team.

Mr. Bethwell started by acknowledging the effort made by the chief in mobilizing the community members to attend the meeting. He also appreciated the community members for honouring the invitation and attending the meeting.

Mr. Sang then explained briefly that the disclosure meeting is meant to basically give the general information about the project. He informed the members that an ESIA consultant will be coming in three weeks' time to conduct ESIA consultation regarding the project.

He further informed the community members that the national and county government leadership were aware of the meeting and they had given their blessings for the meetings to go on. Mr. Sang reminded the participants that they are valued stakeholders as they are the immediate neighbours to Etom and Emekuya well sites.

He then welcomed the ward administrator for Lokichar ward, [redacted] for introduction. The ward administrator was delighted to attend the disclosure meeting because he was unable to attend a previous meeting that was meant for county and national governments administrators at the sub-county level due to other commitments. He mentioned that TCG has been looking forward to having such meetings at the grassroots where the local communities are.

[redacted] lauded the disclosure team and said that such meetings provide the correct information to the communities thus help dispel rumours and propaganda that otherwise could have pre-occupied the communities. He argued that with the right level of information, the communities can develop some sense of project ownership and they can stop claiming that the project is for Tullow, Africa Oil, Total or MoPM.

He clearly stated that the national and county governments are serving the same citizens. Therefore, both the county and national governments are for the community and any project they initiate is for the benefit of local communities.

[redacted] then welcomed [redacted] the Director for administration at the Ministry of Petroleum and Mining to introduce officers from Ministry of Petroleum and Mining (MoPM) and KJV partners. The officers did self-introductions.

The Director then narrated the history of oil exploration in Kenya from 1940s to 2012 when Kenya announced its first crude oil discovery. He then invited Mr. James Kambo to take the community members through the content of the presentations.

At the end of the presentations, the participants made comments, raised concerns and asked questions as shown in the table below

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted]	He appreciated KJV partners for the informative presentation.	Comment noted.
	He requested that the disclosure team enumerates the potential benefits that the local communities may realize as a result of the project.	Mr. Bethwell informed the community members that there will be approximately 2,400 job opportunities during the construction phase. These opportunities will be for skilled, semi-skilled and non-skilled personnel. It was made clear to them that the employment opportunities will never be sufficient to accommodate everyone and therefore those that will not be employed should look at other opportunities that arise as a result of the oil activities. This includes business opportunities such as opening butcheries, salons, shops, bars, hotels and guest houses among others.
	In addition, [redacted] wanted the team to also inform the local community members of the potential negative impacts that the community may suffer from as a result of the project.	Mr. Bethwell explained that a project of such magnitude will have both positive and negative impacts. He added that the team shall look for ways to harness the positive impacts and minimize the negative impacts. He informed the community members that an ESIA consultant will be coming to the communities in the next two to three weeks to have a detailed conversation on the potential impacts identified and proposed mitigation measures. He urged

Commentator	Issue/Question/Comments	Response
		them to make sure they attend in order to discuss in detail with the consultant.
[redacted]	He mentioned that he had recently travelled to Kalemng'orok and was devastated to see several small-scale irrigation farms drying up. He asked if there will be provision of water from the Turkwel – Lokichar water pipeline for community in Kalemng'orok to use in irrigation.	Mr. Bethwell explained to the community that the water pipeline will have some community off-take points where the local communities can have access to the water. He added that discussions are ongoing between County Government, National Ministry of water and the investors to see how they can cooperate and ensure the off-takes are operational.
	He further inquired if it can be possible for POK to support the pastoralists by planting grass in some areas that can be used as animal feeds during dry seasons.	[redacted] lauded the old man for coming up with such idea. He informed him that at the moment, we are only doing project disclosure where we are collecting comments and opinions of the community regarding the project. His opinion has been noted and may be used to inform future projects POK may design and roll out for the communities. However, he should not perceive receipt of comment as commitment by POK to plant the grass.
[redacted]	He mentioned that he was delighted to hear that the project is theirs (belongs to the community). He argued that if this project is really theirs, then certain things should change in terms of field operations. He stated that he would like to see the residents of Kaaroge and Lochwaa getting long-term employment with KJV partners.	Comment noted.

Commentator	Issue/Question/Comments	Response
	He added that he would like the people of Karoge and Lochwa to be awarded contracts worth millions. He claimed that SHABAA and CEAMO contractors were given almost all the lucrative tenders at the expense of local communities like Karoge.	Mr. Bethwell responded and informed them that POK intends to empower the communities as much as possible. He stated that the issues of tenders are not that easy as there are procedures and eligibility requirements that are always required before awarding any tender. He gave an example that if all the people present at the meeting were to put in a race, not everyone will be position one. Therefore, he informed them that POK will try to be as fair as much as possible but the requirements and standards will be observed.
	He strongly pointed out that Tullow had offered an unsustainable water solution through water trucking. He stated that the local communities had suffered from water shortages since Tullow's activities scaled down. He is now requesting KJV partners to drill a water borehole to provide the community with potable water.	Mr. Bethwell agreed with him that indeed the water trucking is unsustainable. He informed the community members that KJV partners are in consultations with TCG who have the primary responsibility to provide water to the community. He informed them that they are looking for ways they can cooperative together and find a sustainable solution.
	He further stated that, he understands personal land ends up to 6 feet down the ground and that anything that goes beyond that point is the property of national government. He however mentioned that, this fact notwithstanding, the communities still have rights to their land. He argued that the government must compensate them if they have to access the resources located more than 6 feet below their land.	[redacted] informed the members that the National Land Commission (NLC) will come to the local communities and explain on the process of land acquisition and compensation that will be applied for POK and the LAPSSET project. He urged them to be patient and wait as the time will come and the discussion will occur.

Commentator	Issue/Question/Comments	Response
	[redacted] mentioned that they are aware that community members in other villages such as Lomokamar and Lokichar submitted some proposals to the ESIA disclosure team. He stated that they were also working on a draft proposal but it is not yet ready and therefore they will submit once it is done.	Mr. Bethwell confirmed that indeed Lokichar and Lomokamar communities have submitted some proposals to the disclosure team. He however made it clear that receipt of proposal does not mean that POK is committing to implementing them. He told the members that they can submit the proposal if they want to but what is important is the comments that the team had already received through the disclosure meeting.
	He was curious and wanted to be given more information on how land acquisition will be done for this project.	Mr. Bethwell responded and informed him that NLC is the state department that has been mandated to conduct land acquisition for the project. He mentioned that NLC will work closely with TCG and they will come to the local communities to explain how the land acquisition and compensation will be conducted.
[redacted] **Senior Elder**	He mentioned that he felt happy and recognized when he heard [redacted] referring to the project as theirs (for community). This to him meant that the KJV partners and the government have finally realized that the land really belongs to the local communities.	Comment noted.
	The elder expressed a concern that they had been told Tullow left the operations and that it was a new Company that was taking over. So, he expected to see new faces. To his surprise, he's seeing the same familiar faces. He therefore interprets this as being the same company	[redacted] responded and explained to the elder that Tullow had not left the operations. He explained that the KJV partners include Tullow, Africa Oil and Total. He further informed them that Tullow is still the operator for POK. He explained that Tullow had just faced some financial

Commentator	Issue/Question/Comments	Response
	(Tullow) that might have changed its name just to trick the community members.	difficulties and the corona pandemic made it worse for the company and that's why it had to significantly retrench staff. So they should not view the slow pace of activities as a sign that Tullow has left the project.
	[redacted] mentioned that the local community of Lochwa and Kaaroge had slightly benefitted from the project. However, it is their hope that the earlier provision of Ksh. 7 Million as well site access benefit will increase to 20 or 25 million shillings.	[redacted] clarified that all matters of land acquisition and compensation will be handled by NLC and that they will come to the local community levels to hold discussions on this matter.
	The elder mentioned that Lochwa and Karoge villages have livestock that can provide sufficient quantities of meat to supply to the residential camp once serious activities resumes. He urged KJV to consider awarding them the tender to supply meat to the camp.	Comment noted.
[redacted]	He claimed that Tullow had employed Village Socialization Officers (VS0) who were elderly and they addressed any issue that arose from the different well sites. He stated that these VSOs had since been laid off. He was of the opinion that if this disclosure is a sign that Tullow is coming back, then the VSOs should be hired immediately so that they start enjoying the benefits that come with such employment.	Mr. Bethwell responded and informed the pastor that the issue of employment is indeed an important aspect to the communities. However, the step the project is at the moment doesn't have the provision for such employment. He added that when the construction phase begins, any available employment opportunity will be availed to the communities.

Commentator	Issue/Question/Comments	Response
	[redacted] also stated that POK should have by now provided scholarship for every Turkana child from pre-primary to university. He claimed that children in other regions where oil has been discovered are enjoying free education.	
	He suggested that the proponents of POK should consider having designated officers and an office nearby so that the local community members can reach out whenever they have a concern or grievance that need immediate attention. He claimed that the chiefs, DCCs, and police are already burdened by other roles and responsibilities and could therefore not adequately attend to their needs.	Comment noted.
[redacted]	He claimed that Tullow brought chaos to Lochwa and Karoge communities. He attributed this to disagreements among the community members on how to share the land access benefits. He suggested that KJV should look for a fair way to ensure all the communities or villages benefit from any future opportunity.	Comment noted.
	He mentioned that in their community, there are more illiterate (unskilled) members compared to the learned ones. He wanted to know if there will be employment opportunities for the unskilled.	He was referred to the presentation and informed that there will be approximately 2,400 job opportunities during the construction phase. These opportunities will be for skilled, semi-skilled and non-skilled personnel. It was made clear to the community that the employment opportunities will never be sufficient to accommodate everyone

Commentator	Issue/Question/Comments	Response
		and therefore those that will not be employed should look at other opportunities that arise as a result of the oil activities. This includes business opportunities such as opening butcheries, salons, shops, bars, hotels and guest houses among others.
[redacted]	He wanted to know if POK will continue using Tullow's model of accessing land for well sites. He specifically referred to the opening ceremonies where communities were provided with goats and camels to feast on and on top are given Ksh. 7 million which they can do projects with.	[redacted] clarified that all matters of land compensation going forward will be handled by NLC and that they will come to the local community levels to hold discussions on this matter.
	He asked if POK tenders were going to be managed by TCG.	
[redacted]	He wanted to know why the location of the CPF will be in Ngamia and not anywhere near Twiga, Agete or Etom oil fields.	
[redacted]	He asked if the KJV team has confirmed that there is enough peace that can allow for smooth oil operations in the region. He was referring to the incessant insecurity situation especially in Turkana East where raids have been occurring and people loose lives and property. He was	He was informed that security is a function of the national government.

Commentator	Issue/Question/Comments	Response
	concerned that insecurity could affect the oil activities.	
[redacted]	Referring to the presentation where they were told that water will be required from Turkwel dam in order to pump out crude oil from the reservoir, he asked how was crude pumped out during EOPS considering there the pipeline has not yet been constructed.	Linda responded and informed him that EOPS production of crude was only a mere 2,000bopd. The operation was supported by water from boreholes within the project area. In the next phase, we are looking at approximately 80,000bopd to 120,000bopd which will require more water thus Turkwel dam was identified as the appropriate source through studies conducted by experts.
	He claimed that he has a friend who lives in Libya and he told him that everybody there is rich due to the exploitation of oil in their country. He expected that the same would happen to him thus he added his wives to five. His expectation has however not been realized.	
[redacted]	He was concerned and wanted to know if drawing water from Turkwel dam will not negatively affect River Turkwel and Lake Turkana because there are several communities downstream whose lives depend on the river and Lake.	Linda informed that there will be a separate ESIA for the water pipeline that will look into that.

Commentator	Issue/Question/Comments	Response
	He was wondering if it is possible to construct a pipeline from Lokichar to Lamu for crude oil transportation, why can't POK then consider constructing a pipeline from Lamu to Lokichar to bring water and have the crude refined in Lokichar.	He was informed by Mr. Linda that the pipeline from Lokichar to Lamu transports crude oil not to be refined at Lamu but for onward transportation overseas for refining. At the moment, Kenya does not have the capacity to refine oil and it will be uneconomical to establish one. Therefore, even if a pipeline was to be constructed from Lamu to Lokichar, we still can't refine our crude in-country.
[redacted]	She claimed that their children do not get employment opportunities because they do not have academic degrees.	
	She decried that she has been burning charcoal all her life and expected her life to change positively after the discovery of crude oil in their area. This, according to her, has not yet happened.	
[redacted]	She claimed that during EOPS, there used to be some sort of smoke emanating from flaring. She argued that the smoke affected their health as children fell sick, pregnant women and livestock had miscarriages, some livestock died and some trees and vegetation in their vicinity dried up. She wanted to know what measures the project has put in place to safeguard the health of the citizens.	Mr. Bethwell responded and informed the community members that the current project design has prohibited flaring unless under emergency situations. He added that ESIA consultants will be coming to the communities in the next two to three weeks to have a detailed conversation on the potential impacts identified and proposed mitigation measures that the consultants will be advising the client to implement in order to minimize negative

Commentator	Issue/Question/Comments	Response
		impacts and enhance positive impacts of the project. They should therefore purpose to attend the ESIA consultations.
[redacted]	He claimed that the life of the community members has not changed despite the discovery of oil in this area. He argued that they are still putting on the same clothes, eat the same food and engage in the same economic activities for survival. He argued that the project is most likely going to benefit the same people if operations resume. He therefore urged POK to ensure some level of fairness in distribution of employment and business opportunities if this project is to have wider positive impact.	Comment noted.
[redacted]	He claimed that the Eldoret agreement that was drafted and agreed upon by the Turkana leadership was disadvantageous to them. He argued that this agreement is responsible for them not getting long-term employment. He asked POK to disregard this agreement.	Comment noted.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1503 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **7th July 2021**

Meeting: **Disclosure – Nakukulas Community.**

Venue: **Nakukulas village**

Start time: **1055 Hrs**

End time: **1521 Hrs**

Preliminary:

The meeting was called to order by the Assistant Chief for Nakukulas, [redacted] at 10:55 am. Thereafter, [redacted] offered the opening prayer.

The chief appreciated all the community members for making time to attend the disclosure meeting. He acknowledged the various groups present including the council of elders, village elders, youth, women, religious leaders and professionals.

He then invited Mr. Bethwell Sang to introduce his colleagues.

Mr. Bethwell started by acknowledging the presence of the Director Administration in the Ministry of Petroleum and Mining, the DCC Turkana East and Turkana County Government ward administrators for Lokori/ Kochodin and Napeitom/ kapedo wards among other dignitaries present. He informed the community members that the project was moving from exploration and appraisal phase to the development phase. He added that currently, the project is following the statutory requirement for ESIA disclosure and thereafter, there shall be ESIA consultations before submission of ESIA report to NEMA for approval.

Mr. Bethwell welcomed [redacted] the ward administrator for Lokori/ Kochodin who was representing TCG for introduction. The ward administrator introduced himself and his colleague from Napeitom/ Kapedo ward, [redacted] He then welcomed the DCC for Turkana East, [redacted] to take over.

The DCC was accompanied by a public health officer whom he invited to conduct COVID 19 sensitization. This session was very important considering the unprecedented rise in COVID 19 cases. The health officer informed the Nakukulas community members that COVID 19 is real and that there were six confirmed cases in Turkana East with one succumbing to the pandemic. He urged the people to strictly adhere to MOH guidelines provided to manage the pandemic.

The DCC then reiterated on the need to take protective measures on combating COVID 19. He urged all the present community members to be good ambassadors and pass the message to the rest who had not managed to attend the meeting. The DCC pointed out that he was aware that some people have been organizing night meetings where a number of community members are taken to the luggas past curfew hours and in breach of COVID 19 MOH guidelines to discuss political interests for 2022. He issued a stern warning against such behaviours and urged the community members to seek police clearance/ approval if they want to organize for any gathering which can be permitted to be done during the day. He urged religious leaders to be vigilant and not allow the places of worship to be used for night political gatherings.

The DCC welcomed [redacted] who in turn introduced his team which comprised of officers from MoPM and KJV partners.

The Director then narrated the history of oil exploration in Kenya from 1940s to 2012 when Kenya announced its first crude oil discovery. He then invited Ms. Linda Were to take the community members through the presentations.

At the end of the presentations, the participants made comments, raised concerns and asked questions as shown in the table below

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Pricipipal Ngamia one secondary school.**	He appreciated POK team for disclosing information regarding the project to the community members. He added that they welcome the project and wish that it continues.	Comment noted.
	The principal had a written proposal with a list of items that he presented on behalf of residents of Kochodin and Lochakula locations. The first item was on security. The principle highlighted that there have been several incidences of insecurity in the area which has resulted to loss of life and property. They are recommending the following to combat insecurity in the area: 1. Establish RDU camps at Kachela, Kaakulit or between Kaepedru and Nayanaea eng'ol. 2. Conduct disarmament exercise in West Pokot for all illegal firearms. 3. Recruit NPRs and deploy them at the volatile areas. 4. Establish peace caravans to spearhead peace talks among these worrying communities.	[redacted] the Sub-County Police Commander in charge of Turkana East responded and informed the community members present that they are working to ensure insecurity incidences are combated. He further stated that anyone with illegal firearm must surrender to the police. Failure to which, such persons will be dealt with by the police when they are found. The commander informed the community members that currently, he has enough security officers in Turkana East as compared to the past. He further explained that Turkana East may be sub-divided into two based on its unique security needs and will be characterized by the following security installations: 1. Kapedo to Kaamuge: GSU based in Kapedo, NPR, KDF & RDU. 2. Napeitom to Katamanak/ Nakukulas: CID, CIPU, NPR & GSU in Lokori. There is also ASTU at Lochakula village.

Commentator	Issue/Question/Comments	Response
		He further urged the community to support the police as policing is not a reserve for Police officers. He urged the members to promptly report any incident that may require Police response.
	Regarding Education, the community are proposing the following: 1. POK to provide MSc. Scholarships to equip community members with the technical skills that will be relevant in the oil and gas sector. 2. Provide bursary for secondary schools and colleges. 3. Establish model secondary schools. 4. In collaboration with other partners, POK to establish secondary schools especially along the highway. 5. TCG to establish ECDEs at Kalouchelem, Kode kode, Lokosim Ekore and Katamanak.	Mr. Bethwell responded and informed the community members that indeed Tullow had started MSc. Scholarship where some students were fully sponsored to study oil and gas related courses in the UK. After some years, the company decided to change the program to make it more effective. It focused on scholarship for colleges and universities within Kenya for students to pursue technical courses such as plumbing and welding among others. During the construction phase, the project will require more technical people to do welding of the pipelines and plumbers to work on the water installations among others. Having said that, Mr. Bethwell mentioned that POK has received their proposals but they should know clearly that receipt does not mean commitment to implement.
	On Health, the community proposed the following: Construct a level three hospital in Nakukulas. Hospital to be equipped with ambulance and mortuary.	Mr. Bethwell explained that Tullow had previously constructed three level 3 hospitals in Lodwar, Lokichar and Lokori. He stated that these projects are designed and executed in close collaboration with TCG as provision of health care is their mandate. Therefore, all discussions about

Commentator	Issue/Question/Comments	Response
		construction of health facilities should start with TCG Ministry of Health.
	On water challenges, they proposed the following: 1. POK and TCG to stop water trucking. 2. Find an appropriate way to pipe water from Nakukulas borehole to Lopii village. 3. Partners to consider if possible, station a very huge tank in Nakukulas to help store the water from Turkwel dam through the proposed off-take point. Water to be used for irrigation.	Mr. Bethwell narrated on the project Tullow did for water in Lopii. He explained that Tullow installed a solar powered water borehole at Lokwamosing and piped water to Lopii village. The villagers deliberately punctured the water pipeline and stole the solar panels thus created this incessant water problem at Lopii. He urged community members to always take care of anything provided by government or development partners as their own. They should not view such project as company project and vandalize such installations believing that they will be repaired. Finally, he mentioned that provision of water to the local communities is a function of the county government. However, the concern had been noted and the project has already planned to have one water off-take point in Nakukulas. TCG can find ways including partnering with other development partners to reticulate water to the nearby villages including Lopii.
[redacted] **Chair council of Elders,**	He stated that the president of the Republic of Kenya, his Excellency Hon. Uhuru Kenyatta took an oath to protect the lives and property of Kenyans. He mentioned that so far, 8 raids have	Comment noted.

Commentator	Issue/Question/Comments	Response
Turkana South sub-county	occurred in Turkana East orchestrated by people from the neighbouring West Pokot community which has resulted to lose of lives and property. He claimed that the people from West Pokot Community are causing insecurity in Turkana because they want to own the Turkana land especially because of the oil prospects. He stated that the national government should focus on restoring peace first before talking about POK.	
	He claimed that the Chinese constructing the Kitale – Lodwar A1 road have drilled several water boreholes in places that TCG were unable to. He added that he had talked to the Governor of Turkana County to engage the Chinese contractor to drill a water borehole in Lopii. But now that POK has started the disclosure sessions, he was of the opinion that POK can as well engage the Chinese company to drill the water borehole. He added that the area MCA had sent him to inform the POK representatives that his priority is having water problem resolved first before oil activities resume in the area.	[redacted] responded to this by stating that the government cares about the health of its people. For this reason, the government cannot provide its citizens with water that does not meet the potable water standards as this may have negative long-term effects on the people. He stated that the difference could be that the Chinese are looking for just any water as their primary role is road construction unlike the government which must look at the health of the people.

Commentator	Issue/Question/Comments	Response
	[redacted] further delved into matters of land. He stated that Turkana being communal land, the residents are expecting NLC to come up with a compensation framework for land acquisition and compensation that will be acceptable to the community members.	Comment noted.
	He claimed that since Tullow left, there are no more Turkanas being employed by POK. He accused [redacted] of lying to the community members.	[redacted] responded and stated that it is wrong to falsely accuse him of lying to the community members. He mentioned that during EOPS flag off, he discovered that there was no Turkana among the 300 seafarers that were employed to take the crude to the international market. Since he discovered that, he had already talked to the people in charge and he had requested for at least four slots for the Turkana people. He challenged the people that if he was lying about employment, could he have requested for those positions? He commented that he has never been accused of lying and advised that people should not play others' emotions.
	He stated that there are some levels of businesses that the local Turkanas can handle. He recommended that POK should look at all available business opportunities and not put stringent conditions that will disadvantage the Turkana people on some businesses they can do. He mentioned that other Kenyans can do the	Comment noted.

Commentator	Issue/Question/Comments	Response
	capital-intensive tenders as the Turkanas do the other middle and low ones.	
	The chair, council of elders further faulted the national government claiming that the community has not received its share of proceeds from the sale of EOPS crude.	[redacted] explained to the community members that the government had not started commercial exportation of crude and that EOPS was just a pilot scheme or rather a trial to see how the Kenyan crude will trade/ behave in the international market. He assured the community that once the country begins commercial exportation of crude then the 20% County and 5% local community benefits will be realized as provided for in the Petroleum Act 2019.
[redacted]	With reference to Ngamia one, [redacted] wanted to inquire if compensation will be done to the communities for the already acquired pieces of land some of whom crude oil has been discovered.	Mr. Bethwell explained to the community, the process Tullow used to follow for land acquisition which involved both TCG and community members. He further stated that TCG still holds the land in trust of the local community members. He mentioned that going forward, NLC will be responsible for land acquisition and compensation.

Commentator	Issue/Question/Comments	Response
	He further wanted to be informed if there will be community water off-take points along the proposed Turkwel – Lokichar water pipeline.	Mr. Bethhwell responded and informed him that there will be six community water off-take points: One in west Pokot and five in Turkana County (Katilu, Kaptir, Kalemngorok, Lokichar and # Nakukulas).
	He requested that the local communities be taken through the identified potential impacts and proposed mitigation measures in a more extensive session to enhance their understanding and improve their contributions towards the ESIA report.	Mr. Bethwell responded that in the next 2 -3 weeks, Golder Associates consultants will be at the field to take the communities through the ESIA consultations. During this time, the potential impacts and proposed mitigation measures will be explained in detail to the community members.
[redacted]	He claimed that the local communities had been peaceful since Tullow left. He added that since they heard that oil operations are likely to resume, they started to fear that the community members may start fighting each other over employment and business opportunities.	
	He also inquired whether the previous VSOs will be recruited back to their former positions.	
	He was concerned that the water from Turkwel dam may take ages to reach to them. He therefore requested water trucking to continue until the time they will be connected to water from Turkwel dam.	He was notified that water trucking was not sustainable and POK was engaging TCG so that the county can take up the water issue in a more sustainable way.

Commentator	Issue/Question/Comments	Response
[redacted] **business representative.**	With reference to the total number of wells estimated to be drilled (Ngamia 246, Amosing 173) during the development phase, he asked if these wells will make the ground to sink in future.	He was assured studies have been done and the ground will not sink
	As they were told that several wells will be drilled within one well pad, he wanted to know how the communities will benefit from each well (having in mind previous Ksh. 7 million that Tullow used to offer to communities as well pad access fee).	Mr. Bethwell responded and informed the communities that POK will not directly be involved in land acquisition or compensation. He added that NLC is the state department that will engage the communities on matters land acquisition and compensation.
	He inquired why KJV asked TCG to propose to POK on the possible locations for community water off-take points along the Turkwel- Lokichar water pipeline. He proposed that POK could have asked the communities directly to propose these locations as he claims TCG does not really know their water problems.	He was informed that the functions of water supply lies with TCG.
[redacted] **Community Activist**	He was of the opinion that matters of land acquisition and compensation should have being discussed first with the community before discussing the components of the project as detailed in the presentation.	Mr. Bethwell informed him that what is being done today is project disclosure. They are being made aware of the various components of the project. It is only through project disclosure that the community will understand why the project will require a certain size of land and other main resources such as water. It Is only after knowing the exact project requirements that discussions on acquiring them (example land) can start. Project proponents cannot ask communities for

Commentator	Issue/Question/Comments	Response
		land when they have not explained to them what exactly they want to do.
[redacted]	She claimed that Tullow had given men priority in terms of employment and business opportunities. He requested that POK should reconsider and give women equal opportunities as men.	Comment noted
	She alleged that Tullow had favored people living in urban areas. She claimed that those in the interior are not employed equally as those in towns. She added that even business opportunities are largely given to town-dwellers at the expense of the remote villagers. She requested POK to consider giving equal opportunities for business and employment for both town-dwellers and those residing in the villages.	Comment noted
	She requested that the illiterate village women should also be considered in case there is an opportunity to take community members to learn about the oil and gas whether at the oil fields in Lokichar basin or anywhere else. She argued that once these villagers are taken and they witness/ learn for themselves, they will be the best people to explain to the other illiterate villagers.	Comment noted.

Commentator	Issue/Question/Comments	Response
[redacted]	She wanted to know where they can report in case their animals are injured or killed by the razor wire at Tullow's well sites.	She was informed that incase of grievance people can channel that to chiefs which will eventually be picked up by POK and the matter will be resolved well.
[redacted] businessman	He wanted to be furnished with further information on the negative impacts of the project on the communities.	Linda informed that an independent consultant will be coming in three works time to state the impacts identified and the mitigation measures proposed for the project
	He mentioned that currently, some community members live near Ngamia 1 and Amosing 7. He expressed concern that perhaps the activities on these sites may have already affected the health of these people. He asked if the Ministry of Health could do scanning for probable oil and gas related diseases.	
	In addition, he asked if routine soil, water and air testing is being done to confirm if there is potential for any health risk.	Linda informed that there are annual audits done and so far every parameter is in normal range

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1521 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **8th July 2021**

Meeting: **Disclosure – Kalapata Community.**

Venue: **Loperot village**

Start time: **1059 Hrs**

End time: **1504 Hrs**

Preliminary:

The meeting was called to order by the Senior Chief, [redacted] at 10:59 am. Thereafter, [redacted] offered the opening prayer.

The senior chief welcomed all the community members and staff from MoPM and KJV partners to the meeting. He urged the community members to be very keen and pay attention to details during the presentations. He introduced the community members as per the villages represented. Thereafter, he welcomed Mr. Bethwell Sang to introduce POK team.

Mr. Sang thanked the senior chief and the community members for attending the disclosure session. He mentioned that Loperot village is very special to the project as it was the first area where drilling started in Turkana. He added that the main agenda of the team was to inform the community members on the progress of Project oil Kenya.

He added that in the next 2 – 3 weeks, a team of consultants will come to conduct community consultations. At that time, the community will get another opportunity to give comments or ask questions on the various aspects of the project.

Mr. Sang then welcomed TCG ward administrator for Kalapata ward, [redacted] to greet the community members and welcome POK team to Kalapata ward.

The ward administrator was glad and thanked POK team for having the disclosure session. He urged the community members to take this opportunity to learn from the team about the oil project. He explained to the community members that the disclosure started at the national level, then it was cascaded down to the county and sub-county levels and now it was the time for the local community members.

[redacted] mentioned that the community members had been asking him several questions regarding the oil project and he believed that they will get the answers from POK team.

He requested the community members to share the information with the rest of the community members who did not manage to attend the meeting.

[redacted] then welcomed [redacted] who was leading the POK team to introduce the rest of the team members and proceed with the agenda of the day.

[redacted] invited the team from MoPM and KJV partners to do self- introduction. After that, he narrated to the community members the history of oil exploration in Kenya from 1940s to 2012 when the country announced its first crude oil discovery. He also explained that the project had assessed a number of water sources and finally arrived at Turkwel dam as the most appropriate source. [redacted] then invited Mr. James Kambo to take the community through the presentation.

Mr. Kambo explained in detail the main components of the project and what is remaining for project to move to the construction phase.

At the end of the presentations, the participants made comments, raised concerns and asked questions as shown in the table below

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **representing council of elders**	He expressed his gratitude to the team and mentioned that they are appreciating the presence of Director [redacted] In his view, the presence of the director signifies that the meeting was very important.	Comment noted.
	He mentioned that the community values graves of their deceased members and that the project should not tamper with any grave site. He added that the community members are willing to help in mapping out these sites.	Mr. Sang responded and informed the elder that baseline studies had been conducted where potential grave sites, water points and areas of religious or cultural significance have been mapped. He added that the project respects the community and it does not intend to do anything that will be against the culture of the people. He also informed the community members that when the consultants will come for community consultations, they should share the information on the location of these graves and any other place of religious or cultural significance. [redacted] added that some national government departments including National Museums will be involved in identifying areas of archaeological importance. He assured the community that they will be listened to and nobody will destroy their grace sites.
	He added that the community would like to have access to grazing land and therefore are	Mr. Sang informed the community members that the project will fence off only the well pads and

Commentator	Issue/Question/Comments	Response
	suggesting that unnecessary structures should not be erected outside the oil wells.	there will be open spaces between the well pads where the community can graze their livestock.
	He claimed that there was disparity in terms of payment of employees based on classification as either “local” and “national”. He urged that the project should refer to all employees as Kenyan nationals and pay them as per the job requirements.	Mr. Bethwell explained to him that the main reason for classifying employees as “locals” or “nationals” was purely for reporting purposes. He stated that at times the national government, investors, county government and some local politicians may want to know how many locals have been employed by the project. He added that payment is based on the positions that one holds and not where one comes from.
[redacted]	He claimed that having the logos of national government and KJV partners in the printed presentation is an indication that the project has been approved. He asked if there is any Turkana elder that has approved the project.	Mr. Sang explained to him that the logos are there to show the partners that are working together for this project. He added that the community disclosure and consultation meetings are meant to make the communities understand the details of the project and seek their approval.
[redacted] **Youth leader.**	Mentioned that they are welcoming the project.	Comment noted.
	He requested that the project should consider constructing a health facility and secondary school in Loperot village.	Mr. Bethwell responded that the team has received their request. He made it clear that receipt of their request should not be seen as a commitment by POK to doing what the communities has requested.

Commentator	Issue/Question/Comments	Response
	He appreciated Tullow for employing some community members as road marshals during the exploration activities.	Comment noted.
	He claimed that 1,500ha is such a big chunk of land. He expressed concern that some community members may be homeless if the project acquires this size of land.	Linda notified that NLC is responsible for acquisition and compensation but the area around the wellpads will be fenced off however communities can graze in other surrounding areas.
	He alleged that the CLOs who are recruited by the companies end up supporting the company at the expense of the community. He argued that the CLOs should be in the middle and support the company as well as the community.	Mr. Sang mentioned that the government's presence will be more prominent going forward.
	He claimed that TAI is currently working with Lomokamar, Kaaroge and Nakukulas communities on managing waste but they are left out.	Linda informed that waste consolidation was a small exercise and Tai just engaged the three areas for information purposes.
[redacted]	He asked if the national government can provide title deeds to the locals so that they can use them to claim compensation from the project.	NLC is mandated in matters land acquisistion

Commentator	Issue/Question/Comments	Response
	Requested that the project considers them for both skilled and unskilled employment opportunities.	Mr. Sang responded and informed the community that approximately 2,400 employment opportunities will be available during the construction phase of the project. These positions will be for the skilled, semi-skilled and unskilled personnel.
	He requested that any job advertisement to be posted at the chief's office for the locals to conveniently apply.	Comment noted.
[redacted] **Leader for the women.**	She wanted to know how deep the flow lines will be buried underground.	She was informed by Mr. Sang that the flow lines will be buried approximately 2m underground.
	She asked if there will be compensation for the people that will be displaced by the LAPSSET project.	Linda informed that the process of land acquisition and compensation is the mandate of NLC
	She asked if there are any plans by POK to support women groups.	Linda informed that currently the project is seeking ESIA license but when the project start off POK will engage with the community again on such matters
	She also asked where waste will be stored.	Linda responded and informed the community that all types of waste that will arise from the project will be managed at the IWMF which will be located within the Central Processing Facility.
[redacted] **Chairperson for PWDs in**	He appreciated the company for doing the disclosure meeting.	Comment noted.

Commentator	Issue/Question/Comments	Response
[redacted]	He wanted to know the benefits and opportunities that PWDs and the elderly can get from the project.	Mr. Sang informed him that the project will consider PWDs and the elderly for opportunities that they can do. Mrs. Linda also added that it is a requirement by the government that disadvantaged groups such as PWDs, Women and youths be considered for employment and business opportunities.
[redacted] **PA to the area MCA.**	Informed the community members that the area MCA had sent his apologies for not attending the meeting. He mentioned that he was attending to some other important issues.	Comment noted.
	He added that the area MCA is supportive and welcomes POK.	Comment noted.
	He wanted to be informed if there are wells in their locality (ward) that are being considered for development. He mentioned that he had not seen Loperot in the displayed banners as part of the six oil wells that are going to be developed.	Linda informed that well location are informed by data and so far the six fields have the potential to produce oil.
	He claimed that the water borehole at Kaimegur has been piped to ACS camp and yet the local communities living nearby have no access to the same water. He requested POK to support and pipe water from that borehole to the nearby villages.	Comment noted.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1504 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **9th July 2021**

Meeting: **Disclosure – Lokori Community**

Venue: **St. Daniel Comboni Parish Social Hall - Lokori**

Start time: **1047 Hrs**

End time: **1513 Hrs**

Preliminary:

The meeting was called to order by the Assistant Chief [redacted] at 10:47 am. Thereafter, [redacted] offered the opening prayer.

The assistant chief appreciated POK team and the various representatives of different groups present at the social hall for attending the meeting. He then introduced the participants based on the sub-locations they come from and the groups they represent.

The assistant chief then welcomed Mr. Bethwell Sang to introduce POK team. Mr. Sang appreciated the assistant chief and the participants for creating time to attend the meeting. He informed them that the main agenda of the meeting is to disclose information concerning POK to the stakeholders. He added that Turkana East is important to the project as the areas of Lotubae and Kangitit will be impacted by the construction of the midstream infrastructure. Lokori is also recognised for being the Headquarters for Turkana East Sub-county.

Mr. Sang mentioned that in the next 2-3 weeks, a team of consultants will come to conduct ESIA consultations. He stated that the participants will get an opportunity to ask questions or make comments during the disclosure meeting and also when the consultants will conduct the consultation sessions. Mr. Sang then invited [redacted] the ward administrator for Kapedo/ Napeitom ward to introduce himself. The administrator welcomed the participants and POK team and mentioned that he was representing [redacted] who is the host ward administrator for Lokori/ Kochodin ward. He informed the team that [redacted] will be joining the meeting later as he had rushed to attend to some urgent matters elsewhere.

[redacted] urged the participants to take this opportunity and listen to the presentation from POK team. He then invited [redacted] the deputy sub-county administrator to make some comments.

[redacted] commended POK for conducting the disclosure session in accordance with the constitution of Kenya. He invited [redacted] DCC for Turkana East who in turn introduced [redacted] the Disease Surveillance officer to sensitize the participants on the corona pandemic. The officer informed the participants that Corona virus is real and that they have six confirmed cases in Turkana East. He therefore advised the participants to take caution and fully adhere to MOH COVID 19 protocol. The DCC also invited the parish priest, [redacted] to greet the participants.

Thereafter, the DCC welcomed [redacted] to introduce his team and proceed with the disclosure. [redacted] introduced officers from MoPM and KJV partners. He reiterated on the importance of following the MOH Covid 19 protocol. He also informed the participants that he had tested positive for corona virus but he recovered.

[redacted] then narrated the history of oil exploration in Kenya from 1940s to 2012 when the first crude discovery was announced. He also explained the reasons why the government launched EOPS and what it achieved. He further explained the challenges that faced EOPS and the re-adjustments that the project is undertaking

in order to move forward. [redacted] then handed over to Mrs. Linda Were and James Kambo to take the participants through the presentations.

At the end of the presentations, the participants made comments, raised concerns and asked questions as shown in the table below

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Youth representative**	He mentioned that there have been numerous insecurity incidences in Turkana East that has caused loss of lives and property. He recommended the following to the security team as measures to improve the security situation in the area: 1. Deploy security officers and NPR to the vulnerable and insecure areas. 2. Empower sub-county security officers. 3. Apprehend cattle rustlers. 4. Mass disarmament of both Turkana and West Pokot communities. He mentioned the following areas as the most affected: Lochakula, Kaakullit, Lokori, Kaamuge, Kapedo and Lokwamosing.	Mr. Bethwell appreciated the participants for their comments. He informed them that their views and comments have been noted and are valued as they shape the project's future. However, he made it clear that health and provision of water services is a county government function. He also mentioned that security is a national government function. Having in mind that the project is being executed by KJV partner's together with county and national governments, Mr. Sang informed the participants that the two governments will be given the comments so that they get to know the community's priority needs. This may help them in designing community projects.
	He requested POK to construct a dam at a place called Lowat. He argued that having such a dam will provide water to irrigation schemes in the area which will in turn boost food security. In addition, Below are more recommendations he provided that can improve food security. 1. Mechanize irrigation schemes. 2. Provide extension services to farmers. 3. Rehabilitation of existing irrigation schemes. 4. Provision of seeds and equipment.	The DCC informed the participants that he had visited all the irrigation schemes and by April 2021, land preparation was ongoing. He added that he expects harvesting to start from August 2021. He added that the national government has tractors available for community members to use and they only charge Ksh. 2,000/- but they are hardly used. He further stated that there are government extension service providers who help communities within the irrigation schemes.

Commentator	Issue/Question/Comments	Response
	5. Fencing of Morulem, Lotubae and Elelea irrigation schemes.	
	He alleged that Turkana East was disadvantaged during previous Tullow's operations as they got very few employment opportunities. He stated that out of 300 drivers residing in T.E, only 7 were employed by the project.	Mr. Sang informed the participants that all the available employment opportunities are not only for Turkana East and South sub-counties. Other areas are also considered. In addition, the recruitment is a competitive process and there are some bare minimum requirements that people must meet to be considered.
	He suggested that CLOs and VSOs should be recruited from the affected communities.	Comment noted
	He requested the national government to extend the tarmac that has terminated at Amosing area to reach Lokori.	The DCC informed the participants that the road from Kapedo to Lomelo is currently under construction. He added that the construction has reached Napeitom and it is expected that the same road will be extended to Lokori.
[redacted]	He claimed that the residents lack access to water. He suggested that the project should consider drilling water boreholes, construct water pans and dams to supply the communities with clean water.	Mr. Bethwell appreciated the participants for their comments. He informed them that their views and comments have been noted and are valued as they shape the project's future. However, he made it clear that health and provision of water services is a county government function. He also mentioned that security is a national government function. Having in mind that the project is being executed by KJV partner's together with county and national governments, Mr. Sang informed the
	He listed the following as potential ways the project can support education and literacy in Turkana East. 1. Construction of primary and secondary schools.	

Commentator	Issue/Question/Comments	Response
	2. Provide scholarships and bursaries for needy students. 3. Provide attachment and internship for students in TVETs, colleges and universities.	participants that the two governments will be given the comments so that they get to know the community's priority needs. This may help them in designing community projects.
	He requested the project to support the health sector by: 1. Donating drugs and constructing health centres. 2. Providing veterinary services to livestock. 3. Providing ambulance services for medical emergencies.	
	He mentioned that the community expects to be compensated for the land that will be used by the project.	Mr. Bethwell referred the participants to the presentation they were taken through by Linda Were and James Kambo. He reiterated that all matters of land acquisition and compensation for POK will be the mandate of NLC. He informed them that NLC will come to the communities to explain how land acquisition and compensation will be executed.
	He also suggested that any employment and business opportunities that will arise through waste management should be shared between Turkana South and East sub-counties.	

Commentator	Issue/Question/Comments	Response
[redacted] **business representative.**	She listed the following as ways that the project can support businesses in Turkana East. 1. Award tenders for car hire, catering services, supply of food and non-food items to the local communities. 2. Establish slaughter houses for supply of meat.	Comment noted.
	She requested county and national governments to fast track registration of community land and issuance of title deeds to the locals in order for them to access land benefits.	Comment noted.
[redacted] **chairperson for PWDs**	He wanted to know how PWDs can benefit from the project. He proposed setting aside some jobs for PWDs or even employing children whose parents are PWDs.	Mr. Bethwell responded and informed the participants that POK will try as much as possible to employ PWDs to work in the project. He added that Tullow had previously employed 2 PWDs as CLOs and they did their work perfectly.
	He criticized the title "South Lokichar Basin Oil Project" as being discriminatory. He alleged that it makes people from Lokichar to feel they own the project and apportion themselves all the benefits. He asked if the title can be edited to include Lokori or Turkana East sub-county.	
	He also wanted to know if the participants will be provided with allowance for attending the meeting.	[redacted] notified that there were no allowances as the disclosure is to be free and people should give their opinions and comments at their will

Commentator	Issue/Question/Comments	Response
[redacted]	He wanted to know if the Ministry of Health has COVID 19 testing reagents and whether they conduct testing in the Lokori health facility.	The disease surveillance officer from the ministry of health responded and informed the participants that they have reagents and they do conduct COVID 19 tests at the Lokori hospital.
	He also asked if there is an isolation facility for COVID 19 patients.	The medical officer confirmed that there is an isolation facility at the hospital although it is not active as all the COVID 19 patients have been subjected to home-based care.
	[redacted] further inquired if TCG has put in place preventive measures to deal with the pandemic. He asked if the government is going to provide masks, sanitizers and soap to people.	[redacted] mentioned that the government was not planning to issue soap, sanitizers and masks to citizens. Such is considered as personal responsibility for citizens. However, the government can provide some basic drugs to support the recovery of people who test positive for Corona.
	He claimed that the political leaders in West Pokot, Laikipia and Isiolo counties have helped their people to register their land as required by the community land act. He challenged TCG and local politicians to do the same.	Comment noted.
	He alleged that the chiefs are overwhelmed by the work they already have thus adding more responsibilities to them to support the project will be a disservice. He suggested that the oil companies should recruit CLOs to do the community engagements.	Mr. Bethwell reiterated that the presence of the national government is going to be more visible as the project continues. He added that as much as POK may recruit CLOs, the chiefs will still be active in the project because they have a wider coverage and they are in every sub-location thus easier to be reached by the residents.

Commentator	Issue/Question/Comments	Response
[redacted] **kangitit sub-location.**	He made reference to EOPS and asked where community's share for the crude that was sold went to.	Mr. Sang responded and informed the participants that the petroleum act provides the revenue sharing formula between the national government, county government and the local community. He stated that the project has not yet produced revenues to be shared as per the petroleum act. He advised them that once the revenue are realized, the community will get its share.
	He wanted to know why the project decided to take water from Turkwel dam and not Lake Turkana.	It was explained to him that the project had experts who analysed all the potential water sources which included the Indian ocean, Lake Turkana, Turkana's underground water, Turkwel dam and Lake Victoria. After a comprehensive analysis, Turkwel dam emerged as the best option.
	[redacted] expressed concern over people living along River Turkwel and asked if drawing water from Turkwel dam will have significant negative impact on these people.	Mr. Sang explained that the project intends to draw water from the dam itself and not at the tailrace where the water that has gone through the turbines is released to flow down the river. For this reason, the turbines will continue to operate normally and therefore, the flow of water downstream will not be affected.
	He claimed that some diseases may crop up due to oil and gas activities. He asked if the project has put any measures to handle such diseases in case they erupt.	He was notified that routine health checks were always done for the workers and so far no diseases was associated with the activities

Commentator	Issue/Question/Comments	Response
[redacted]	He alleged that Tullow was biased to Turkana East in terms of employment and business opportunities. He attributed this allegation to the project title and recommended that it should be renamed to include Turkana East.	Mr. Sang asked the participants to be sincere and speak the truth. He pointed out that most employment and business opportunities have been dominated by people from Nakukulas which is still part of Turkana East sub-county. He urged the residents of Lokori to talk to their brothers and sisters in Nakukulas so as to find a better way to share opportunities mean for Turkana East.
	Making reference to the community off-take points that will be provided along the water pipeline from Turkwel dam to Lokichar, [redacted] asked if there is any way they can also benefit from the same water.	Mr. Sang reminded the participants that water is a devolved function to the county governments. He added that investors can do as much as they could to supplement the county government in this role but the main responsibility remains with the government.
[redacted]	He claimed that the oil and gas activities may cause some rare diseases both to people and livestock. He alleged that the women may end up giving birth to children without legs.	
[redacted]	She requested POK to consider female drivers from Turkana East. She urged that the requirement of 5 years work experience should be removed in order for upcoming female drivers to compete fairly with the men.	Comment noted.
[redacted]	He wanted to know if the project is ready to start.	He was informed that oil and gas projects are usually executed in phases. At the moment, the project is preparing to move to the construction phase and that's why ESIA disclosure are

Commentator	Issue/Question/Comments	Response
		ongoing and consultations will follow soon. He was also informed that the project will then need to get land and water in order to proceed to construction.
	He claimed that companies contracted by Tullow did not pay some employees all their dues upon termination of employment. He suggested that all employees should receive their salaries directly from the oil company so that at the end of employment, they can get their dues.	

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1513 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETING HELD WITH COUNTY AND NATIONAL GOVERNMENT OFFICIALS OF WEST POKOT COUNTY

MINUTES

Date of meeting:	**13th July 2021**
Meeting:	**Disclosure – West Pokot County and National government officials**
Venue:	**Horizon Hotel Kapenguria – West Pokot**
Start time:	**11:07 Hrs**
End time:	**15:55 Hrs**

Preliminary:

Mr James Kambo (Africa Oil) called the meeting to order at 11:07am by welcoming all members and there after requested a volunteer to lead with a word of prayer.

Introductions:

James introduced himself and asked each member present to do a self-introduction and mention the relevant department or ministry they come from. After the introductions Mr Kambo gave an overview of the meeting being the project disclosure which will be followed by ESIA consultations. He then welcomed [redacted] from MOPM to give an overview of the project.

[redacted] took the attendees through the history of oil exploration from the 1940 to 2012 when the first discovery was made by the KJV. He informed that transportation of the crude oil was very expensive by road and the plan was to utilize the LAPSSET corridor by setting up a pipeline from Lokichar to Lamu. He informed that water was required to add pressure in the resoiver to enable the oil to flow to the surface and that after several studies water from Turkwel dam was identified as the most preferred option.

He mentioned that the intention of the meeting was to disclose the project which will then be followed by ESIA consultations after which the report will be submitted to NEMA as the technical team work on the design of the project. He added that the government through the Ministry of Petroleum and Mining is working with the Kenya Joint Venture comprising of Africa Oil, Total and Tullow as the contractor. Tullow has the highest percentage in regard to shares. He called upon the members to fully participate as their views are very important to the success of the project.

[redacted] then welcomed KJV partners to give the presentation.

Mr. Bethwell Sang fromTullow Oil Kenya thanked the members for turning up for the meeting and informed that part of the POK team have gone for a courtesy visit at the Speakers office but will later join the meeting.

He set the context of the oil and gas lifecycle, EOPS, the different blocks and the composition of the KJV partners,

James Kambo then welcomed the POK team that had visited the Speakers office thereafter took the team through the presentation. [redacted] the Director MOPM then appreciated the county assembly team lead by the speaker for attending the meeting and welcomed all the attendees to ask questions, comments and any clarifications.

The following are the issues, comments and questions raised.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Speaker West Pokot County.**	Welcomed the team to West Pokot County and recognized the presence of the [redacted] Confirmed receipt of the invitation letter but honorable members were on recess. Appreciated the members for turning up for the meeting.	Comment noted.
[redacted] **Leader of minority**	Appreciated the presentation and welcomed the visitors. He noted that previous partners didn't know that water was needed for the project and that's why West Pokot was left out in many things. He lamented that Turkwel dam haven't benefited the people of West Pokot County and that KVDA decided to build their main office in Eldoret instead of building it close to the people where the dam is located. He emphasized that community engagement is very crucial for the success of any project as per the constitution which clearly states that the power is vested in the people.	Bethwel notified that the Tullow through KCB foundation had given scholarships to students both in Turkana and West Pokot and therefore the community had been considered. On the community engagement POK is committed to the process and this is just the first step for this phase of the project

Commentator	Issue/Question/Comments	Response
	He noted that previously the people upstream were instructed not to do any farming to avoid impact on the dam and generally the communities haven't benefited and that POK should consider them as they did for the Turkana community. He noted that water is equally very expensive just as oil and that the county assembly has a mandate over the water since it's a devolved function.	
[redacted] **MCA Swam ward**	He asked what compensation plans are in place for those who will be impacted or affected by the project, he also noted with concern why there is only one community water off take in West Pokot and the rest in Turkana County yet the source of the water is west Pokot. Inquired on CSR project that will benefit the community and whether there are exploration or production well in West Pokot County.	[redacted] informed that the county had been requested to present the community water need for consideration in the design of the project but it hasn't been presented. He added that NLC will engage and follow the due government process in place. Bethwell highlighted on some of the CSR projects that benefitted Turkana, West Pokot and the other counties along the proposed pipeline. He also informed the there were no well in West Pokot.
[redacted] **Speaker West Pokot**	Emotionally referred to the photo on slide 16 and asked the members to compare the two photos water being drawn from West Pokot and a Turkana lady fetching the water from the tap. She also noted that there was no photo from Pokot that featured in the presentation. She then	Linda apologized on the photo and mentioned that it was an oversight and will be corrected. She was also informed that the community meeting was being organized by the chiefs and that county commissioner was aware of the

Commentator	Issue/Question/Comments	Response
	asked the meeting to be suspended till everything is done right. She noted that the leadership will be blamed by the community if the photos are not corrected. She noted that consultations shouldn't be top down and there is enough water in Turkana hence no need to come for water in west Pokot. She asked the POK team to speak the truth unlike the lies that was used during dam construction. She reminded the POK team that West Pokot leadership isn't the Speaker and assembly members but also the other elected members(MPs, Senator and the Governor) She also wanted to know who was tasked with the responsibility of mobilizing the community meeting in Turkwel. She acknowledge God's presence that has made it possible for the team to come and engage the leadership and that the engagement should be done in the right way. She also wanted to find out why the water for the	meeting. She was also notified that the other leaders including the MPS and governor had been invited in Nairobi and Kapenguria respectively but had not turned up.

Commentator	Issue/Question/Comments	Response
	project was being drawn from the reservoir and not the tailrace. She also mentioned some of the unfulfilled promised/ commitments related to the dam (Irrigation, Power distribution, water points among others)	
[redacted] **Lelan Ward**	He started by asking who owns the Project, he noted with concern how the people from West Pokot were treated when they went to Turkana seeking employment but turned away. He wanted to know why the people were not protected and given an opportunity to work in the project. He attributed the way the project was being handled to the fact that the CS for MOPM came from Turkana community so he ensures that his host community benefit from the project. He also mentioned how the community was lied to when power was generated in Turkwel, the host community still don't have power despite the power generation at the Power house. The community upstream were also instructed not to have any human activity in the catchment area.	Bethwell informed that during exploration stage the project used water from boreholes but as the project progresses there has been realization for the need of water and that therefore informs the engagements. He added that West Pokot and the other counties along the proposed pipeline had benefitted greatly from bursaries in 2019. The bursaries were allocated to students through KCB foundation he also noted other projects implemented in West Pokot which included funding of Pelow and Masol conservancies through NRT and Green challenge initiative implemented through Ken Gen foundation. Encouraged the members to give their input which will help the project progress well.

Commentator	Issue/Question/Comments	Response
[redacted] **Nominated MCA**	She appreciated the presentation and that the request for water reminded her of previous injustices on the dam such as their livestock and children being killed by crocodiles, displacements and lack of compensation for their land. She noted that the dam was their cow and the request for water have woken up a sleeping dog or lion. She acknowledged that the project was massive and the head of state will also be involved. She emphasized that there is need for proper consultation with all the stakeholders.	Comment noted
[redacted] **Kapenguria Ward**	He reported that the host community at the catchment have been very careful on the trees to plant so as to conserve the environment and ensure enough water get to the reservoir. He noted that POK shouldn't engage in any public participation before holding a leaders forum. He reported that the area member of parliament wasn't aware of the Nairobi leaders meeting that was mentioned in the presentation. He also reported that some cows and goats were killed on the highway during EOPS but the owners were not compensated.	Comment noted [redacted] committed to follow up with HE the governor and other leaders on the joint leaders forum

Commentator	Issue/Question/Comments	Response
[redacted] **Batei ward**	He started by quoting “If you fail to plan, you are planning to fail” and water is a resource just like Oil. He mentioned the many promises made by the government during dam construction have never been fulfilled. He noted that all the promises were in government archives. Noted with concern how the county producing power wasn’t benefiting from the power generation. Asked POK to organize for a bottom up consultation to ensure project success. He emphasized that there was need to consult with all the leaders then proceed to the ground.	Comment noted
[redacted] **Sook ward**	He lamented the many lives lost during dam construction, noted the conflict that have existed between the two communities of Pokot and Turkana due to resources. Noted West Pokot county have invested resources in ensuring the dam is sustained and that the county have invested in peace caravans between the Turkana and Pokot. The government should be very sensitive to avoid conflict. Noted that the approach being used by the government is meant to divide and rule the people and should be relooked at. The	[redacted] agreed that there are historic injustices but noted that different government departments have different mandates and issues on land will be handled by NLC which they will come to engage with the community He further added that issues to do with water is being handled by an inter-ministerial committee in place and the community and all the stakeholders will be fully involved. No one will give out water license without following the due process. Noted the new constitution was very clear that no project can be implemented without proper

Commentator	Issue/Question/Comments	Response
	government should not take the communities back to the bad days. Reminded POK to use a fair equation to ensure resources are shared fairly and the value for water should be equivalent to that for oil.	stakeholder engagement. The differences between the Pokot and Turkana communities are there but at the end of the day there should be a win-win situation so as to move forward.
[redacted] **MCA Weiwei ward**	Noted with concern the very small percentage of Pokot employed in the project in the previous phase, he gave a practical example of when he took his car for hire but was turned away from the gate for being a Pokot. He emphasized that POK should allocate a good percentage of employment to the Pokot in regard to the skilled, unskilled and semiskilled. He noted that positions for other Kenyans will also be available but there is need to have a formula on how to share employment opportunities between the Pokot and Turkana. Reminded POK to be extra careful since boundary issues between the Turkana and Pokot are very sensitive.	**David Kombe** noted that the KJV are a government contractor just like those building roads and the project had been affected by Covid 19 pandemic and therefore the company had to lay off its employees including those in Turkana and Nairobi.

Commentator	Issue/Question/Comments	Response
[redacted] **MCA Kiwawa ward**	Wanted to know from slide 7 on water off takes the number that fall under Pokot and if POK was aware of the specific communities benefiting from the off takes. Noted the leaders were bitted on water being taken to tukrakna because of previous injustices. The Pokot have never benefitted from employment, compensation, irrigation, electricity. Wanted to know what compensation plans were in place.	
[redacted] **Kasei ward/ Deputy Speaker**	Noted the project started on a wrong footing, urged POK to suspend all meetings till everything is aligned. Wanted to know if the Turkana employees were also laid off in December like the three Pokot who were laid off. He urged that all the elected leaders to be called for a meeting before holding a meeting with the community. Wanted to know who was mobilizing for the community meetings in the ground (Chiefs or MCAs) noted the MCAs alone can't endorse the project.	[redacted] appreciated all the honesty in the discussion. Noted everything that was done in Turkana was courtesy of Exploration and EOPS which was meant to test the market and not commercial gain. He noted the government or POK did not come to take water from Turkwel instead to engage and agree. On community off takes, he noted it was the responsibility of the county governments to present its community water needs to POK for consideration. Turkana county already presented its plan but yet to receive from West Pokot . MPs from Turkana and West Pokot had been sent invitation for a disclosure meeting in Nairobi.

Commentator	Issue/Question/Comments	Response
	Felt the government was causing a fight between the Pokot and Turkana from the way its handling the issues and cited the example of the government employing an assistant chief in Lorogon which falls in his ward but the chief reports to Turkana county and not West Pokot. He also accused Turkana county government for funding residents of Lorogon with iron sheets to build houses along the water pipeline route so as to be compensated.	Informed the meeting that the governor was to attend the meeting but was held up in a security meeting in Tot. He noted Engagements will continue and water will only be drawn once all parties agree.
Cliff- County Director of Environment	He notified the attendees that according to the water Act 2016, water is owned by the National Government on behalf of all citizens and that every person has a right to access water. Reminded POK the need to have enough studies done in order to understand the water volumes and to assure that drawing water will not interfere with other water users. He noted that there was need to have water allocation plan done through consultative process. Advised POK to follow the advice from the MCAs so as to succeed with the project.	[redacted] notified that there is a water technical working group with different stakeholders including KVDA, Ken Gen and other government ministries led by [redacted]

Commentator	Issue/Question/Comments	Response
[redacted] **from Kenya Forestry services**	Noted the meeting was for project disclosure and further consultations will follow. Inquired from POK what resources have been allocated for the conservation of the forests feeding the reservoir.	He was notified that currently the project is focused on getting the ESIA license first before any allocations are done.
[redacted] **NLC West Pokot**	Appreciated the meeting and committed NLC will be involved when it comes to compulsory land acquisition and the due process will be followed which is fair and just since the formula is already in place.	Comment noted
[redacted] **CEC land housing and physical planning**	Noted the same issues expressed by the MCAs were raised by the CECs in a previous meeting held with the County CECs. He informed that the discussions falls in two categories**: Historic injustices** such as compensation, irrigation, and that is why MCA are bitter on any development projects. Acknowledged several meetings to have been held including meetings in Nairobi and the county government was aware of the project. Requested the members of county assembly to move together as a team. Retaliated what the Speaker had asked on the need to have a joint meeting with the leaders.	[redacted] **a**ppreciated the good explanation from the CEC and reminded the members to embrace the project since the country have had a long history Oil exploration and now headed the right direction to success.

Commentator	Issue/Question/Comments	Response
	Noted Water should be distributed far and wide in West Pokot even up to Masol ward. Assured POK that no one is opposed to the project but through proper engagement the project will be delivered	
[redacted]	Confirmed the fears from West Pokot were real and there was need to do everything that was done in Turkana to West Pokot.	[redacted] assured the members that all their views will be incorporated to the project as we move together as a team . Once land and water is delivered the investor will go ahead to deliver on the project. Community priorities will also be taken into consideration.
[redacted] **MCA Seker ward/ Leader of Majority**	Appreciated the guests for the consultation especially the honest and precise presentation including the photos that madam speaker took note. Referred to the previous engagement that was held on 2nd August 2019, he mentioned about the mining act which classified mines into seven categories. He also noted community water off takes had already been identified as per the previous meeting yet one presenter mentioned they will still engage and agree Wanted to know the life span of the project, he	He was notified that engagements on water were still ongoing and that there will also be a separate ESIA for water where they will still be engaged.

Commentator	Issue/Question/Comments	Response
	understood the water and mining act which clearly states that engagement must be undertaken before the project implementation. Noted water can't be taken without engagements and public participation. Wanted to know how the project will be incorporated to the County Development Plan. Urged POK to suspend the planned community engagement till the leaders meeting is held. He assured the project full support once the right strategies are put in place.	
[redacted] **Endugh ward**	Apologized for turning up late for the meeting, appreciates the project is picking up again and requests that it be fully consultative. Cited the planned community meeting as very dangerous since all the leader haven't been consulted. He reported to have been accused from the previous engagement for selling water to Tullow by the area MP. He also reported environmental degradation in the upstream. He noted that KVDA and Ken Gen compensated themselves not the community and that it was time for the government come and address those injustices. That the president should come and	[redacted] requested to be allowed to attend the community meeting so as to demystify the misinformation that water was sold. Being key stakeholders consultation of the community also very critical for project success.

Commentator	Issue/Question/Comments	Response
	sign an agreement on the water	
[redacted]	Summarized the meeting by noting – Members of the county assembly leadership led by the Hon Speaker met and agreed on the following as a way forward; A leader's consultative forum to be held before proceeding for community participation at the grass root. Also noted the CSR that was delivered through Ken Gen, KCB foundation and NRT were not fairly handled till a petition was brought to the county assembly.	[redacted] noted the community meetings were also suspended after the previous leaders meeting as per request from HE the governor after he was also accused of selling water, unfortunately before the leaders forum was held a series of natural catastrophes occurred including the floods that led to loose of lives in West Pokot and Covid. The industry like any other was hit hard by the pandemic and this saw companies including Tullow lay off its employees. Reported that the ministry supported West Pokot county during the floods as assign of good gesture

Commentator	Issue/Question/Comments	Response
[redacted] **Speaker**	Asked POK to read the mood of the meeting and go to the drawing board. POK to organize for leader's forum which will then be followed by community public participation. Instructed POK not to have community meeting in Turkwel until all the elected leaders are met and engaged. Thanked the honorable members for attending the meeting.	[redacted] MOPM and KJV will respect the opinions of the leaders. He will follow up with the governor to see if the leaders meeting can be convened soon.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayerat 15 55 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETING HELD WITH LOROGON COMMUNITY

MINUTES

Date of meeting:	**14th July 2021**
Meeting: Disclosure	**Lorogon community**
Venue:	**RCEA church Lorogon**
Start time:	**15 36 Hrs**
End time:	**17 04 Hrs**

Preliminary:

[redacted] assistant chief Lorogon welcomed the community members and visitors and asked [redacted] to open the meeting with a word of prayer. He then asked Mr Sang to introduce the POK team.

Bethwell Sang from Tullow Oil appreciated the community members for turning up for the meeting despite the short notice. Reported that similar meetings had been held in other parts of Turkana and West Pokot. He informed the congregation the objective of the meeting (Project disclosure). He then gave a brief summary of the exploration journey before welcoming [redacted] to introduce the POK team.

[redacted] from MOPM thanked the community for turning up for the meeting. Acknowledged the meeting to be special for being held inside a church. Requested the community to own the project so as to succeed. He then went ahead and did a round of introduction of the POK team then gave the CIPU commander to make a few remarks.

[redacted] **CIPU commander t**hanked the community for maintaining peace with its neighbours and having a peaceful way of presenting its issues and grievances without having to block the road. Encouraged the community to remain united since God had blessed us with Oil.

[redacted] expressed his Impression that the two communities were living harmoniously unlike in the past when tension characterized the Pokot and Turkana. He noted that developments will be realized as a result of the peaceful coexistence. Gave an overview of the exploration history in Kenya and the new developments after the first discovery in 2012. He also mentioned the challenges that led to delays and redundancies within Tullow and the industry at large. POK led by the government and KJVs determined to continue with the project despite the current pandemic. He literary went through the whole presentation and emphasized that water for the project will be drawn from Turkwel dam and part of the water will also serve the communities along the water pipeline. As per the current constitution it's the role of the county governments to ensure water reaches its citizens.

He also noted that NLC will lead in the acquisition of land for the project and if compensation is to be undertaken the due process will be followed. He emphasised that project will also have a waste management plan in place to ensure minimal negative impact to the community and environment.

He noted that job opportunities for the project will be shared between the two communities of Turkana and Pokot. Encouraged the youth to enrol in technical courses so as to secure employment during the construction phase of the project. He reminded the community that the success of the project will depend on the cooperation from all stakeholders within the project.

Commentator	Issue/comment/concern	Remarks
[redacted] – Youth	Asked the guests to listen and consider the views of the community He reported that he has been looking forward to such an engagement on the project He informed the members present that the ESIA will have more benefits than looses to the community and highlighted on the following areas: **Employment** Asked the company to consider residents of Lorogon in employment during the project implementation. Requested for the position of a liaison officer from Lorogon. **Education:** construction of Lorogon girls secondary school Installation of power in Lorogon primary school and the village Piped water to the school and community Construction of a library in Lorogon primary school Scholarships for secondary and universities. **Food security** He reported that the community do have land and water and requested for the establishment of an irrigation scheme to boost food security.	The community document with all the requests handed over to [redacted] from MOPM All concerns noted

Commentator	Issue/comment/concern	Remarks
	Construction of a concrete water storage tank to enhance irrigation. **On Health he requested for:** Upgrade of Lorogon dispensary to a health centre Construction of a laboratory facility at the dispensary Purchase of an ambulance for the dispensary Construction of a dispensary at Naikalale village **Under Business opportunities he requested,** Project to consider grants for small businesses Lorogon community to be considered for tenders during the project **Environment** Reported that Lorogon community are environmentalist and therefore the to fund a CBO in Lorogon which will deal with environmental conservation. The CBO will also ensure human/ wildlife conflict is minimized during the project. **Infrastructure** Project to fix the road between Ken Gen power and Lorogon which is currently in bad shape	

Commentator	Issue/comment/concern	Remarks
[redacted] **Representing the women**	Appreciated the visitors who arrived with rains and that the engagement came when the community needed it most. She also acknowledged that the Oil discovered in Turkana should benefit all Kenyans. She requested the project to consider building a resort to be utilized by tourist and so generate income for the community. That the project to consider the construction of an orphanage Tap water to all households within Lorogon community before the water is taken to the Oil fields	Bethwell appreciated the contribution from all community representatives and committed to continue with engagements as the project move forward.
[redacted] **Youth**	Reported that grave sites are very sensitive culturally and wanted to know how will the company protect that. Also wanted to know how compensation will be undertaken since people don't have title deeds in Turkana. He also asked for the consideration of elders in Lorogon with monthly stipend like those who were considered in Lomokamar, Nakukulas, karoge and other well sites after Oil discovery.	**Bethwell Sang** Informed the community that the project will ensure all cultural sites will be respected. Compensation will be handled by NLC and the project area is already gazette Thanked the community representatives for their views and questions
[redacted] **Ass chief Lorogon**	Thanked the community members and visitors for turning up for the meeting and called the pastor to close the meeting with a word of prayer.	

Adjournment: There being no other issue to be discussed, the meeting was adjourned with a word of prayer from [redacted] at 15 55 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

MINUTES FOR PROJECT DISCLOSURE MEETING HELD WITH TUEKWEL COMMUNITY

Date	**14th July 2021**
Meeting: Disclosure	**Turkwel Community**
Venue:	**Turkwel Primary School**
Start time:	**1109 Hrs**
End time:	**1434 Hrs**

Preliminary:

Turkwel senior [redacted] confirmed the attendance of represenatatives of all villages: Lokeke, Karon, Katukumwok, Kachambilwa, Kamurio, Ywapit, Riting, Reres and Kamokongwo. He then asked [redacted] to open the meeting with a word of prayer.

[redacted] Welcomed all guests including MoPM, KJV, Chiefs and Community for the meeting and mentioned that he received communication from the County Commissioner to mobilize for the meeting. He argued the community to first listen and get the agenda of the meeting before asking questions or giving comments. He then called upon Bethwell to introduce the team.

Bethwell Sang- Tullow Oil, Appreciated the welcome and good turn up for the meeting. Informed the community that the team is led by MOPM which is the ministry in charge of the project. The main objective of the meeting is to disclose the project. He then gave an overview of the project before handing over to the POK team leader to introduce the team members.

[redacted] MOPM gave the POK to do a self introduction before giving the CIPU commander a chance to make a few remarks on security.

[redacted] **CIPU Commander** introduced the security team and argued the community to embrace the project. He further reminded the community the role of

the security team (maintain law and order). He reiterated that security was very important for the success of any project

[redacted] thanked all the community members for turning up in large numbers for the meeting. Appreciated the development within the community which has been realized as a result of the peace between the two communities. He informed the community of the other meetings that have been held with other key stakeholders both in West Pokot and Turkana counties. He reiterated that engagement will be continuous and highlighted the challenges faced in the implementation of the project citing the landslides witnessed in West Pokot in 2019 that lead to the road being cut off and the current Covid 19 pandemic. He informed that government with the contractor had agreed to embark on the project despite the challenges. He further gave a summary of the exploration process and that it had taken so many years before oil was discovered in Kenya. He also explained why water will be needed for the project and that engagements will be held before water is piped from Turkwel to Lokichar. He further informed the gathering that all issues will be dealt with through consultations, inclusivity and stakeholder engagements.

Below are the concerns and issues raised by the community.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] Youth	He asked if the project will employ youth with specific certificates/ qualifications. He further requested for the consideration of unskilled reformed warriors in the project.	He was informed that jobs will encompass both skilled, unskilled and semi-skilled.
[redacted] Youth	He confirmed that Tullow have had several engagements and they understand the water pipeline route and those households along the pipeline route have been mapped out. Apart from employment opportunities, he wanted to know what other opportunities are available for the neighboring villages.	Bethwel Sang reminded the community that the company only knows about the amount of water needed for the project and that the company still waiting for the community water needs from the West Pokot County Government. [redacted] explained that CSR will be aligned with the priorities of the community adding that communities have differing priorities.
[redacted] Elder	He requested that the National Government should handle their water demands and not the County Government. He reminded that there have been meetings about water off take points and urged that the Pokot community does not require a series of meetings.	Bethwel Sang said that there is a water working group which consists of WPCG, TCG and other government water regulatory bodies which shall assess work out water needs. On meetings, Bethwell reminded them that such meetings are a requirement by law so that POK acquires a license to commence the project.
[redacted] Pastor	He asked why meetings are not being held at Riting the village adjacent to the dam. He urged that Turkwel Dam water should be requested from the community and not county Government.	[redacted] promised that a meeting shall be held in Riting Village in 3 weeks time. [redacted] explained that POK has not reached a point of coming to formally request for land and water adding that the meeting is only for informing community about the project.

Commentator	Issue/Question/Comments	Response
[redacted] astor	He argued that the success of the project lies on the engagement of grassroots leaders to get factual information. He noted that the community needs nothing but development. He appreciated the presentation and requested that their views be taken and feedback brought directly to the community. He advised that those county level stakeholders will derail the project.	Comment Noted.
[redacted] Ass. Chief Kachawa Sub-Location	He noted that the project is a blessing to the community and that water is life. He urged that it is risky for upstream dwellers and school to fetch water from the dam even due to crocodiles and requested that an alternative source of water would be appreciated. He requested that water at proposed off take points should be sufficient for irrigation farming	Comment Noted
[redacted] Resident	He recognized that the meeting was for disclosure and therefore urged the community to wait for the time that their, demands and priorities will be sought. Even water needs per village. He reminded that West Pokot and Pokot North Sub Counties share the dam and urged such meetings should be held on both sides.	Bethwell Sang said that chiefs were informed to mobilize people from those areas so that they may attend and take the information. He added that the meeting is just a start and that more meetings are being planned in the future.
[redacted] Village Elder Turkwel	He urged that whatever benefit was done to the Turkana during exploration, discovery and EOPS should be replicated in West Pokot. He requested that Pokot from the extreme upstream should be considered for employment. He reiterated that the project should benefit reformed warriors. He lamented that the project will take a shorter period in	Comment noted.

Commentator	Issue/Question/Comments	Response
	West Pokot than Turkana and so the benefits to Pokot should be doubled.	
[redacted] **Former Councilor**	She welcomed the project saying that they had worked with the project before the COVID19 Pandemic halted operations. She requested that this being a government project, starting consultations at the community level is commendable adding that leaders who wanted to postpone the meeting were against the community. She thought the meeting was for water pipeline land compensation but happy that their fears of water had been sold have been cleared. She requested that their views be taken direct to the government.	Comment Noted.
[redacted]	He sought to be told about land compensation and requested that even the unskilled be considered for employment when project commences.	Bethwell Sang reminded them that land compensation is the mandate of National Land Commission (NLC). He added that NLC will survey and identify those affected whilst following the law and right procedures.
[redacted] **MP's Office**	Thanked POK for the meeting noting that such was not done during dam construction which led to failure in CSR Projects. He further appreciated the involvement of every village. Thanked the community for the manner in in which they presented their views. He had a draft of their requests as Kasitei Location which included: a) An office in Turkwel. b) Water for community. c) Schools-Infrastructure.	Bethwell Sang assured the community that their concerns and views are being noted down and none will be left out. He added that the minutes handed over to POK Team Leader will inform the report.

Commentator	Issue/Question/Comments	Response
	d) Bursaries and Scholarships. e) Employment-Affirmative action especially for reformed warriors. ❖ [redacted] **handed over the minutes to** [redacted]	
[redacted]	Introduced KVDA Staff who were present at the meeting noting that they are key development agent in Rift Valley as well as an important government parastatal making them key project stakeholders.	Comment Noted.
[redacted] **KVDA**	Noted that KVDA recognizes Tullow and that they have been having correspondences up to the ministry level. Thanked POK for the water pipeline project and urged the Community to support the project as it will benefit the area. He noted that the Dam is managed by KVDA and was designed for 3 main purposes; a) Power Generation done by KenGen. b) Fishing for community c) Irrigation Scheme which was not successful due to security issues but KVDA is going to deliver on this. It has already been assessed recently by an Italian Contractor.	[redacted] Thanked them for attending the meeting and reminded them that there have been several concerns about KVDA and that POK is going to liaise with them going forward. [redacted] thanked the KVDA Team for clarifying issues to do with Dam Management and the Irrigation Project.
[redacted] **Turkwel Gorge Dam Chairman**	He argued that water requirements for West Pokot County have delayed due to politics and suggested the involvement of grassroots leaders like chiefs and elders for the project to be successful. He requested that the next meeting be held in Riting and they shall attend through the mobilization of chiefs.	Bethwell Sang explained that The Constitution of Kenya 2010 devolved water issues to counties. He advised the community to avail their water requirements to the WPCG and POK shall eventually receive them. He appreciated [redacted] for giving examples of community water needs per villages most affected adding that this is a clear sign that the community is ready.
[redacted]	She proposed that meetings should be conducted in Turkwel and Riting first before heading to the counties. She said that water for community should first be delivered	Bethwell Sang told the meeting that there shall be more meetings and that the chiefs will communicate to the community whenever there is a meeting.

Commentator	Issue/Question/Comments	Response
	before it reaches Lokichar for Project.	
[redacted] Youth	He noted that insecurity affected them and not those leaders who wanted to stop the community meeting. Consequently, he urged POK to consider reformed warriors for business opportunities during the project. He added that land should be compensated as individual land and not as community land.	Comment noted
[redacted] Opinion Leader	He proposed that the Project should be designed to benefit women noting that water and electricity is important for women. She further added that the Project should bring peace noting that conflict in the area had left orphans and widows who should be considered where possible. She urged that women should be given business grants since they have a lot of responsibilities in the community.	[redacted] explained that it is a government policy that 30% Of tenders must be set aside for women, youth and PWDs and so women are now more privileged. He reiterated that project will adhere to the law.
[redacted] Elder Takaywa	He requested for a meeting in Pokot North Sub County arguing that not everyone's views have been collected. He urged POK to take community views seriously.	[redacted] reminded the community that Bethwell clarified that more meetings will be conducted and so no area has been discriminated. He reiterated that the community will give out its demands together.
[redacted] Deputy Head Teacher-Turkwel Primary School	She appreciated Tullow for initiatives in Turkwel Primary School including Schools Greening Initiative in partnership with KenGen adding that Tullow had further given the school more 250 tree seedlings. She noted that pupil's enrollment has increased in the school causing congestion in class and dormitory spaces	Comment Noted [redacted] informed that POK will continue to engage and consult more on its water and land requests and reminded the community that all their requests might not be addressed immediately and finally thanked the

Commentator	Issue/Question/Comments	Response
	hence requesting POK to consider the infrastructure. She further added that the school recorded improvement academically during last national examinations and that most students who are vulnerable should be offered scholarships where possible.	community for welcoming POK Team and attending the meeting.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1434 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **15th July 2021**

Meeting: **Disclosure – Kaputir Community**

Venue: **Kaputir village**

Start time: **1009 Hrs**

End time: **1254 Hrs**

Preliminary:

The meeting was called to order by the Senior Chief [redacted] at 10:09 am. Thereafter, [redacted] offered the opening prayer.

The senior chief appreciated the team from POK for having the disclosure meeting at Kaputir. He then introduced the participants based on the villages they come from. He also acknowledged the presence of village elders, religious leaders, professionals and student leaders from within the ward.

The senior chief then welcomed Mr. Bethwell Sang to introduce POK team. Mr. Sang appreciated the chief for mobilizing the community members to attend the meeting. He informed them that the main agenda of the meeting is to disclose information concerning POK to the stakeholders.

Mr. Sang explained how far the project had come from and informed the community that going forward, the project requires ESIA approval by NEMA and thereafter, land

and water access from the community. It is only after acquiring the mentioned items that the project will move on.

He added that in the next 2-3 weeks, a team of consultants will come to conduct ESIA consultations. He stated that the participants will get an opportunity to ask questions or make comments during the disclosure meeting and also when the consultants will conduct the consultation meetings.

Mr. Sang then welcomed [redacted] the director for administration in the Ministry of Petroleum and Mining to introduce the team he was leading. [redacted] invited his team and they made self-introduction.

After, the introductions, the director narrated the history of oil exploration in Kenya from 1940s to 2012 when the first crude discovery was announced. He also explained the reasons why the government launched EOPS and what it achieved. He further explained the challenges that faced EOPS and the re-adjustments that the project is undertaking in order to move forward.

[redacted] then handed over to Mr. James Kambo who took the participants through the presentations. After explaining the major components of the project and how the project intends to operate going forward, Mr. Kambo welcomed Ms. Linda Were to take the community through the questions, comments and answers session.

The comments made, concerns raised and questions asked were recorded and are presented in the table below.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Kapelbok resident.**	Appreciated the team from POK for having this meeting at Kaputir. He had a printed community memorandum that he read on behalf of the people of Kaputir ward. Below is the list of things the community are requesting the project to do for them. 1. Water. Villages near the pipeline to be connected to water from the pipeline as those that are distant to have separate boreholes drilled to supply them with water. 2. Construct a girls' secondary school between Lokwar and Juluk. He argued that this school will improve cohesion between people living in these two area. 3. Construct a modern hospital that can offer services such as minor and major operations/ surgery, blood transfusion and maternal healthcare which he claims are not currently being offered by health facilities in the area. 4. Revive the dormant existing irrigation schemes. 5. Representatives to be appointed from every village to oversee sharing of employment opportunities for both skilled	Mrs. Linda responded and informed the community members that their proposals are good as it reflects the priority needs of the community. She however made it clear that POK is not committing to fulfilling any of the requests. She added that the main objective of the meeting was to disclose the project to the community so that they can know the main components of the project and what the project intends to achieve. She informed them that most of the highlighted priority needs of the community are functions that are supposed to be undertaken by County and National governments. She informed them that all the issues raised have been noted and will be shared with the two levels of government and perhaps such information may be used to design / inform some future government projects.

Commentator	Issue/Question/Comments	Response
	and unskilled personnel. He added that the community expects to have a CLO from Kaputir ward. 6. POK to compensate all community members that will be affected by the water pipeline. 7. Youth, women and PWDs to be given grants to start businesses. 8. Construct a stadium at Kapelbok to boost youths sporting activities. 9. Construct a sale yard where locals can sell their livestock. 10. Construct a bridge to ease access to villages that are on the other side of the river e.g kapelbok and Juluk villages. 11. Scholarship positions for residents to access higher education in the country and overseas. 12. Establish a trust fund for residents of Kaputir just as it happened for Kapese Trust Fund. 13. Provide solar panels for villages that do not have access to electricity from the grid.	
[redacted] **Secretary council of**	He mentioned that he understands that Turkana County Government holds the land in trust for the local communities. He therefore wanted to be informed how the local community members will	He was informed by Ms. Linda that NLC is the government department mandated to handle matters of land acquisition and compensation for the project. She added that NLC will come to the

Commentator	Issue/Question/Comments	Response
elders, Turkana South.	benefit in terms of compensation if their land has to be taken for this project.	local communities to have a discussion on how it will carry out land acquisition and compensation thus his question can be answered at that time.
[redacted] **Representing Nakwamoru professionals.**	He claimed that people use sweet words to lure communities when they want to start a project but the sweet words disappear once they get approvals from the community. He argued that Kaputir is a warzone and has people who now live with disabilities due to war. He alleged that he was a driver at Tullow and he noticed that Tullow had not employed PWDs. He wanted to know how PWDs will benefit from the project.	Ms. Linda informed the community members that it is not accurate to claim that Tullow did not employ PWDs. She stated that Tullow had employed two CLOs who are PWDs. She added that POK will endeavour to employ all categories of people including PWDs in accordance with the laws of Kenya.
[redacted]	She mentioned that she had several questions but most were answered during the presentation	Comment noted.
	Knowing that provision of water is a devolved function, Christine claimed that TCG has never connected water to the villages in Kaputir from the inception of devolution. She therefore asked that KJV partners consider piping water from the water pipeline to the villages.	[redacted] responded and informed the community members that the project respects and recognizes all the stakeholders including the seers.
	She mentioned that there are elderly men and seers who are the owners of the kraals and are even the ones who named the luggas in the area. She claimed that these men have been ignored and therefore, if they are not recognized and appreciated/ compensated, they have the power to halt the project.	

Commentator	Issue/Question/Comments	Response
	She also expressed concern and asked whether the water pipeline will affect the water flow at the river that the Kaputir community depends on for irrigation.	Linda informed that a separate ESIA for the water pipeline will be done and that water is being taken direct at the reservoir therefore minimal impact on the community consumption.
	She mentioned that there are registered women groups in Kaputir. She urged POK to recognize these women groups. She requested that a fresh goods market be established at the Kaputir junction along the A1 road to offer a decent place where these women can sell their agricultural products.	
[redacted]	Claimed that when Tullow's operations were on top gear around Lokichar area, the people from Kaputir were not given opportunities. He alleged that people in Lokichar told them to go and fight with the pokot people to defend their land. He therefore stated that they should now be allowed to work exclusively with people from West Pokot on the water pipeline.	Comments noted
	He stated that he had visited Nakukulas village sometimes back and he was amazed by the transformation that the oil activities have done to that place. He mentioned that he hopes that Kaputir village will also realize such transformation as a result of benefits they expect from the construction of the water pipeline.	Comments noted

Commentator	Issue/Question/Comments	Response
	He requested POK to give them the right information and to be truthful in order to win the community trust and confidence.	Comment noted.
	He asked another elderly man to stand up and introduced him to the community as a seer. He stated that they should be recognized and given some benefits. Failure to which, the project will face unprecedented challenges that common knowledge will not resolve.	Comment noted.
[redacted] **Juluk resident.**	He claimed that many residents of Lokwar, Lorogon and Mariwomoru have been displaced due to the insecurity incidences that have occurred in the area. He stated that many of these people fled their homes and now need to be resettled.	Comments noted
[redacted] **Kawalase.**	Claimed that sometimes back, they were shown some maps that indicated Kaputir had some prospects of crude oil. He stated that since then, they have been waiting for the oil companies to start exploration in Kaputir but it has been in vain. He wanted to know if such exploration will ever happen in Kaputir.	He was notified that at the moment oil development and construction is in the six fields only.
	He claimed that the people who were previously appointed into committees that were engaged during employment turned to be biased. They favoured their family members, clans and their political friends. He mentioned that future	Comments noted

Commentator	Issue/Question/Comments	Response
	opportunities should be shared in the open (baraza) so as to avoid such bias.	
	He argued that pastors have been forgotten. He urged POK to consider purchasing musical and public address systems for the religious leaders to preach the gospel to the neighbours and perhaps this can bring peace among the worrying communities.	Comments noted
[redacted] **Professionals Representative.**	He claimed that there may arise some disagreements and perhaps conflict between the Turkana and pokot communities as a result of sharing benefits arising from the water pipeline. He asked if POK has put in place mechanisms to manage any conflict if it arises. He proposed that POK constitutes a committee comprising members from both Turkana and Pokot communities to be responsible for resolving any conflict among the two communities.	Comments noted
[redacted] **Senior Chief Kaputir**	The chief mentioned that he had no office in his area and that he has been serving the local community under trees. He requested POK to consider constructing an office for the chief in order to improve his service delivery to the community.	Comment noted.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1254 Hrs.

SOUTH LOKICHAR BASIN OIL PROJECT

PROJECT DISCLOSURE MEETINGS

MINUTES

Date of meeting: **16th July 2021**

Meeting: **Disclosure – Kalemng'orok Community**

Venue: **Share International Hall – Kalemng'orok**

Start time: **1040 Hrs**

End time: **1457 Hrs**

Preliminary:

The meeting was called to order by the area chief [redacted] at 10:40 am. Thereafter, [redacted] offered the opening prayer.

The chief appreciated the team from POK for bringing the disclosure meeting to their village. He then introduced the participants based on the villages they come from. He stated that the community members had met on 9th July 2021 and drafted a memorandum of their priority needs that they expect POK to do for them.

The chief then welcomed Mr. Bethwell Sang to introduce POK team. Mr. Sang appreciated the chief for mobilizing the community members to attend the meeting. He informed them that the main agenda of the meeting is to disclose information concerning POK to the stakeholders.

Mr. Sang explained how far the project had come from and informed the community that going forward, the project requires ESIA approval by NEMA and thereafter, land and water access from the community. It is only after acquiring the mentioned items that the project will move on.

He added that in the next 2-3 weeks, a team of consultants will come to conduct ESIA consultations. He stated that the participants will get an opportunity to ask questions or make comments during the disclosure meeting and also when the consultants will conduct the consultation meetings.

Mr. Sang then welcomed [redacted] the director for administration in the Ministry of Petroleum and Mining to introduce the team he was leading. [redacted] invited his team and they made self-introduction.

After, the introductions, the director narrated the history of oil exploration in Kenya from 1940s to 2012 when the first crude discovery was announced. He also explained the reasons why the government launched EOPS and what it achieved. He further explained the challenges that faced EOPS and the re-adjustments that the project is undertaking in order to move forward.

[redacted] then handed over to Ms. Linda Were who took the participants through the presentations. After taking the community members through the presentation, they were given the opportunity to make comments, ask questions or seek further information regarding the content of the presentation or the project.

The comments made, concerns raised and questions asked were recorded and are presented in the table below.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **Opinion leader.**	Mentioned that professionals from Kalemng'orok area met on 9th July 2021 and discussed various things affecting them that they would like the project to support them with. Below is a list of what the community identified as their priority needs. 1. Lack of clean water. They propose that a bigger metallic tank be erected at Kalmeng'orok to store water from the turkwel dam pipeline. All nearby villages to be supplied with water from this tank. 2. Construct a modern secondary school at Kalemng'orok which may cost approximately 50 Million shillings. 3. Construct additional classroom at Naroo School which may cost approximately 25 Million shillings. 4. Construct a modernized technical college at Kalemng'orok. 5. Site camp to be constructed at Kalemng'orok instead of Lokichar to increase employment opportunities for the locals. 6. First priority for any employment opportunity to be given to the people that will be affected by the pipeline construction. 7. All indigenous trees that will be cut down to pave way for pipeline construction to be	[redacted] appreciated the opinion leader for presenting the community needs. He informed them that matters of land acquisition and compensation will be handled by NLC in conjunction with TCG. He mentioned that the county government and NLC had already started discussions on how to sensitize the community members on the process of land registration. He further mentioned that the council of elders and CSOs are likely to be called for a meeting on 17th July 2021 where they will be informed in detail on how land registration will be conducted. He added that there will be replacement of the indigenous trees that will be cut down during the pipeline construction. He also mentioned that there will be fairness in considering women, youth and PWDs for any employment opportunities. [redacted] informed the community members that the duty of providing water to the communities is the function of county government. He added that if POK may decide to support on this, there must be consultations with the county government

Commentator	Issue/Question/Comments	Response
	replaced by planting new ones or the community to be compensated because their livestock depend on these trees for survival. 8. Community members to be compensated for their land that the pipeline will pass through. 9. Women and PWDs to be given loans to start their own businesses.	for operations and sustainability reasons. He told the community members that the project is estimated to last for about 25 years after which the county government and the community will still exist and therefore it is best if the county government takes full control of this function. He informed them that all the issues raised have been noted and will be shared with the two levels of government and perhaps such information may be used to design / inform some future government projects.
	Requested POK to consider adding another community water off-take point at Nakabosan village.	
[redacted]	Stated that the people of Kalemng'orok have approved the project. He added that the communities appreciate being recognised by the project. He reiterated on the issue of water and stated that the project must consider providing water for the community as this is the most pressing need.	[redacted] responded that water provision to the local communities is a function of County government.
	He listed the following as things the community would like the project to do for them: 1. Establish an irrigation scheme at Nabeye. 2. Establish meat factory at Kalemng'orok. 3. Construct a big livestock market for pastoralists to sell their animals.	

Commentator	Issue/Question/Comments	Response
	4. Two positions for CLOs to be given to residents of Kalemng'orok. 5. Construct a modern hospital at Kalemng'orok.	
	He was concerned about the insecurity situation in Turkana East. He asked if the project has plans to stabilise the security situation in the area.	Mr. Bethwell responded and informed the participants that the project proponents are aware of the security situation in the area and that the national government will liaise with all stakeholders and ensure there is peace in the area.
	He stated that the seers and council of elders want recognition by the project. They expect to be engaged separately before the pipeline construction begins.	Comment noted.
[redacted] **from Nakabosan village.**	She wanted to know if Kalemng'orok will have a community water off-take point.	Mr. Bethwell responded and informed her that Kalemng'orok is one of the places that will have an off-take point. He further stated that all the community off-take points were identified by TCG.
	He claimed that Kalemng'orok did not benefit from previous scholarships offered by Tullow. Therefore, they expect the residents of Kalemng'orok to benefit from any future scholarships.	Comment noted.
	He highlighted the following as the things the residents of Nakabosan village would like the project to do for them: 1. Construct boys and girls dormitories at Nakabosan primary school. 2. Construct two classrooms at Kaakipon and Nakalale.	[redacted] responded by informing them that the requests were functions of county and national governments. He commented that Turkana South MP was recently voted the best performing MP in Turkana County. He informed the participants that these requests have been noted and will be shared

Commentator	Issue/Question/Comments	Response
	3. Construct maternity and medical wards at Kalemng'orok.	with the relevant entities for them to consider in their future plans.
	He also wanted to know if there will be compensation for any animal that may be injured perhaps by getting into the ditch during construction or laying of the water pipeline.	He was notified that there will be a grievance mechanism to handle all sorts of grievances.
[redacted] **Kang'iregae resident.**	He claimed that the national government benefited from the sale of EOPS crude oil. He asked where the community's percentage is.	[redacted] responded and told the participants that there was no revenue generated during the sale of EOPS crude oil. He mentioned that the purpose of EOPS was to test the international market and observe how the Kenyan crude will perform. It was also to search for potential buyers. He told the participants that the Petroleum Act provides for how the revenue will be shared among the local community, county and national governments.
	He wanted Tullow to acknowledge that there are business people in Kalemng'orok.	Comment noted.
	He claimed that they were told that meat from Turkana was unhealthy and that Tullow used to get meat supplies from Nairobi.	
[redacted] **community elder**	Wanted to know if Tullow was going to employ road marshals again.	Mr. Bethwell responded and informed the participants that the project may not employ road marshals but was going to offer approximately 2,400 job opportunities for skilled, semi-skilled and unskilled personnel.

Commentator	Issue/Question/Comments	Response
	Stated that POK team should come with TCG representatives during consultation meeting in order for the residents to inquire about plans the government has for provision of water.	Comment noted.
	He mentioned that the law which states that anything found more than six feet underground is property of the national government should be applied elsewhere and not in Turkana County.	[redacted] responded and informed the participant that any law that is passed in Kenya is applied everywhere in the country.
[redacted] **PWD representative.**	Claimed that the PWDs of Kalemng'orok have never benefited from the 30% presidential directive of tenders and employment opportunities for special groups. He wanted the project to support PWDs by offering them with jobs and business opportunities.	Ms. Linda responded that the operations will be guided by the stipulated law which also observes the presidential directive on Youth, Women and PWDs to be considered for employment and business opportunities.
[redacted]	He claimed at Kaekunyuk primary school, pupils in two different grades share one classroom. Two different lessons are conducted in the same classroom. He requested the project to consider constructing a classroom in order to separate these pupils.	Comments noted
[redacted]	He alleged that having the operations camp at Kapese benefited the people of Lokichar. He suggested that the camp be constructed at Kalemng'orok in order to increase employment and business opportunities for the locals.	Mr. Bethwell responded and informed the participant that the operations camp will be constructed at the Ngamia area. He informed him that the camp can only be located near the active operations area. It will be impossible to have the residential camp in Kalemng'orok since it is far from the active oil wells.

Commentator	Issue/Question/Comments	Response
	He asked if there will be employment opportunities when developing Field Development Plan.	[redacted] responded and informed him that there will be no employment opportunities as FDP are developed in the office.
[redacted] **from Simailele village.**	He wanted to know if construction of the water pipeline will reduce the water flow downstream. He was concerned about those practising irrigation along the malmalte river.	Mr. Bethwell informed the participants that the pipeline will draw water from the headrace (dam itself) and not at the tailrace where water that flows to the river comes from. He added that the operations of the power generating plant will not be affected thus the water flow downstream is also expected to be normal.
	He suggested that the project should consider drilling water boreholes to support the irrigation schemes.	
[redacted]	Commented that POK should share any opportunity equally among the affected communities.	Comment noted.
	He asked POK team to tell the community members the secrets that they need to know so as to get tenders from the project.	
	He alleged that the children in Turkana South have been affected mentally and health-wise by the environment which he claims has been contaminated by oil activities. He stated that the community is planning to get a lawyer to represent them and advised POK to get prepared for legal battle.	

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1457 Hrs.

Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **County Chief Officer for Agriculture, TCG**	Acknowledged that there is immense knowledge within the KJV partners as exhibited through the presentations. He was glad the presentations were done by Kenyans which means to him that Kenyans have now a deeper understanding of the oil exploration activities. He asked if it is possible to utilise such knowledge and incorporate it in the education curriculum for Kenyan institutions. He mentioned that he is a lecturer at a certain institution and would like to see such courses offered there.	[redacted] the General Manager for Africa Oil responded by appreciating the Chief Officer for asking that question and informed the participants that the KJV partners are open for information and knowledge sharing. He however clarified that the mandate of curriculum development and/ or amendment is the mandate of the National Government, Ministry of Education. The participants were further informed that some institutions such as Kenyatta University, University of Nairobi and Eldoret University already have students pursuing Petroleum Engineering related courses.
	The Chief Officer also inquired on the potential employment opportunities for the local community members.	The presentation had indicated that various employment opportunities will be available to the local community members as well as Kenyan nationals. These opportunities will be for non-skilled, semi-skilled and the skilled labour force.

Commentator	Issue/Question/Comments	Response
	The Chief Officer was concerned that the oil activities, due to external funding may turn out to be some sort of way to colonize the country. He asked what the contribution of the Kenyan government towards Project Oil Kenya is	[redacted] and [redacted] both answered this question. It was explained that investors spend their own money/ resources during exploration and appraisal. This is the practice globally. If the investors discover sufficient amounts of hydrocarbons, then they proceed to the development and production phase. - It was added that Governments can at this point choose to participate in the project based on the percentage participating interest they hold and agree with the investors on how the Government will cater for its contribution.
	The Chief Officer Suggested that the roles of both National and County Governments should be enumerated in the design of Project Oil Kenya.	Comment noted
	The Chief Officer mentioned that land is an emotive issue in Kenya. How is NLC programming to conduct the land acquisition? What if there will be no more land when the project starts?	Land is being acquired as per the stipulated law and this will be followed to the later.
	Making reference to other countries that have explored oil and are currently exporting crude, he asked how Kenya will ensure that this oil does not become a “curse”.	

Commentator	Issue/Question/Comments	Response
	He asked how reliable water from Turkwel dam is. Is it sufficient for the project or we may experience shortage at a later time? He suggested that the water shortage in Turkana County (mostly in the interior parts) should be solved first before drawing the water for the oil project.	Studies have been done both from the KJV and National government and Turkwel was the most viable option however designs are still ongoing and there will be a separate ESIA for the water pipeline to assess the impacts and mitigation measures. option
[redacted] **County Chief Officer,Ministry of Water Services, Environment and Mineral Resources,TCG.**	Appreciated the KJV partners for the "beautiful" presentation.- Mentioned that the issue of gas flaring had been of a greater concern to TCG and he was glad to see that there is a plan to re-inject produced gas into the reservoir to maintain pressure. It was unsettling for him to see provision of flaring in the presentation and therefore sought clarification on the circumstances under which such flaring can be allowed.	Mr. James Kambo clarified that under the current design, all gas produced will be utilized for heating requirements at the CPF and excess gas re-injected to the reservoir. He clarified that flaring will not be a routine activity but will only be allowed under emergency circumstances.
	Inquired if Lokichar basin is the only block in Turkana where Project Oil Kenya will take place. He further asked if there are other areas under consideration.	It was explained by Linda that the South Lokichar basin is the current area where sufficient information and data has been collected and several studies undertaken that are informing the decisions to proceed ahead with PoK. However, it is not the only block where oil exploration will be undertaken. Other exploration endeavours can only be determined at a future date and based on several other factors.

Commentator	Issue/Question/Comments	Response
	Have studies been conducted to establish the possible impacts of drawing water from Turkwel dam will have on people living downstream? - If yes, can the outcomes of these studies be shared with relevant stakeholders such as TCG?	[redacted] responded and affirmed that separate ESIA had been planned for the pipeline. Through this, the potential impacts the pipeline may have on the people living downstream shall be captured and mitigation measures proposed which will be implemented through ESMPs.
	From the presentations, National Government is set to acquire land through the National Lands Commission (NLC) and MoPM will lease this land to the investors. Land is an emotive issue and if not properly managed, it may stall the project. Why can't this be done by TCG?	It was explained that the current plan entails NLC spearheading the land acquisition. However, the County Government is not left out as the compensation money will still be channelled to the affected people through the county government. In addition, there will be ongoing consultations between NLC and TCG concerning this process.
	Asked to what extent did the Risk Matrix that was jointly developed by both TCG and National Government informed the design as shown in the presentations?	[redacted] explained that the Risk Matrix was very important as it informed much of the discussions and content of the presentation that the participants were taken through. He thanked TCG for their valuable contributions towards the development of that particular risk matrix.
	Given that the project lifespan is estimated to be approximately 25 years, what will happen at the end of the project? What is the exit plan?	[redacted] explained that the joint venture partners had a robust exit plan. Furthermore, it was mentioned that it is a requirement that all projects provide a detailed

Commentator	Issue/Question/Comments	Response
		plan on how they intend to conduct decommisioning and restoration after the project comes to an end. This was also highlighted to have been captured by the Petroleum Act 2019 and is one of the critical components that international lenders such as the IFC look at before approving funding for such projects. Participants were further informed that funds are usually set aside for restoration purposes and the money is safeguarded and ensured they are utilised for the said purposes.
	Sought clarity on how TCG will continue to be engaged going forward. Mentioned that TCG would like to know what shall be expected of them.	
[redacted] **Director for Environment,TCG**	Appreciated the presenters for the good information shared.	
	Argued that the information provided was too much to be internalised by TCG officers in short time such as the length of the meeting. Suggested that presentations and any relevant materials ought to be shared with TCG in advance so that the officers can have humble time in going through and internalizing the information.	Comments were noted.

Commentator	Issue/Question/Comments	Response
	Added that his Environment Directorate expects to see an implementable ESMP through this process for easy monitoring and evaluation.	Comments were noted.
	He mentioned that their key priority areas are on Proper waste management, minimization of air pollution, Ecosystem conservation and restoration of well sites.	Comment was noted.
	The director mentioned that TCG and the local communities would wish to get an assurance that the waste that will be produced and managed during the project lifecycle will not have negative effects on people and livestock.	
	He insisted on having clear restoration plans and ensuring the plans are fully implemented at the end of these projects.	The participants were assured that Project Oil Kenya will have a robust restoration plan which will be implemented as this is not only a commitment, but it is a legal requirement and best practice that the Joint Venture Partners will ensure is done.
	He proposed that the team considers adding the people of Lorogon village for the ESIA disclosure and consultation meetings in the current schedule. He mentioned that they are very key as Lorogon is a community near the Turkwel dam that will be affected by this project.	Comment was noted. [redacted] mentioned that such comments were welcomed and that the team will discuss further and decide on this request.

Commentator	Issue/Question/Comments	Response
	He added that TCG has environment officers in every ward of this County and they should therefore be involved during ESIA disclosure and consultation sessions at their level.	Comment was noted.
	He also asked if the waste being held in the various sites around Twiga will continue to be there for the life of the project?	It was clarified that the waste (SBM cuttings) will be treated and disposed off in accordance with the relevant legislations.
[redacted] **Director for Lands, TCG**	Has public participation been done regarding land acquisition for Project Oil Kenya?	It was reported that the land acquisition would be undertaken by NLC in accordance to the law
	There were a lot of complaints for NLC regarding land acquisition/ compensation for the A1 road construction. In relation to this and for avoidance of similar occurrence, has TCG been engaged regarding land acquisition for Project Oil Kenya (POK)?	

Commentator	Issue/Question/Comments	Response
[redacted] **Director Water Services, TCG**	From the presentations, it appears that some studies regarding the design of the pipeline are underway. In his opinion, TCG has not been fully engaged in these studies or rather been kept abreast on the developments of the study. Having in mind that the studies are conducted by consultants, he commented that TCG need to be engaged as they can contribute to the designs or be having details of such design knowing that at the end of the project, they may be the ones operating the pipeline for purposes of community water supply.	[redacted] clarified that the County Government has been constantly engaged in relevant discussions concerning the design of the pipeline through the working committee. He gave an example that the community offtake points were even suggested by County Government officials.
	Proposed that the presentation should entail a list of the proposed community water offtake points.	Comment was noted.
	Suggested that the presentation should indicate or state the estimated water usage for the community and the project. It should be clear what is expected to be utilised by the community and the project.	Comment was noted.

Commentator	Issue/Question/Comments	Response
[redacted] **Director Mineral Resources, TCG**	Asked if the national government had developed another risk matrix other than what was jointly developed in 2019. Mentioned that if this was the case, then they should share with TCG.	[redacted] responded that the National Government had not developed another risk matrix and that they used the one that was jointly developed by County and National Government previously.
[redacted] **Economist, TCG**	Sought clarification on the exact roles of the different joint venture partners i.e. Total, Africa Oil and Tullow Kenya BV regarding Project Oil Kenya.	[redacted] explained that Tullow is the Operator in the Kenya Joint Venture and that accountability for the operations still remain with Tullow. It was explained that the rest of the Joint Venture Partners liaise with Tullow to ensure the project activities are carried out and are successful. It was pointed out that discussions are taken among the partners and changes can be agreed upon regarding the duties of each partner as long as it is geared towards achieving the main objectives of Project Oil Kenya.
	Mentioned that TKBV had made certain commitments with the communities in Turkana South and East. He asked if Tullow has a mechanism of tracking all the commitments it made with the communities and whether they are going to fulfil any that may not have been accomplished.	Mr. Bethwell Sang responded that TKBV has a list of all commitments it has ever made to the communities. He added that all commitments that Tullow has ever done has been documented and it has so far accomplished all except for the construction of classroom at Ng'imuriae.

Commentator	Issue/Question/Comments	Response
[redacted] **Director Public Health, TCG**	Argued that many community members do not have sufficient information regarding Project Oil Kenya. He suggested that KJV partners should consider developing a robust communication strategy to ensure proper information flow to the local communities.	Comments were noted
	Raised a concern that there are fears within the communities and public health officers that there could be long-term health impacts as a result of exposure to heavy metals like mercury, lead and chromium. According to him, oil exploration activities are likely to result in diseases like different forms of cancer. He asked if there are mitigation measures to ensure people's safety is guaranteed.	He was notified that there was a robust mitigation measures put in place and this will be disclosed during the ESIA consultations
[redacted] **Deputy County Commissioner, Loima sub-county**.	Commented that he believes nothing will go wrong if the laws are followed to the latter.	Comments were noted.
	Highlighted the need for County and National Governments to constantly engage on matters of Project Oil Kenya and in doing so, he believes, all challenges will be resolved.	
	He mentioned that communities are most likely going to persistently be asking on what types of CSR or benefits they are going to get as a result of Project Oil Kenya.	

Commentator	Issue/Question/Comments	Response
	He added that misinformation has always been the greatest challenge for communities' members. He mentioned that proper communication channels and information flow should be established to avoid misinformation.	
[redacted] **Deputy County Commissioner, Turkana South,**	Mentioned that he is relatively new in the area and is still acquainting himself with the project details.	
	He asked if there is a robust security plan for the Project Oil Kenya. He added that the security personnel need to know their roles in this project.	Comments were noted
[redacted] **Kenya Wildlife Service.**	Mentioned that the proposed designs and routes for the pipeline from Turkwel dam to the CPF should be shared so that they may advise pertaining wildlife restricted areas or areas gazetted to be of conservation concern or endangered species.	Mr. Bethwell responded by informing the participants that KWS officals from the Turkana South Wildlife Reserve had been engaged and provided valuable information concerning the boundaries of the wildlife park and areas that may contain sensitive habitats. All this information is used to identify the best pipeline route.
	He added that CSR should also encompass aspects of wildlife conservation.	Comment was noted.
Purity Country Manager Total Kenya	Mentioned that this is basically the beginning of the journey towards realizing the objectives of Project Oil Kenya. She	

Commentator	Issue/Question/Comments	Response
	added that there are going to be more sessions where all the stakeholders will have opportunities to share their views regarding this project. As she was concluding, she reiterated that these disclosure sessions are requirements for NEMA to approve Licence for the project.	Comments were well received by the participants.

APPENDIX C

ESIA Consultation Meeting Minutes

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings
Audience: Turkana County Government officials and Civil Society
Venue: Cradle Hotel Lodwar
Time: 1100hrs – 1537hrs
Date: 28/7/2021

ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor - EcoScience
- Grace Lotoom - Golder

Supporting Team Members

- [redacted] Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- [redacted] - Ministry of Petroleum & Mining
- [redacted] - Ministry of Petroleum & Mining
- [redacted] - National Land Commission
- Bethwel Sang - Tullow Oil
- David Kombe – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Emase Lodungo – Africa Oil (Notetaker)
- Lochaman Emoit Wilfred – Africa Oil (Translator)

OBJECTIVE OF THE MEETING

To present ESIA process and key environmental and social impacts and proposed mitigation measure: the process will collect stakeholder issues; register comments and responses.
Key observations:

- The meeting that was intended to start at 0900hrs started at 1100hrs
- The civil society organization did not turn up for the meetings except for Ikaal Angelei
- The MCAs attended the meeting partially with an excuse that they had an afternoon session in the county assembly
- The Chief Officer in charge of the Ministry of Environment requested for the members of county assembly meeting to be scheduled for 9th august:
- There was also a concern from the stakeholders; they claimed that the document would have been shared earlier to give room for them to interrogate the document in order to ask valid questions:

- There was one MCA physically disabled who requested for a brail to enable him read the document.
- MCAs wanted the session to be divided into to two sessions the morning session which will be majorly on going through the draft and afternoon session for Questions and Answers.

PRELIMINARY

- Bethwel Sang welcomed all the participants and welcomed DCC Turkana south who gave his opening remarks
- [redacted] (MoP) introduced the participants from the National Government at the county level; National Land Commission, County Commissioner and [redacted] representing CSOs
- [redacted] (Chief Officer, Ministry of Water Environment and Mineral Resources) acknowledged the presence of MoPM, Turkana County Government.
- He went ahead to introduce other county government employees present and the MCAs.

KEY EXPLANATIONS

- [redacted] narrated the history of oil and gas exploration in Kenya from 1940 to 2012 when Kenya made its first discovery
- He narrated the origin of Early Oil Pilot Scheme (EOPS) - why it was conducted, and the lessons learnt from it.
- He explained how the project explored several water options and finally arrived at Turkwel dam as the most appropriate and suitable water source
- He explained how land, water and NEMA approval is crucial for the project.
- He mentioned that the ESIA consultation meeting is the process of acquiring NEMA approval.
- Mr Kombe touched on legacy issues; 10 discoveries done in 40 wells between 2012 to 2018. He talked about joint ventures and their shareholdings.
- He reiterated that Tullow is still part of the joint venture; he also added that the project was negatively affected by COVID 19.
- [redacted] explained the purpose of the meeting to the participants and the ESIA process that it would present key environmental and social impacts and proposed mitigation measures.
- Linda took participants through project overview and informed the participants that the project will concentrate on block 10BB and 137
- Linda handed over the session to Muthoni who took the participants through ESIA background and stakeholders.
- Philip took over from Muthoni and explained about the ESIA matrix method and ESIA findings and mitigation measures on biodiversity and physical. Philip handed over to Muthoni to cover Cultural Heritage and the Social findings. Unfortunately, due to pressure from the MCAs to go for lunch Muthoni rushed through her presentation.

- Mr Kambo explained to the participants the importance of the consultation meeting as it will feed into ESIA report

Question and Answers Session

Commentator	Issue/Question/Comments	Response
[redacted] **(Lobokat Ward)**	My great concern is that we the MCAs are used to debating issues that affect our people In order to achieve this, we need enough time to go through the document and interrogate it.	**James Kambo** He reiterated that 3 weeks ago we had similar meetings with government officials and local communities at local setting on ESIA disclosure. He added that the participants came late and the team is ready as much time as possible: He also replied to the MCAs that although the document has been presented late there is a feedback form for participant that the participants can use to send questions or feedback.
[redacted] **(Nakalale Ward)**	We need more time to interrogate the document because we have just received it now We also want our MPs, Senator and Governor to be present in the meeting.	
[redacted] **(Nominated MCA)**	She appreciated the meeting but requested for the meeting to start at the community level. She requested for the meetings to be broken down to cover government ministries, separately. She suggested the MCAs to be given budget of holding meetings at local level	
[redacted] **(Kalobeyei Ward)**	He also requested for more time for them to interrogate the document in the county assembly and get a legal advice	
[redacted] **Founder, Friends of Lake Turkana**	There is need to have anthropogenic data of turkwel dam. Need full disclosure of EOPS in term of figures	**Philip - climate change** 4 year's data is more than adequate for an ESIA Study- though not stipulated in EMCA Regulations, annual data would suffice/taken as best practice).

Commentator	Issue/Question/Comments	Response
	Climate impact assessment has not been done. The document has not looked into the issues with gender lens. The details of the quantity of water 3400M cubic should be explained in simple terms for the community to understand. 4 years is a short period to study biodiversity If there is change of contractor what will make it binding for the company Biodiversity monitor is not adequate for the work Is there a Gender Impact Assessment for the project?	The collective impact of a number of different gases has been quantified and assessed as carbon dioxide equivalent (CO_{2e}). The annual emissions potential for the Project has been calculated as approximately 589 ktpa (kilo tonnes per annum) CO_2e, which equates to approximately 3.0 % of the 2019 Kenyan annual emissions. **James Kambo** The gas produced will be used to generate heat and power to be used at the facility, more will be re injected into the wells to stabilize the wells Flaring will only happen during emergency circumstances. If there will be any change on contractor NEMA must be notified, request for license variation should be made and evaluate on potential impact of any such variation on the project; EOPS ESIA was also uploaded on the website, all details of EOPS were availed and full disclosure is being done by POK.
[redacted]	He mentioned that some of the issues in the ESIA are devolved functions therefore the	**Bethwel Sang - waste consolidation exercise interruption**

Commentator	Issue/Question/Comments	Response
(Director - Environment Department, Turkana County Government)	county government and the concerned department should not be by passed on such issues The interest of the county government is that oil and gas activity should not interfere with the environment in polluting it and affecting livelihoods; they are interested on how waste will be managed The county needs a detailed waste management plan to be presented to them and be approved by the county. How will gas emission be managed? Best technology should be used in venting and flaring gas and to be indicated in ESIA How will produced water and cuttings be managed? Turkana county government must be informed of decommissioning plan Emergency response plan should be elaborated What are POK climate change commitment plan?	• The community members during the exercise interrupted the exercise claiming that they were not notified of the exercise. • After consultation with the chief the matter was addressed • Tullow did not give any money to the culprits. The matter was addressed amicably. **Philip Abuor - climate change.** We have quantified carbon emission and suggested mitigation measures stated… as above. The POK Environmental Performance outline the procedures. These will include; - Management of evaporation through control and surface area reduction; Storage of odorous materials in sealed containers and pipes. - Application of odour abatement methodologies e,g adsorption by activated charcoal, absorption by scrubbing and treatment chemicals. **Linda Were** Waste sampling is ongoing, and the results will be shared During ESIA disclosure we explained more on waste management More answers on gas flaring and gas emission

Commentator	Issue/Question/Comments	Response
	Health impact assessment has not been captured in the report we need baseline data for comparison in future. He suggested that the 4 TCG officers working at the sub county level together with NEMA should be allowed to access TKJV sites for the waste consolidation exercise. He cited the recent scenario that happened during waste consolidation where some few culprits interfered with the exercise requesting to be offered the work, he said that such people are looking for business opportunities and their own interest rewarding them is not right. The ESIA would need to align with the County Environment Action Plan.	**James Kambo** • Several oil industries are going green • the technology that will be used will ensure that no gases are emitted.
[redacted] **(Director – Sports Department) TCG**	What is the lifespan of the ESIA**?** He alleges that the language in the report appears as if the government has already approved the project. The use of terms as residual, minor, negligible are not understood. He also alleges that waste at the Twiga site could have sipped into the ground and caused pollution in that area. Waste should be transported to another place by Tullow.	**Philip Abuor** This is not the final document that is why we have come for consultations. The impact identification mitigation is given in the template; after putting in the mitigation measures to the already identified potential impacts, then the residual impacts are indicated. If it states negligible it means that if the mitigation measures are implemented this will be the outcome.

Commentator	Issue/Question/Comments	Response
	There is an allegation that West Pokot County has given crazy condition to Tullow in order to get water from the Dam;10 000 Ha of land is required by the Pokot in Turkana County. We want a joint meeting to be organized between us and the Pokot in order to have discussions. The issue of land acquisition should also be looked into. Borrow pits dug during the project were not rehabilitated and this has turned to become a disaster The issue of insecurity and boundaries in this area of Turkana South and East should be handled with care. Employment for locals the local content policy should be fully implemented in future.	He mentioned that the team has noted all the concerns or views and are going to be incorporated into the final report. [redacted] The issue of boundaries are the mandate of IEBC. The local content policy will be fully implemented. Turkana and West Pokot are inseparable. Water, for the project is from West Pokot and oil is from Turkana County.
[redacted] **(Ministry of Water, Environment & Mineral Resources, TCG)**	He noted that the 2nd presentation by Muthoni was unfortunately rushed through. Who is NLC engaging on matters of Land? NLC should inform other stakeholders how far they are on matters of land acquisition.	[redacted] NLC acquires land for both National and County governments. Any land that acquisition that has a compensation aspect becomes an NLC mandate. We are at stage 3 over the nine stages in acquiring land for LAPSSET:

Commentator	Issue/Question/Comments	Response
	There is need for detailed waste management plan: what about the current waste on sites? We should not get used to such kind of meetings but let's be mindful of bringing feedback: Is there redesigning of the project due to COVID 19 and fall in prices to make it profitable? What will happen to the project? I haven't seen water sprinkling in dust mitigation measures. You have indicated in your draft that there will be monitoring of soil; air quality and water quantity: I hope Turkana county will be included as part of the team to conduct monitoring. There is need to input adequate measures to clean up any spillage. What are the mitigation measures against long term implication of water being used for the project for the Dam to upstream users? What happens to water projects that were there for instance Namanatalem water project? I understand there was money for it. What will be done to ensure the project goes on?	1. Formal request 2. Consider request 3. Notice of intention to acquire land; this is what caused chaos previously on acquisition of land gazetted without community consent. Gazettement of land is as per the law and this enables NLC to know the affected person's: politics at times confuses things. TCG Ministry of land should be in the driving seat in matters of land acquisition. NLC and other stakeholders will support the government in land acquisition; alternative justice system framework designed by judiciary should also be used. **Linda Were** Linda answered the issue of the current waste by informing them of the current waste consolidation exercise and that the plan of waste management is crucial and will be put in place as it is in the draft Water is a scarce commodity as we know there are other mitigation measures that will be used such as reducing the speed of the vehicles. There will be continuous monitoring of dust, soil water quality and quantity and NEMA will always be notified in case of any changes.

Commentator	Issue/Question/Comments	Response
	He urged presentation materials to be shared in advance for participants to engage constructively during the meeting. I hope to see to see comments made here in this meeting featuring in the final draft	Other matters of concerns have been noted down and will be used in the draft improvement **Philip Abuor** On oil spillages and leakage in the pipeline there are leak detection systems that has been recommended to the proponent. Moreover, the crude is waxy and has high pour point hence will not flow when exposed to the ambient conditions. The long-term implication of water utilization on downstream users; there is a provision where water levels in the dam will be monitored and alternative water sources used to ensure people downstream are not affected **David Kombe - Namanatalem water project.** TKBV is committed to fulfilling all their commitments considering that water provision is a devolved function TKBV and other KJV partners will work together to see how the project will go forward. Redesigning implies that the project planned to have six wells in one well pad but now they've designed to have 8 or more wells in one well pad, this reduces cost.

Commentator	Issue/Question/Comments	Response
[redacted] **County Advisor on Extractives**	The issue of force majeure shocked the stakeholders, and this cannot be found online. There is change of partners, he alleges that he is aware that AOC is looking for partner to finance the project He requested for the deadline of views submission and the draft be made available to the county government to interrogate and make technical inputs. He wanted the issues of health issues and mitigation measure to be given more weight because the actual effect of oil exploration on health will be infections like cancer and other respiratory disease. He observed that land issues will drag the project behind.	**David Kombe** • There is no change on KJV partners; Tullow still has 50 percent shares • Force majeure was lifted • There is bigger presence of National Government in the project • Government is the owner of the project and KJV partners are contractors • On health issues there is a global movement to ensure oil companies are going green to reduce emission of greenhouse gases **Philip replied.** *The issue raised was noted.* The issue of land was already answered by NLC representative.

Next step of action

- Since the MCA attended the meeting partially another meeting was scheduled for 9th August.
- The disclosure materials were distributed to various stakeholders in the county government and a letter written to the county assembly as a confirmation of the scheduled meeting.
- Information packs sent to the County Secretary, County Commissioner on Friday 30th July 2021.

Closure of the meeting:

- The DCC appreciated the fact that the meeting has been very informative
- He instructed that grievances to be addressed through existing laws.
- He mentioned that illegal gathering and road blockage are prohibited
- Further discussions to be done going forward on how POK partners will work together**.**

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Location: LOKICHAR

TIME: 11:00am to 15:37pm

DATE: 29/7/2021

NAMES PARTICIPANTS

OBSERVATONS

- The participants turned up early and the meeting proceeded well without any disturbance
- The question session was well covered with both men and women asking questions
- Special group was also represented by one blind lady who asked the question on importance of inclusion of the people the people with disabilities in the project
- Youth had also stake in the engagement-most of the youth engaged in question session:
- Most of the questions were on land acquisition and waste management and employment
- We also observed that community members require feedback of such engagements
- The matter of insecurity was very crucial and repeated by most community members.

PRELIMINARY

- Opening prayer was done by word prayer from local pastor
- Purpose of the meeting explained by [redacted]
- Bethwel Sang took on Introduction of Africa oil and Tullow participants
- Muthoni did introduction Of Golder team and a recap of ESIA disclosure that happened three weeks ago

- She explained the theme of ESIA disclosure which is meant to take the stakeholders through the possible impacts of the project both social and environmental impacts and mitigation measures put in place
- Muthoni handed over to Philip Abuor who took the community through the key environmental issue by the aid of posters: Muthoni tackled the social impacts.
- Philip took the community through environmental impacts key commitments to mitigate that are recorded in the draft:

Questions and answers session

[redacted] kuya-kakali community

- We don't know the status and progress of the project so far we are only seeing this meetings
- Kakali community wants a session with NEMA pertaining the issues surrounding their grazing land and vegetation

Answer by Philip

The piece of land that will be required for the project is 1500h and this will not be everywhere and in the draft there is a provision for resettlement and livelihood restoration; the land intake for the project is minimized to enable land users to continue using their land for their own use. there will also be improvement livestock grazing land

- We are very worried about this oil project because we hear where oil production is done vegetation is depleted and degraded.

ANSWER BY PHILIP-There will be continues replenishing of indigenous trees of the same species

There will be continuous monitoring of biodiversity to ensure that endangered species are not destroyed to avoid extinction

- What will happen to the people who will be displaced from their ancestral land
- Issue of employment for locals should be put first if this is not done it will cause interruption to the project.
- Important things mentioned by the community should be tackled for the success of the project oil Kenya.

Sang had earlier stated that we have been here three weeks ago Africa oil, Tullow and MoP doing project disclosure and now we are here with GOLDER associates coming for ESIA consultation.

[redacted]–NLC REPRESENTATIVE

The issue of land is a big issue not only here but allover Kenya

Kenya law indicated that people displaced by any project will be compensated, however there are three categories of land

Pubic land-this is the government land that if you encroach you will be displaced any time near schools; riparian land; along the rivers mountains:

Communal land –this is the status of the land in Turkana it is not registered it is held in trust by the county government so any compensation of this land will go to special account in the count government until when the land is registered ,but any investment done on it will be paid to the owner

Private land-this is the registered land that belongs to an individual

Our land is not yet registered and registration takes three stages

Registration ;planning and issuance of tittle deeds land planning is done by ministry of lands in the county and so far the main towns identified for land registration are nine ;Lokori;Lokichar,Lodwar,Lorugum,Kalokol,Lokitaung,kakuma,Lokichoggio and Kainuk.

After land planning allotment letters will follow and what proceeds that is issuance of tittle deeds.

People will be compensated depending on what has been invested on Land but land value will go to the county government

People will not be compensated twice if you have been paid it will be your obligation to look for another land but if you are not paid you will moved to another piece of land

ANSWER BY JAMES KAMBO ON EMPLOYMENT

There is a National and local content policy that will for cater for local employment there will be more jobs 2400 opportunities

The project will require different skills

[redacted]

- Is NEMA aware of waste consolidation happening in Twiga now and how is it handled since we all know the danger of this waste
- I worked with Tullow under Mbote for three years when the project closed I was not given any benefit this is not fare there should be improvement if the oil project starts again.

ANSWER FROM LINDA

Yes NEMA is aware because we notified them we have been with them in the process; the waste is handled well according to required standard:

The project is keen not to repeat the mistakes highlighted by the community

[redacted]

We are requesting for the government to solve the security issues which is the main issue in this corridor

Answer by [redacted]

The national government is very keen on security issues and there is an ongoing dialogue among the governors of the affected area.

Security is the function of the national government

.Employment of the locals has been by passed we request this issue to be considered of importance

[redacted]

- We want transparency in this project especial in terms of benefits such as employment and business opportunities the local locals have been marginalized in employment even the number of locals we see in this engagement are few – **this was answered by James kambo**
- Pollution of any kind should be avoided.
- The indigenous vegetation should be conserved and protected.-**this was answered by PHILIP**

- How will the people displaced from their ancestral rehabilitated? Is there any plan-**this was answered by NLC representative**

[redacted]

- Environment should be improved more in order to sustain biodiversity-

ANSWER BY PHILIP-There will be continues replenishing of indigenous trees of the same species

There will be continuous monitoring of biodiversity to ensure that endangered species are not destroyed to avoid extinction:

- The government should more vigilant on matters of security because this will cause disturbance to the progress of the project-**this was answered by** [redacted]
- Qualified locals should not be left out on employment opportunities
- There should be a defined way for locals employment –

JAMES KAMBO

There is a local content policy that will for cater for local employment there will be more jobs 2400 opportunities

[redacted]:

- Is there any plan or provision in the draft for mitigation measure for climate change?
- The benefits of the community should be considered especially employment and other benefits –**this was previously answered by James Kambo**
- Is there any plan for population influx because this is the major impact of this project?

Muthoni Koinange Answer on influx management

There are plan and provision the draft for influx management; influx management system will be there to manage impacts of influx; there will be health information system to monitor infections, there will always be continuous monitoring

- Is there vegetation restoration plan
- Is the plan to rehabilitate degraded sites caused by the project?

Answer by Philip Abuor there will be continues replenishing of indigenous trees of the same species

There will be continuous monitoring of biodiversity to ensure that endangered species are not destroyed to avoid extinction:

Degrade sites will be rehabilitated.

[redacted]

I have seen inclusion of the people living with disability –project have not been keen in inclusion of such group of people:

Answer by Linda

There is inclusion of special group in employment and other benefits that come with the project

[redacted]**.**

- All this mitigation measures you are talking about were not done during EOPS so we don't trust that this will happen

Philip had talked about all mitigation measures that have been put in place and will be followed to the later

- Security is paramount in this project so we need peace first.
- Our land has also been taken by Pokot.

Answer by [redacted]

The national government is very keen on security issues and there is an ongoing dialogue among the governors of the affected area.

Security is the function of the national government.

Matters of land is the mandate of IEBC and it is very aware of boundaries.

[redacted]**;**

- The issue of insecurity has become a big problem in Turkana East and south disarmourment was not done in all communities **–this was previously answered by** [redacted]
- Employment opportunities for locals should be considered. **This was previously answered by James Kambo**

[redacted]

There should be employment slots for youths and people abled differently

This was earlier answered by Linda

There is inclusion of special group in employment and other benefits that come with the project

[redacted]

Noise reduction should be done in all ways possible when the project starts.

People's problems should always be listened to and grievance mechanism in place followed exhaustively.

There should be a plan to restore degraded sites this was answered by Philip Abuor on previous questions

[redacted]

Tullows mistakes should not be repeated for trust to be there when the project begins.
(**This was not answered because he was not specific but most speakers clarified that there will be improvement in whatever was not done right before.**
Philip talked of regular monitoring of his impacts in order to minimize the impacts
Linda also talked about regular monitoring of waste in partnership with NEMA and county government

[redacted] **–student from Nairobi University**

- We should not forget the potential impacts of oil project we should implement the mitigation measures in the draft
- We want to know how the land will be acquired
- Is this the only way we will be consulting because I see most of the community members here are illiterate
- We need more engagements on project oil Kenya
- Will there be compensation for community members who will be impacted negatively
- He told the community to be vigilant are refuse silenced with bribes when it comes to matters affecting the community
- He requested for local partners to be used in advocacy

Answer by James Kambo:
There will be compensation for those who will be impacted negatively, there will be identification of the impacts and impacted

Consultation welcomes all groups of people; we have engaged civil society and we know among the people attending such meeting are people from various categories

[redacted] **–land issues**

The issue of land is a big issue not only here but allover Kenya

Kenya law indicates that people displaced by any project will be compensated, however there are three categories of land

Pubic land-this is the government land that if you encroach you will be displaced any time that is near schools; riparian land; along the rivers mountains:

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Our land is not yet registered and registration takes three stages

Registration; planning and issuance of tittle deeds.

land planning is done by ministry of lands in the county and so far the main towns identified for land registration are nine ;Lokori;Lokichar,Lodwar,Lorugum,Kalokol,Lokitaung,kakuma,Lokichoggio and Kainuk.

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People will be compensated depending on what has been invested on Land but land value will go to the county government

People will not be compensated twice if you have been paid it will be your obligation to look for another land but if you are not paid you will moved to another piece of land.

[redacted] **-civil society**

- This the draft for the contractor to get license what is the status of this draft?

- Golder has been doing consultation since 2015 is there any feedback mechanism in place?
- According to my observation if this is consultation it is poor –the turn up is low
- Time of notification has been short to allow a good number to attend the meeting
- Mitigation measures should be during construction and operation
- He talked about missing aspects in the draft
- Emergency response and ESMP but this is in the draft
- There should be a baseline of air quality, soil and water quantity so that we may detect any change in future
- Pollution during foundation stage and how the gas will be managed

ANSWER FROM PHILIP ON ENVIRONMENTAL ISSUES

- Golder has been doing consultation since 2015 and they are in continuous process to improve the document this is not a final draft.
- We are committed to bringing feedback the draft was put in the website we see how to improve feed backing
- Baseline for environmental issues like water soil and noise was done was done, people living close to the areas of noise production be notified to move a distance of 100m .
- Water levels and quality will be monitored regularly during the project
- There will be alternative ways of getting water for utilization to cater for water scarcity
- Land for intake will be required I will refer that to NLC representative
- Gas will not be flared it will be used to regenerate power and re injected back to the well to help in drilling.
- Emergency response plan is in the draft as well as environment social management plan.

[redacted]

- *We need to see cooperate responsibility of POK upgrade the already existing tertiary colleges to provide relevant skills to locals to re align them with job opportunities that are required in oil production.*

ANSWER BY JAMES KAMBO

The project will require different skills people will be employed according to the skills they have acquired

ESIA CONSULTATION MINUTES

Stakeholder Engagement: Esia consultation meetings

Location: Lomokamar

TIME :10:30-15:30

DATE: 30/7/2021

Team Participants

- Muthoni Koinange –Golder
- Philip Abuor-Ecoscience
- Grace Lotoom-Golder

ESIA SUPPORT TEAM

- Bethwel Sang -Tullow
- Linda Were –Africa oil
- James Kambo-Africa oil
- AnnWanjiru- Africa oil
- Emase Lodungo –Africa Oil
- Lochaman Emoit Wilfred –Africa oil
- [redacted] Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted]Ministry of Petroleum and Mining
- [redacted] Ministry of Petroleum and Mining
- [redacted] –National Lands Commission
- [redacted]-assistant chief Lokichar
- [redacted]-Ward Administrator Lokichar

Preliminary:

The meeting was called to order by [redacted] at 10:11 am. [redacted] volunteered and offered the opening prayer.

[redacted] informed the community the objective of the meeting and reminded them of ESIA disclosure meeting that took three weeks ago he urged them to attentive to the presentation

The chief then invited Mr. Bethwell Sang to welcome his team. Mr Sang informed the community members the role of Golder Associate in the consultation meeting and importance of the process.

He urged the community members to make their contribution that will enrich the ESIA report.

Mr. Bethwell welcomed [redacted] who introduced the entire ESIA support team from MoPM and KJV. [redacted] urged the community members to be keen and ensure that they have asked relevant questions pertaining the potential impacts of the project and recommended mitigation measures.

She assured the community members that their concerns will be noted down and follow up done whatever will not be answered feedback forms will be left behind for them to fill.

[redacted] invited Mrs Linda who welcomed the Golder Associates consultants, Mrs Muthoni Koinange and Mr. Philip Abuor to go through the main agenda of the meeting

Mr. Philip did a recap of the project disclosure by going through the project overview and the main requirements of the project and thereafter proceeded to presentation of the potential impacts of the project to the physical environment: Air quality; Noise and vibration; water resources; soils, geology and geo-hazards; biodiversity, ecosystem services and road safety

Mr. Philip then invited Muthoni present the potential impact of the project to social aspect of the environment: cultural heritage; demographic impact assessment; influx management; economics and employment and finally; community health, safety and security

OBSERRVATIONS

- The meeting started early and the community was very receptive
- The chief was very cooperative and encouraged the community members to be open minded and the questions that will help them
- Ward administrator was very instrumental in clarifying the issues of the county government
- More discussions were on waste and employment

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted]	It is obvious when the project is starting there is always a tendency to say the environment will be protected and conserved in order to get the license but when the operations begin every commitment is overlooked. If trees are found where construction will be done will trees really be spared?	**Philip Abuor** Philip informed them that in case trees are fell in operation and construction sites the contractor is recommended to restore similar species by replanting. Biologist will be employed to monitor biodiversity- **Muthoni Koinange** Site assessment will be done before the operation and consultation with community members to know the exact location of shrines and graves.
[redacted].	He wanted to know if there will be some employment opportunities for the elderly. Are you taking into consideration that this waste will affect our livestock and people? Where are jobs for site marshals Job opportunities should be shared equally and fairly Lokichar has been benefit a lot from our jobs	**Mr.Bethwel Sang** He informed the community that the project will require 2400 employees: skilled; semi-skilled; technical people. The phase of construction will bring job opportunities which will be based on capabilities.
	He alleges that the current waste consolidation exercise did not consider people from Lokichar different people were selected by chief	[redacted] On waste consolidation exercise he informed them that chief Josephine was requested to recommend ten people who will be hired within a short period, names were taken and the people were considered for employment. Later people of Lomokamar claimed that they were not consulted. He noticed that Lomokamar wants to make decisions on issues pertaining employment without the

Commentator	Issue/Question/Comments	Response
		involvement of the chief which he sees as dangerous way of doing things. He informed them that Chiefs are better placed to distribute job opportunities equally. He encouraged them to work together with the office of the chief in matters that concern them in the community
[redacted]	Rose is so much delighted with women presentation in this consultation meeting and wishes that POK will consider promoting local women when operation starts	**Muthoni Koinange** The project will follow all employment policies There will be a national and local content policy that will ensure equitable distribution of opportunities and benefits to various category of groups.
	She reported that her goat was recently knocked run over by either a vehicle or a motorbike the circumstances are not clear; she wanted to know if there are ways the project will tackle accident issues during operation.	**Mr Philip** Good transport management system will be put in place to ensure that accidents are minimised. Speed limit will be set and reporting mechanism that will take grievance from people will be in place When such thing happens don't be silent report to the chief or ward administrator If the driver is found guilty of his actions there will be compensation.
[redacted]	When the operation started Tullow was doing well in distributing opportunities but later even what can be found locally such as meat and vegetable supplies was given to people in Nairobi and most of job opportunities We have lost trust with the project because these mitigation measures mentioned here were not implemented earlier.	**LINDA AND BETHWEL** We have been sharing small job opportunities and in consultation with local community members

Commentator	Issue/Question/Comments	Response
[redacted]	He stated that Lomokamar community has accepted waste consolidation to be done at Twiga. What he is requesting is the hospital to be constructed there in order to cater for the health issues arising	**Linda:** Waste in Twiga is just here for the shortest period When we get a licence there will be an integrated waste management facility in Ngamia; On jobs we still see the benefit of the project to the communities When the project starts we will talk with the county government to know the viable projects
	He cited that the project constructed a school after realizing that waste was dumped in Lomokamar without their consent. He asked how the community is going to benefit from the project.	The comment was noted.
[redacted].	She is happy to see women participating in this exercise, we also encourage the project to encourage women participation and inclusion at local level	The comment was noted.
	She alleges that they thought oil project will improve their livelihoods Nothing has happened so far we are still burning charcoal and fetching firewood for sale	This was answered by **Mr. Bethwel** on job opportunities
[redacted]	The pokot have been left to take our land the government has failed protect us and our land.	
	We are keen to know the size of land required for the project And what will happen to the people living close to the wells and operation area?	**Mr. Philip** The size of land required is 1500ha and people living close to operation areas will be moved to distance of 250m to avoid disturbance. And land acquisition is the mandate the national government and county through NLC

Commentator	Issue/Question/Comments	Response
		[redacted] It is not our mandate to protect boundaries it is the work of the ministry interior and Lands The governor of Turkana county is Also Engaging with west pokot county on matters of land encroachment. Our land is communal which means it is not registered so anybody affected will be compensated Compensation will be based on the investment on the said piece of land but land value will paid to the special account in the county government, this may later be paid to the owners of the land upon registration
	How will the employment opportunities divided among the youths, elderly and women?	Question was answered by Mr.Bethwel Sang
	Vegetation should also be protected and conserved;	**Mr Philip** The baseline of vegetation and trees was done and we know the exact number of trees and species ; Ecologist will be there to monitor the existence of tree and in case some trees are fell the same species will be replanted to ensure continuity. There are very small tree that will not even be touched
	We believe that the trees that will be destroyed by the project will be compensated	
[redacted]	We still a problem of water ,if the project has come back kindly consider water for the community	**Mr.Bethwel Sang** This is well noted ,we realize water tankering was not viable and sustainable

Commentator	Issue/Question/Comments	Response
[redacted]		
[redacted]	ESIA report should be shared with the community earlier	The comment was noted.
	The first phase of the project did not consider ESIA for waste management	**Linda:** Waste management is one of the project in phase one therefore it was covered in project description in exploration that was covered in ESIA ; **Philip** Audits will be done annually and permanent solution of waste management is building of integrated waste management facility once licence is acquired that will be implemented. Waste management facility has its own impacts this impacts will be mitigated noise will be monitored ,well around the project will also be monitored Water quantity will also be monitored to ensure water levels have not gone down.
	Water for the community should be made a priority in this project and viable alternative for water supply be put in place water tinkering was too expensive to sustain.	
	Health baseline should have been done to help monitor changes in future.	Health information system has been put in place to help monitor any change.
	There should be long term measures to mitigate impacts on water, soil and air.	
	He alleges that there is a report that goes round and it states that only 500 households will be compensated.	[redacted] **–NLC** The five hundred household that people are claiming is the number of beacons that are used to demarcate

Commentator	Issue/Question/Comments	Response
	We need to know the origin and authenticity of the report	the lapsset corridor; it is 513 beacons and that does not refer to number of households We should not mislead our people;

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 1438 Hrs.

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Location: Karoge

TIME:11:00am to 15:37pm

DATE: 31/7/2021

ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor – Eco-Science
- Grace Lotoom - Golder

Supporting Team Members

- [redacted], Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted] – National Land Commission
- Bethwel Sang – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Emase Lodungo – Africa Oil
- Lochaman Emoit Wilfred – Africa oil
- [redacted]-chief Lochwaa
- [redacted]-Ward Administrator Lokichar

Preliminary

The meeting called to order by [redacted]

Word of prayer was done by [redacted]

The program was handed over to Linda Were who introduced [redacted]From MoPM who introduced her colleagues and did a recap of ESIA disclosure

[redacted] also hinted the requirement of the project which is Land and water.

The team did self-introduction except Golder team which was to be introduced later as they take the participants through key commitments

Ward administrator informed the community members the objective of the meeting and requested them to make valid comments and question that will to build the draft

The ward administrator invited Golder team who were introduced by Muthoni Koinange, before proceeding with the program Muthoni gave a brief history of Golders work since 2015 to date.

She told the community that the process seeks for community comments and questions that will be handed to NEMA for validation.

She informed the community members of feedback form that will be given to anyone who wants to register their comments and questions pertaining the key commitments that they will be taken through

She later welcomed Mr. Philip Abuor who took the community member through potential environmental impacts of the project and mitigation measures recommended.

Muthoni took the participants through the possible social impact of the project and mitigation measures and later moderated question and answers session

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted]	The previous project was doing very well but the operations were stopped. When we heard that the project has resumed we were very happy because of opportunities. We hear the contractor has changed and work will be done differently am happy because I see Tullow is here. What will happen to the people who will be displaced and what happens to sacred places If there are any changes we will go by it but we request the benefit to the community to increase Compensation of wells should move from 7million to 15 Million or even 20 Million I see there are many wells here this implies that more land will be required what will happen to our grazing land? Last time a high percentage of benefits and opportunities was bagged by Lokichar Business opportunities for this place should be done by people from karoge This wells are within our settlements what will happen? We were told that some percentage of money will go to the county government and 5 Percent to the community; the community percentage is very little.	[redacted] **–Ward administrator Lokichar** Five percent is the policy that has been put their the share of the national government is 75 percent county government is 20 percent while the community get 5 percent don't underestimate that percentage it is a lot of money. People who will be displaced by the project will be compensated but our land is communal held in trust by the county government ;compensation fee will go to the special account and will be paid back when land will be registered All this benefit will not be implemented unless the project begins so let's be receptive to the project as we give our concerns, I will also be vigilant to point anything can affect the community negatively. **Muthoni Koinange** –cultural heritage Nobody will tamper with graves and sacred places We have requested the proponent to try as much as possible to ensure that such places are preserved and protected.

Commentator	Issue/Question/Comments	Response
[redacted]	We real appreciate what the previous project did to us we have schools and hospitals. If the project has come back we request the project to employ professionals from this place we have youths here who have completed colleges. Benefits that come with the project should be divided fairly and equally to avoid conflict between communities living in the operation area:	The comment was noted
[redacted]	Dust brings respiratory infections which plans has the project put in place to mitigate this impacts? He alleges that has Korean people have such kind of eyes because of the impact of oil production. People living here are illiterate and are devoid of information on oil production and its impacts and there is a possibility they will not be in a position to protect themselves, what will be done to help this group of people? What will happen to our graves and vegetation I believe pastoralism will change drastically because a lot of land will be required.	**Mr. Philip Abuor** Yes there impacts of the project but the project will ensure that this impacts don't affect the community ,there will be health information system that will monitor new infections Philip informed the community that oil oil production will not have any effect on unborn whatever happened in Korea is a case that happened because of the bomb that was directed to Hiroshima and Nagasaki so those are the effect of the bomb not oil exploration Vibration will be there but it will not cause destruction to trees or cause tremor ,people will be moved a distance of 250m away from operation site The noise will not cause deafness, it will be monitored and report taken to NEMA and also shared with the community. Dust will be controlled by limiting speed of vehicles and nets put in the area of operation

Commentator	Issue/Question/Comments	Response
	How will influx be managed we foresee that many people will migrate and our land will be taken from us. Education should be promoted by the project. We need tittle deeds the government is taking advantage of our land being communal, what show that the land belongs to us if we don't have tittle deeds. Vibration will cause deafness and affect trees	Nobody will do flaring it will only happen in emergency circumstances because the gas will be used to generate power and the rest re injected back to the wells to stabilize All this elements will be monitored and the report shared with relevant stakeholders (NEMA,Turkana county government and the communities There will be continual engagement with communities to sensitize them on the impacts of the project : [redacted]**–Ward administrator** The issue of tittle deeds is the function of the national government and county government. It is a process and the government is working on it so far nine towns have been identified. Land required by the project is 1500ha, nobody will forcefully displace people, representatives from NLC; county government will come for consultation meetings, if your land will be in lapsset project you will be compensated and given award letter, according to our land status which is communal the value of investment on land is what will be paid to the owner but land value will be directed to special account in the county government. He assured them that new immigrants will not grab any ones land, it will be business they will negotiate and buy land from the community members. There should be no fear that influx will cause many people to lose their land. **On the issues of oil production causing some genetic** problems [redacted] informed the community that information given is a lie He told that what [redacted] is referring to was effect of the bomb in Korea that affected subsequent generation and was not the effect of oil production. On benefit sharing [redacted] replied that

Commentator	Issue/Question/Comments	Response
		Five percent is the policy that has been put in place for profit sharing the share of the national government is 75 percent county government is 20 percent while the community gets 5 percent. He informed them that they should not underestimate 5 percent it because it is good resource that will be used for development **Muthoni Koinange** She informed the community that the proponent has been recommended to prepare influx management plan that will cater for the impacts brought about by influx She also added that health information will also be put in place to ensure that new infections are recorded and shared with the county government and NEMA. The proponent has also be requested to do regular monitoring of influx:
[redacted]	He urged the community to be receptive to the project since it the project of the government	Comment was noted
Kaaman [redacted]	We accept the project to continue with its plans ,but we are so much worried about insecurity issues along this corridor We are wondering why the government and our leaders are silent. We also need to be informed of the progress of the project and see how we can work together	[redacted] –Ward administrator [redacted] informed the community that there is an ongoing dialogue between west pokot and Turkana county on insecurity issues. He told them that Security issues are the concerns of the national government and they are there to ensure that peace is restored.
[redacted]	We are very happy that the project has come back Our concern is how benefits will be shared among locals who are directly affected by the operation and those far from operation areas	[redacted] –ward administrator He informed them that policies will be put in place on benefit sharing but the project has not yet started. He also added that displaced people will be compensated.

Commentator	Issue/Question/Comments	Response
	We also request to considered in tenders ,we have companies that have a potential of doing big projects	
[redacted]	We are experiencing new disseases;women and our livestock are miscarrying And you are here lying to us. Continue lying.	[redacted] **administrator** He informed them that the most important thing in life is hope you should not stop hoping for good things. It is wrong to mislead people that our livestock will perish the project will be keen to ensure that the operation does not cause any harm. He encouraged them to be hopeful that when the project starts it will come with benefits, and all this benefits will come to us when the project begins.

[redacted] the ward administrator for Lokichar thanked the community for being attentive and coming in number from kasuroi, lochwaa and other areas to attend the meeting:

[redacted] also appreciated the community members for coming to the meeting and assured them that their concerns will be taken and feed into the final draft

She urged them to be patient as they wait for the report.

The meeting was closed with the word of prayer and people dispersed.

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Location: Nakukulas

TIME: 10:36HRS – 15:00HRS

DATE: 2/8/2021

ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor - EcoScience
- Grace Lotoom - Golder

Supporting Team Members

- [redacted], Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted] – National Land Commission
- Bethwel Sang – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Emase Lodungo – Africa Oil
- Lochaman Emoit Wilfred – Africa oil
- [redacted] -assistant chief Nakukulas
- [redacted]-officer commanding station of Lokwamosing

Observations

- The youths were very annoyed and did not want the meeting to continue unless their previous concerns raised during disclosure were answered
- The mood of the meeting was not good in the beginning but ended up well after the intervention of Mr. Bethwel sang and Director [redacted]

- Questions section was dominated by youths mostly on employment and waste management
- They wanted available opportunities to be divided equally; they cited the current waste consolidation exercise did not consider youths from nakukulas.
- The issue of land acquisition was the major concern, the word gazette in the document brought a lot of controversy they though the word means the land has already been acquired.
- Before the meeting started the chief urged the community members to articulate all their issues of concern including the ongoing waste consolidation exercise.
- Seemingly the community had planned how today meeting should goes because they never wanted the meeting to start without feedback from the previous meeting.

Preliminary

The meeting was called into order by assistant chief [redacted] kochodin location.

Prayer was made by [redacted]

[redacted] invited Mr. Bethwel Sang who acknowledged the presence of the entire team and the community members

Mr. Bethwel went ahead to explain to the community the objective of the meeting and reminded them of the disclosure meeting that was there three weeks ago.

He further reminded them that for the project to start water, land and pipeline will be required

He also explained to the community members the importance of ESIA process and that it is a procedure that needs to be undertaken and handed over to NEMA for approval to enable the project to get a license.

He informed them of the engagements that have been done so far with the county government of Turkana and west Pokot.

He reiterated on what chief said on waste consolidation exercise by telling the community that the issues will be discussed he urged the community to be attentive and give Golder

Associate a good time to go through the key potential impact of the project and later collect view that will enrich ESIA draft.

Youths in Nakukulas were very impatient and wanted the meeting postponed until their previous concerns were addressed.

The community members also wanted refreshments and water to be supplied to the meeting by their traders instead of transporting from Lokichar; that will be a gesture of promoting their businesses.

Bethwel urged the community members to be calm and give room for the team to answer some of the crucial issues they wanted the team to respond to.

After an hour of persuading the youths to calm down Bethwel invited ministry of Petroleum and Mining representative [redacted] to introduce the entire ESIA support team and hand over to Director – Administration, Ministry of Petroleum & Mining (Head of delegation [redacted].

The director requested one of the youths to highlight the issues they wanted to answer first before the consultation meeting begins.

The first four commentators covers the concerns that were raised during disclosure meeting.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentators	Issue/Question/Comments	Response
[redacted]	He complained that this meeting was not mobilized early has been prepared they claim they received information about the meeting yesterday He thought we were coming to answer their previous concerns that we raised during disclosure meeting. He asked why the land is gazetted yet they have not been involved in land acquisition process ,he wanted to know who the county is engaging on matters of land acquisition He wanted issues of land, water education and job opportunities to be answered and submitted in written. He was concerned why they see different stakeholders engaging them on ESIA; He criticized the action of bringing them Sodas and water today yet they have been having a problem of water shortage in Nakukulas They wanted bethwel to explain to them why they are not accessing water in borehole 10 in Nakukulas. He said if issue of land is not settled well they will hire a lawyer to represent them in court He complained the use of the government to threaten them; he also	[redacted] replied to the community that the team was here three weeks ago and the community was aware of the meeting, concerning the issues that were raised earlier in disclosure meeting he assured them that the project has not started and there is no reason of lying to them that those issues will be implemented, he further explained to them that approval of the ESIA is what will determine the project commencement. On ESIA engagement he clarified to them of involvement of the government who is the owner of the project, Africa oil and Tullow were doing disclosure and ESIA consultation is done by Golder an independent consultant.

Commentators	Issue/Question/Comments	Response
	said that they accepted to die, in Libya people advocated for their land issue some died and some were spared.	
[redacted]	[redacted] alleges that [redacted] who is the director Administration ,ministry of petroleum and mining has been monitoring the wells without involving the people of Nakukulas He requested the community to be involved, he added that employment opportunities of the people of Nakukulas have been interfered by [redacted] security patrol officer and Bethwel sang. He also asked why they are not getting water from borehole 10. The land in the draft is gazetted, this shows that the land has already been acquired. He also commented that they are tired of this consultation meeting since whatever is shared is never implemented. He also added that he has observed in today's meeting lokichar people have been given tender to supply; sodas, water and seats have also been transported from Lokichar.	**Replies by** [redacted] informed the youth who were requesting for Minister for Petroleum and Mining [redacted] to come and address them in person on matters pertaining POK that his office is here to represent him He informed the community that the project has not yet started, the first project was early oil pilot scheme .it was a trial and it informed the country that oil is viable and production is possible He told them to succeed in the project we need to know if the oil is sufficient for business and how it can be transported. Previously the project used to transport 2000 barrels a day and that took one hundred and twenty days without filling the capacity of the boat The big task ahead now for the project is consultation with the communities on requirement needed by the project He informed the community that constitutionally 6 feet up in any land in

Commentators	Issue/Question/Comments	Response
	He also said that they were not informed of the current waste consolidation exercise jobs He urged the team to promote their traders too in such meetings.	Kenya belongs to the occupant beyond 6 Feets is the government property. He told the community that before the project starts the government will ensure that environment ;health and safety of the people is put into consideration, the county government and the national sat down and came up with risk matrix; this procedure is constitutional and must be followed ESIA process will explain the potential impacts of the project and its mitigation measures. The process should be done by an independent consultant **Land acquisition** Land gazetment is one of the procedure in land acquisition it does not imply that land has already been acquired. He welcomed [redacted] who is a representative of National lands commission to clarify the issue of land raised / [redacted] **–national land commission** [redacted] explained to the community three categories of land Public land ,private and communal land ,he explained to them further

Commentators	Issue/Question/Comments	Response
		that Turkana land is communal therefore it is not registered He reminded them of the organizations that have been going round sensitizing the communities about land registration in Turkana and how that process can be fast-tracked. He encouraged the youths who were present to go and read land 2012 lands acts sec 8 on the procedure of land acquisition in Kenya. He informed them that in an event that the project wants to acquire land in a certain community where land is communal they will gazette land first a procedure that is different from private land. For communal land compensation is done to the county which is the custodian of land; the money is paid to the special account and paid to individual upon registration of land, he notified the community that any investment done on the land will be compensated to the owner of the Land. He told them that it is the ministry of lands in the national government that will issue tittle deeds He also told them gazzetment of land is to notify the people where the project will be located.

Commentators	Issue/Question/Comments	Response
		Upon gazette notice the government will come to consult will the community to seek their consent. NLC has agreed with the county government that when they will be consulting with the community on matters of Land they will be engaging communities together. He requested them community to be patient and wait for the time when the government will come and consult with them on matters of land **Bethwel sang replies on water issue** On water problem, he told the community that the pipes used to take water to kodekode tank are old and breaks at several point, we considered using the borehole in lokichada to pump water to kodekode tank; so that this borehole in Nakukulas can pump water to the school and the health facility as we consider replacing the pipes. He explained to them that no one had denied them a right of using Nakukulas borehole. He promised them to ensure that repair has been done and water availability restored.
[redacted]	She urged the team never to get used with them because they have closed	Comment noted

Commentators	Issue/Question/Comments	Response
	their businesses purposely to come and listen to the meeting and their expectation was that their previous questions will be answered. [redacted] was requesting for an opportunity for them to prepare food in such meetings instead of promoting black gold alone It is not fair that you are coming to us with a new content with new stakeholder. She added that they expect that water shortage should be addressed	The issue of water was exhaustively answered by Mr. .bethwel Sang.
	[redacted]wanted to know who is in charge of land is or who holds their land in trust in the national government? because they know who is the custodian of their land in county He is requesting both the national and county government officials and the minister of the ministry of petroleum and mining to come and have dialogue with them. He was asking why their land was gazetted without their knowledge and consent. He is requesting land representative to come and discus with them further on land issues	[redacted] informed the community members that consultation started with members of the parliament ,civil society and trickled down to the county government He told them that their leaders are aware of this consultation meetings. On matters of land acquisition National lands commission representative had explained to the community that it's the county government that holds community land in trust, it is the custodian for now till registration is done. NLC representative had also informed them earlier that today's activity is different

Commentators	Issue/Question/Comments	Response
	He is requesting the project to benefit the community largely because the community is not farming.	when the time of land consultation comes NLC ,ministry of lands in the county government will come to discuss more on land ,he clarified that to gazette land is to give a notice of required land .
[redacted]	He asked when the project will start He also asked the criteria that was used to award TAI company a tender for transportation of waste He alleges that it was a normal truck yet the waste being transported is hazardous We are seeing some ongoing work yet you are telling us that the project has not yet started is this not a lie? He also added that we are saying NEMA is an independent body but who gives them a mandate to work? Maclevis informed the team that there are some things they will agree with but some they will not yet when they disagree and protest they are arrested. We are requesting TAI to be stopped from transporting waste.	**Bethwel replies on waste consolidation** He informed them that they had earlier engaged Environmental and combustion consultant limited but they delayed to do the work ,and because they failed to start the work they had to look for another option ,the county government during their monitoring had a concern why waste was not consolidated ,we gave them a report of what happed He informed them that they approached TAI and they accepted the offer ,but there were conditions they were supposed to meet as per NEMA procedure ;their trucks were inspected by NEMA and they started the exercise On 23rd it true some waste dropped from the truck ,he told them that was an accident that was not intended to happen, the waste was later picked and the place was cleaned He encouraged them to report such happening immediately:

Commentators	Issue/Question/Comments	Response
		On water problem, he told them that the pipes used to supply water to kodekode tank are old and breaks at several point, he to them that they considered using the borehole in lokichada to pump water to kodekode tank so that this borehole in Nakukulas can pump water to the school and the health facility. He answered them that they were not denied a right of using Nakukulas borehole. He promised them to ensure that repair has been done and water availability restored
[redacted]	[redacted] alleges that all the commitments we are explaining to them is a lie He wanted to know where the dust referred to in the ESIA draft emanates from. He claims that drivers who were earlier employed by Tullow were rude and were not able to implement the stated speed limit He gave a scenario where he was knocked down by a project vehicle in Ngamia and no one bothered about that He also claimed that in the previous project waste water from Ngamia was dumped in the lagas without caring	**Mr. Philip** clarified to the community that the dust emanates from construction and operation sites, the mitigation measures that have been put in place such us use of nets, reduced speed limit for vehicles and regular monitoring will ensure that dust emission is minimized and the data collected does not go beyond the data collected during baseline. **Mr. Bethwel sang** clarified the issues of waste water to the community by making it clear that waste water was never discharged to the lagas and other water sources

Commentators	Issue/Question/Comments	Response
	that it will pollute other water sources and in Kalapata He was concerned about feedback because previous meeting never gave them feedback He had meeting in Naivasha together with civil society. He alleges that the birds displayed in a poster are not from Turkana; this photos have been taken from another place, he wished that they would have been told about camels, goats; sheep and cows. They claimed that they cannot sell those birds to take our children to school He talked about the effect of the bright lights that were put around the wells that once affected their camel and caused livestock to stumble in the mesh wire He repeated on the independence of Golder, He said that if that is the case golder would have come alone without the rest of the team that is not independence He requested the arms of the government to work together to ensure peace is restored back between in the community.	On the issue of feedback he ensured them that has been noted and will be taken serious **Mr. Philip** informed the community that baseline was done on the highlighted aspect of environment and what has been documented is From Turkana; he explained to them that birds also play a role in the eco system; the fact that other category of livestock have not been documented does not mean that they are not of any importance; he informed them that it is important to protect such birds for future generations to behold. [redacted]**officer commanding station-Lokwamosing** [redacted] assured the community of Nakukulas that government is working tirelessly to ensure that peace is restored back between the two warring communities He informed them of the current meeting that was held in Laikipia brought together governors from pastoral communities; the meeting was to chat forward strategies of

Commentators	Issue/Question/Comments	Response
		ensuring that pastoral community coexist in harmony . [redacted] also told the youths that peace start with them.
[redacted]	A according to the first report you said flaring will not affect people but we know effects will be there ;we propose that instead of wasting the gas to be used to generate power or sold to people. He said that the meeting has come the right time when waste consolidation exercise is taking place I have a concern on 23/7/2021 TAI truck was transporting waste on the way some of the waste fell along the road when we raised alarm we were chased by the police don't you think this waste is hazardous? He asked if there is anyone monitoring this exercise of waste consolidation. [redacted] claims that ECCL was handling waste well they don't trust the work that TAI is doing and feel that the entire exercise is compromised He asked how waste water will be managed (he had confused waste water with silicate He suggested water to be recycled	Comment noted **Mr. Philip replies** There will be no flaring ,and if it happens it will occur during emergency, gas will be re- injected back to the wells to stabilize wells and the rest will be used to generate power; there will be a technology that will be used to ensure that gases are not emitted. The mitigation is incorporated in the design of the project. There will be regular monitoring of this as well and data shared with NEMA, county government and the community.

Commentators	Issue/Question/Comments	Response
	He also wanted to know the measures that have been put in place to prevent landslide that might be caused by vibration.	
[redacted]	He refutes that the species of birds shown there are not from Turkana He is requesting to know mitigation measures put In place to prevent effects of vibration during drilling process. He was asking how the livelihoods of the people will be improved He also added that the community has failed to distinguish between the stakeholders; the community is confused and has failed to know who is telling the truth. He also wanted to know about job opportunities that will be available and requested the community to be given the jobs they are capable to do. Some of the problems we are having are legacy issues which were not implemented previously. Ensure people have benefited from job opportunities.	**Muthoni** had earlier explained to them that there will be a national and local content policy that will cater for issues of employment to ensure equitable distribution of benefits and inclusion of all categories of people Comment on jobs and other opportunities was noted because they were told this issues will be tackled when the project starts.
[redacted]	He wanted to know the status of the project and also how employments are distributed He claimed that KK the security firm are the ones doing cleaning and bush	Comment noted.

Commentators	Issue/Question/Comments	Response
	clearing in well pads is that really accepted There is no equal distribution of opportunities between T.east and South. He claimed that there was Eldoret agreement that sated 50 percent benefit sharing	

Stakeholder Engagement: ESIA consultation meetings
Location: Loperot -Kalapata
Time: 11:18HRS – 14:18hrs
Date: 3/8/2021
ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor – Eco-Science
- Grace Lotoom - Golder

Supporting Team Members

- [redacted], Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted] – National Land Commission
- Bethwel Sang – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Emase Lodungo – Africa Oil
- Lochaman Emoit Wilfred – Africa oil
- Assistant chief: [redacted]

Preliminary
The meeting was called to order by [redacted]

[redacted] welcomed [redacted] who opened the meeting will a word of prayer

After prayer chief welcomed Mr. Bethwel sang who appreciated the community for turning up for the meeting; Mr. sang also acknowledged the presence of the entire ESIA team

Mr. Bethwel proceeded to remind the community members of ESIA disclosure meeting that took place three weeks ago and gave recap of project overview

Mr. Bethwel explained to the community the purpose of the meeting and its significance to the project

He also went further to inform the community about the status of the project and the requirement needed for the project to begin.

He highlighted that water, land and pipeline are the major requirement needed to enable the project to commence ,he reminded them that ESIA consultation is very because the communities will be engaged and taken through the key potential impacts of the project to the social and environmental aspect of the environment and recommended mitigation measures; he informed them that they will be required to make their contributions and concerns that will feed into the final draft that will be Handed over to NEMA and finally for approval or amendment ,Mr. Sang encouraged the community members to be attentive and involved in the process:

After that session with the community Mr. Sang invited [redacted] from the ministry of petroleum and Mining to introduce the entire ESIA support team from KJV and MoPM

[redacted] introduced Golder associate team as well and handed over the program to them to take the community through the anticipated potential impact of the project and recommended mitigation measures;

Philip Abuor from explained to the community the key potential impact of the project to the environment and mitigation measures while Muthoni koinange Explained the potential impact of the project to the social aspect of the community.

Questions and answers session was moderated by Muthoni Koinange.

Table 1: Identified Issues, Questions, Comments and Responses

Commentator	Issue/Question/Comments	Response
[redacted]	What distance will the community members living near the operation area be moved? Will the nets that are used in operation sites to reduce dust be used in our homesteads too? Will this key commitments be implemented? During EOPS some of these commitments were not implemented, waste was not managed well and littering was done all over. How will the project help us to restore our land that has been affected by the project, she cited a scenario during EOPS whereby trees nursery was established and it was not sustained by the project, casual laborers were employed for six months and after that period they were left to take of the tree nursery on their own; [redacted] requested the project to research on the effect of flaring on women, she claimed that since the beginning of EOPS women around the oil fields started experiencing more complication on child birth.	**Philip Abuor** Mr. Abuor replied to [redacted] that people will be moved 250m from the fence line he also added that netting will be at the construction sites not at the receptors. Other suggested mitigation measures will be reducing speed limit of vehicles, erection of bumps and sprinkling water; he however noted that water sprinkling is a bit challenging because water is a scarce commodity in the area since there will be competition of water between the communities and the project On waste management, he reiterated that the observation has been noted and the proponent will be advised and recommended to use international standards that are acceptable because waste management is a good practice.

Commentator	Issue/Question/Comments	Response
		He also replied that there will be no foul smell emanating from the wells because the technology that has been incorporated in the design will not emit gases. The gases will be utilized in the project by re injecting it back into the wells to stabilize the well and also to generate power. **Mr. Philip** also added that in the ESIA draft the proponent has be recommended to replant trees of the same species in case of destruction of any during construction and operation
[redacted]	[redacted] appreciated all the presentation but he said he was not sure if the commitments will be implemented by the contractor He was also concerned about the water provision method that was earlier done by Tullow, he pointed out that the method of water tinkering was not a sustainable way of water supply; He recommended that in future sustainable ways of water supply should be sort:	**Mutnoni Koinange on implementation of key commitments:** Muthoni assured the community that the key commitments should be followed by the proponent because the draft is a legal document that will be handed to NEMA for approval. The county government and community members will access the document; in an event that the mitigation measures are not followed the community or anybody has a

Commentator	Issue/Question/Comments	Response
	[redacted] advised that benefits that come along with the project should be distributed equitably and fairly among communities. He advised that kalapata has good vegetation that should be preserved and protected for future generation. He requested a tree nursery to be established in order to replenish and the destroyed trees. Adding to the list of his request he also pointed out that more water pans and health facilities should be established in Kalapata.	right to sue the proponent because the process has conditions that must be followed. His recommendation were noted but Sang reminded them that the projected has not yet started; ESIA consultation is a crucial process of seeking to get a license and approval for the project. He informed the community that the license will enable the contractor to implement operation and construction work To performance of key commitments Mr. sang added there will be annual audit by NEMA to ensure compliance by the contractor. In development initiatives Mr. Sang pointed out that community development is the mandate of the national and county government,there are also ways people have been benefiting from non-governmental organizations such as red cross, if there will be development initiatives the project will discuss with the county government which will recommend development needed based on the need of communities. On tree planting projected Mr. Sang replied that the agreement was that the project will start the project and thereafter leave the community to continue with it.

Commentator	Issue/Question/Comments	Response
		He encouraged the community members to own the projects for sustainability.
[redacted]	[redacted] said that he thought water for the project will be derived from Turkana. He pointed out the community has waited for 5 Percent oil benefit in vain. [redacted] was also concerned that the pipeline may affect their grazing areas and the foul smell from oil fields will affect the community.	Mr. sang clarified to the community that the choice to derive water from Turkwel dam was reached after exploring many options; the choice was cheap and proximity to the project made it to viable and suitable source. Mr. Philip explained to the community that the land uptake for the project will be 1500 ha and will not occupy the entire pastoral land; the impact will be short term and will only be felt during the pipeline construction, after construction normal activities will be carried out on land except construction Mr. Sang had also explained the same to the community. He also discouraged the communities to vandalize project utilities around the oil fields which were later reported after the closure of the project.
[redacted]	[redacted] complained that the previous project did not benefit them ,they saw development in Nakukulas, Lokichar and other places	The comment was noted.

Commentator	Issue/Question/Comments	Response
	She requested development initiatives on social amenities like health centers and schools in case the project starts.	
[redacted]	[redacted] was concerned that the project will cause depletion of pasture and grazing Land She also asked in case of oil spillage what will happen.	**Mr Philip** explained to the community that oil will no longer be transported using trucks as witnessed in EOPS the mitigation measures has been incorporated in the design that in an event of any leakage it will be detected and correction done quickly. The issue of pasture depletion was earlier answered by Philip.
[redacted]	[redacted] pointed out that during EOPS there were inequalities in employment that created conflict among members of one community. She cited a scenario where a person from another village is employed as road marshal of another village yet people from that village have not been employed.	The comment was noted.

Action Item
The ESIA consultation materials were handed over to the assistant chief [redacted] and youth representative [redacted]
Summary
The summary was done by [redacted], applauded the community for turning up for the meeting and informed them that this is the government project and the government serves all citizens.
He explained to the community that the project will not start unless some important procedures and requirements are followed; he pointed out to them that the process of ESIA is one of the procedure that must be done to help the project secure a license to start the project.
He also told them that the concerns raised by the community will feed into full field development plan.
He notified the community that the national and county government came up with risk management plan that will ensure health safety and security of the people he assured them that the government is so much keen to implement the project differently.
He notified them that Tullow is still there working with other joint ventures; on benefit sharing he explained to them that sharing will be 75 Percent for the national government, 25 percent county government and 5 percent for communities in the well fields; the community share is what will be used for development and this will happen when the project starts not now.
Having no other business the meeting was adjourned with a word of prayer from [redacted].

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Location: Loperot -Kalapata

TIME: 11:40AMHRS – 16:21AMHRS

DATE: 4/8/2021

Senior chief: Lydia Napeyok

ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor – Ecoscience
- Grace Lotoom - Golder

Supporting Team Members

- [redacted], Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted]- Ministry of Petroleum & Mining
- [redacted] – National Land Commission
- Bethwel Sang – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Emase Lodungo – Africa Oil
- Lochaman Emoit Wilfred – Africa oil

Government and county officials

- [redacted] –Deputy county commissioner
- [redacted] –Assistant police commander
- [redacted]-Deputy sub county administrator
- In attendance also was [redacted]–Diocese of Lodwar
- [redacted] environmental resource management representative

Observations

- The meeting was attended by the chiefs from some sub location in Lokori location
- Different categories of groups were in attendance; women representative, PLWD; Drivers, youth, religious, elders, professionals and civil society.
- Community members came from various sub locations to attend the meeting
- The concerns of the community centered on employment, business opportunities and land.
- Some people was so much concerned with feedback of the previous meeting.

Preliminary

The meeting was called to order by [redacted]

She then welcomed to pray [redacted] a word of prayer

Chief invited deputy county commissioner [redacted] who acknowledged the presence of government officials, entire ESIA team and community members and civil society present in the meeting.

He went further to introduce representatives of various groups that were in attendance and explained to them the objective of the meeting and the progress so far

The DCC informed the community members that the members of parliament were earlier taken through the consultation meeting in Nairobi.

The DCC encouraged the community to be keen and stick to the question that pertaining the ESIA discussion, he notified them that the issue of land and water will be discussed later.

For more clarification on land matters he informed them that National Land commission representative is present for them to engage.

After that session the DCC invited [redacted] who acknowledged the presence of all the participants and went further to introduce ESIA team and ESIA support team present.

After introducing the team [redacted] went further to give a brief history of oil exploration which started way in 1940 to 2010;

He also briefed the participants on the status of the project and why the project was on hold for some time, he informed them that the project was affected by heavy rains which affected the projected and later by global COVID 19 pandemic, he notified the participants that there is no project at present.

He added that for the project to begin there are some procedures that are required and one of it is ESIA consultation; the process will help the project to secure a working license.

He further added that the process is mandatory and has been prepared according to international standards, the document has highlighted the potential impact of the project and recommended mitigation measures that must be followed by the proponent.

He later invited Muthoni Koinange from Golder who clarified to the participants that Golder is an independent consultant and totally different from NEMA.

Muthoni did a brief recap of project overview and asked the participants if the they aware of number of the oil fields that will be used during operation, the community members mentioned the six well fields, Muthoni went further to inform them there will 2400 employment opportunities.

Munthoni Koinange gave a brief history of Golder work since 2015 to present.

She informed the participants the stakeholders we have engaged so far from National level to county level.

After giving her explanations she invited Philip Abuor to take the community through the potential impacts of the projects to the environmental aspect of the community and mitigation measures that have been recommended.

Before presentation Philip gave a brief summary of the baseline that was collected and the place where the samples were derived from, he informed them the importance of baseline because it will inform of any change during operation and construction

He did a presentation on air quality, water quality and quantity, noise and vibration, dust; biodiversity, ecology and protected areas, soil terrain geology and seismicity, landscape and visual

He further informed them that baseline was done according international laws and standard procedures and in accordance to the law of Kenya.

Philip in turn invited Muthoni Koinange who took the participants through the potential impact of the project to the social aspect of the environment: social, cultural heritage, demography, physical and social infrastructure, economics and employment, land and livelihoods and community health, safety and security

To make clarification on land matters Muthoni Invited [redacted] from National lands commission to talk to the participants.

[redacted] informed the participant that NLC cover matters on public land, both national and county government occupies public land most of it is occupied by institutions and natural resources, [redacted] notified the participants that the first time he came to Lokori is when the county government and national government had disagreed on gazettement of land that was meant for lappset project.

He educated the public that if the government has identified a piece of land for the government project, the government will write a letter to National Lands Commission and because the project will benefit the community the interest of the public will supersedes the interest of an individual the land, NLC will then give a gazette notice to notify the public land required for the project, to gazette doesn't mean that land has already been acquired it is a notification.

[redacted] went further to clarify that community land unregistered and is held in Trust by the county government and when consultation with the community will be done NLC,county government and national ministry of lands will be involved:

After National lands presentation Muthoni opened the meeting for question and answers session.

Table 1: Identified Issues, Questions, Comments and Responses

Commentators	Issue/Question/Comments	Response
[redacted]	His concern is on the health and safety of the people in the operation area He is concerned about air pollution that might affect people especially pregnant mothers during operation, he asked who will cater for the bills?	**Mr Kambos reply on effect of** operation on pregnant women: He told them that according to studies flaring does cause complications to pregnant women: He told them that the ESIA document prepared will factor in all the policies that will ensure health and safety of the people in the operation area He also added that health and information will be put in place to monitor new infections, he reiterated that it is the mandate of the government to ensure that health of the people is taken care of. Philip also replied that the baseline on air quality that was done was good except dust, the proponent has been advised to minimize dust through various ways during construction and operation such as reducing the speed limit, using nets in operation sites and water sprinkling.

Commentators	Issue/Question/Comments	Response
		He also notified them that flaring will not be done, mitigation measures have been incorporated in the design known as front end engineering no gas will be emitted it will be utilized in wells to generate power and to stabilize wells. Flaring will only happen in emergency.
	He noted during EOPS Turkana east was so much sidelined in development; if the well are in Turkana east why should the operation such as offices be brought to Lokori.	The comment was noted

	He also complained that Nakukulas is a small center in Turkana East but it has been considered in so many development than Lokori ; He also noted that in the project overview more Turkana south well are in the project does it mean that project work will base in those well? He also requested to know if 190 wells pads in Amosing are covering the wells that were discovered in Lokori.	The comment was noted .

Commentators	Issue/Question/Comments	Response
[redacted] [redacted] Member of Turkana East professional association.	[redacted] was concerned about the concerns they raised during disclosure, he said he thought it is the same team that has come to give them feedback.	[redacted] He had earlier told them that the project has not yet started ,what the project is seeking is the approval of the document that will enable the project get a license of work . All the concerns raised in this meeting will feed into full field development plan. .
	He also noted that the ESIA document is about technical things that needs to be interrogated by professionals it's unfortunate that most of the professionals are absent.	**Philip Abuor** On the interrogation of the draft he informed them that there is still more time as the consultation process is ongoing and the Draft ESIA report will be posted on the MoPM/NEMA for public review and comments
	[redacted] went further to inform the NLC representative that Turkana East community did not refuse to give land to lappset project, he said such consultation meetings were not done with the community for them to capture clear information compensation ,land registration ,tittle deeds and resettlement of displaced people . He requested the	Comment noted

Commentators	Issue/Question/Comments	Response
	NLC representative to came and clarify such issues to them in future.	
	He also wanted to visualize if where 1500 ha will be in Lokichar alone on in well pads as well [redacted] also wanted to know if the water pipeline will benefit Lokori community and where will the off - take points be	**Philip Abuor On land uptake** Philip referred [redacted] to the banner with project description and the components/area of influence. The land required for the entire project will be 1500ha inclusive of the well pads, flowlines, central processing facility/area and other associated facilities. The issue the water pipeline and its benefits was referred to the proponent.

Commentators	Issue/Question/Comments	Response
	He alleges that Golder are lying about noise pollution, he claims that they probably mapped area and generalized that data.	**Abuor replies on noise** He informed the community that Golder team had actually done noise measurements/assessments since 2016 and has primary data on the same. The contractor is advised to ensure the noise produced during construction and operation does not exceed the baseline data and the project standards. If it exceed NEMA,county government and the communities around the area of influence will be notified. He further explained that there will be regular monitoring and annual audit as per the Noise Regulations. He referred the participants to page 12 of the presentation manual; he educated the participants on the meaning of major, minor, residual and negligible impacts; he informed them that residual impacts are those impacts that remain following the implementation of mitigation measures.

Commentators	Issue/Question/Comments	Response
		.
[redacted] [redacted]	[redacted] alleges that some areas in Turkana east have been sidelined in engagement such as kapedo and katilia he referred to pg. 12 of the draft which contains a stakeholders list	
	He also noted that a lot of land will be required in the project especially CPF and there are people living in the operation areas what will happen to such people. Which plans are there for compensation?	[redacted] He informed them that people will be compensated, he explained to them that Turkana in Turkana is community land this implies that it is not registered ,this means payment of land will be paid to the county government which is the custodian of the land and improvement value will be paid to the owner of the land ;

Commentators	Issue/Question/Comments	Response
		Land value will be repaid back to the owner upon registration of land. There is another law that will be used in land payment land value index this dictates that every area has different land value ,payment will be based on land value index in Turkana The material used in construction will also determine payment, an individual will negotiate where they want to be to be resettled. He further explained to the community that there nine urban centers in Turkana where spatial planning has been done and Lodwar is among those towns, there is piloting of tittle deeds for private land in Lodwar He further added that on land registration it's the county government and communities to make a decision and fast-track the process. [redacted] also told the community that there will be a tribunal which will be formed to come and listen to the affected people and start the process of compensation.

Commentators	Issue/Question/Comments	Response
	He also claimed that there were some people who came to the community and drew a sketch of lappset map, he complained that there has been no consistency in lappset map. He requested nyumba Kumi chairperson where lappset will pass through	[redacted] told the participants that he is not in a position to tell them where lappset passes through because it will bring a lot of conflict. But he assured them that the displaced will be compensated.
[redacted] [redacted] chairperson PLWD	[redacted] is the chairperson of the people living with disability much of his concern is on inclusion of the people abled different to benefit from the project	Comment noted
	He was also asking if allowance should be given to participants owing to the fact that people come from	[redacted] –DCC later explained to the participants that this meeting is of great importance to the community, he also informed them that the government officials present have not been given allowance.

Commentators	Issue/Question/Comments	Response
	He requested the project to relocate Project oil Kenya offices to Lokori for the road networks to be improved and security enhanced.	Comment noted
	[redacted] also requested the project to extend water off-take points to Lokori so that people may benefit from it ;	Mr Kambo had earlier informed the participants that water pipeline has a different ESIA and question touching on water will be answered then.
[redacted]	[redacted] is concerned about the trees which will be destroyed away from people residents, she noted in the presentation that trees will be re-planted her question who will take of trees that are replanted a far off from peoples residents ?	**Philip Abuor** He informed the participants that biodiversity expert will be employed during construction and operation to monitor whether the commitments have been implemented or not and if not done to advice the contractor to be compliant; He added that the government will also do monitoring to ensure compliance
[redacted] Diocese of Lodwar	[redacted] informed the participants that they are teaching the community to embrace the project and the way the community can benefit	Comment noted

Commentators	Issue/Question/Comments	Response
	They have also informed the community the right way to negotiate for their benefits	Comment noted
	He however discredits the part of ESIA that refers that the impact on grazing land will be moderate yet the land for project uptake is 1500ha. Does it mean that grazing land and forests will not be affected?	**Philip replied** that there will be temporary impacts on grazing land that will only be felt during construction, land access will be limited during construction. The pipeline will be underground other activities such as grazing will continue as usual.
	He alleges that the report is open, it has not informed people land reclamation mechanism that will be used. He points out that the reports says that 924 wells will be drilled does it mean that livelihoods of people in this areas will not be affected? Referring to impacts as minor and residual means that there are no impacts	He also reminded the participants that trees of the same species will be re planted He also added that NEMA process is seeking for people concerns and contribution from other professionals that will enrich the report Philip went further to explain that residual and minor refers to results after mitigation measures are done. He added that there will be regular monitoring of the impacts and the report will always be shared with NEMA, TCG and communities living in the area of operation.

Commentators	Issue/Question/Comments	Response
	On stakeholder engagement he alleges that the process has been biased he points out that Diocese of Lodwar ;international alert: friends of lake Turkana ,Oxfam and national alliance were not involved [redacted] recommends that problems should be identified earlier	Muthoni Koinange replied that some civil society groups were engaged in Nairobi OXFAM, National lands alliance international alert., Friends of LakeTurkana was engaged in Lodwar; [redacted] also added that civil society were invited for a meeting in Lodwar but they never turned up ;he also cited a scenario in Lodwar where civil society walked out of the meeting during ESIA disclosure .
	He also wanted to know what will happen if the contractor does not implement the mitigation measures that have been recommended: [redacted] pointed out that the report has not detailed the response in case of oil spillage He lauded the report that potential impacts and mitigation measures have been covered wells.	Philip replies that if the contractor does not implement the mitigation measures Anyone will have a right to sue the proponent because ESIA draft is a legal document that acts as a guide. Philip also informed the participants that in case of oil spillage there is an emergency response plan on how to mitigate such impacts ,he also added that the oil in Turkana is waxy and mitigation measures have been incorporated in

Commentators	Issue/Question/Comments	Response
		the design in case of any spillage it will be detected .
[redacted] [redacted]	[redacted] complained that the stakeholder list is not sufficient for engagement because some stakeholders are missing.	Muthoni replied to [redacted] He informed him that there is always protocol to be followed in drafting invitation; letters are always written to relevant ministries through the county government then the departments decides on the people they will sent for consultation meetings .
	He wanted to know the role of youth officer; gender officers in matters of employment.	
	He recommended that during stakeholder mapping, the project should include some stakeholders who are invisible but are important in engagement.	Comment noted

Commentators	Issue/Question/Comments	Response
[redacted] [redacted] chairperson morulem cooperative	[redacted] says that according to his observation the project has not considered farmers in the project ,he is requesting the project to support farmers by giving them grants	Comment noted
	He alleges that during seismic operation there are places where seismic lines passed through in their farms and that has affected farming , germination has never been experienced since then	

Action item

Consultation materials were handed over to Turkana east professional representative – [redacted] and DCC [redacted]

SUMMARY

- [redacted] appreciated all the participants for turning up for the meeting
- He reiterated to [redacted] concerns on exclusion of some stakeholders, he informed him that when civil society were called for the meeting in Nairobi they turned up but when civil society in Lodwar were called only [redacted] from Friends of Lake Turkana attended the meeting the rest walked out of the meeting.
- The MCAs also attended the meeting partially
- He informed the community members that to gazette land does not mean that land has already been acquired it is to notify the public of the land required for the project.
- He assured them that the project will not start unless all the requirements are met, he further added that their concerns will be in cooperated in field development plan.
- [redacted] welcomed [redacted] –DCC who thanked [redacted] for his valid contributions and promised to invite him to land forums, he further advised the project to be very keen in distributing business and employment opportunities between Turkana south and east.
- He also informed the team that Lokori is divided into Kochodin and Nakukulas the project should not be biased and incline so much on one location.
- Having no other business the meeting was ended at 16:21 with a word of prayer from [redacted]

ESIA CONSULTATION MINUTES

Stakeholder Engagement: Esia consultation meetings

Location: Kaputir

TIME: 10:07 AM-13:34hrs

DATE: 5/8/2021

Team Participants

- Muthoni Koinange –Golder
- Philip Abuor-Eco-science
- Grace Lotoom-Golder

ESIA SUPPORT TEAM

- Bethwel Sang -Tullow
- Linda Were –Africa oil
- James Kambo-Africa oil
- Ann Wanjiru- Africa oil
- Emase Lodungo –Africa Oil
- Lochaman Emoit Wilfred –Africa oil
- [redacted]- Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted]-Ministry of Petroleum and Mining
- [redacted]- Ministry of Petroleum and Mining
- [redacted] –National Lands Commission
- [redacted] –Environnemental Resource management

LOCATION CHIEFS

- [redacted]-Senior chief Kaputir Location
- [redacted]-Assistant Chief Nakwamoru
- [redacted]-Lorogon Sub-Location

OBSERVATIONS

- The community members attending the meeting were from Nakwamoru and kaputir Location

- Chiefs from the three sub-locations of Kaaputir were in attendance
- [redacted] appreciated the team for considering Lorogon in Stakeholders engagement.
- More of discussions and community concerns were centered on watepipeline, land, jobs and employment opportunities.

Preliminary:

The meeting was called to order by senior chief [redacted].

The meeting was also opened with a word of prayer from [redacted].

The chief acknowledged the presence of the team and community members and later introduced his assistants' chiefs from Lorogon sublocation and Nakwamoru.

After introducing assistants chief; [redacted] invited Mr Bethwel sang From KJV to continue with the program of the day.

Mr Bethwel sang acknowledged the presence of the entire team and went ahead with a recap of disclosure meeting.

Mr Bethwel reminded the community of the requirement needed for the project to start: land, water, and pipeline.

He also added that the project requires a licence and to obtain that the ESIA draft has to be approved.

Mr Bethwel further informed the community that ESIA for water pipeline will be different and on matters of land there will be further consultation with National land commission before land is acquired:

Mr Bethwel informed the community that Golder associates is an independent consultant that has come to take the community through the potential impact of the project and get concerns and feedback that will help enrich the document:

Mr Bethwel invited [redacted] from the ministry of petroleum and mining to introduce the entire ESIA consultation team: MoPM, KJV, Eco-science and golder associate

After introducing the team [redacted] invited Linda Were to take the community through project overview.

After taking the community project overview Linda Were welcomed Muthoni Koinange from Golder Associate to continue with the program.

Muthoni Koinange introduced ESIA team from Golder and went ahead to give a brief history of Golders work since 2015;she later welcomed Philip Abuor to take the community through the project impacts on environmental aspect of the community and later handed over to Muthoni Koinange to facilitate social impacts of the project

Question and answer section was moderated by Muthoni Koinange.

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted]	[redacted] was so much concerned of the graves and sacred places, as much as the projected will try as much as possible to do micro alignment he is very sure that some people will be displaced He wanted to know if there will compensation for the people who will be affected by the water pipeline	**Muthoni Replies** On graves and sacred places and trees she informed them that if the livelihoods of people are affected, there is a provision in law that states compensation, National lands commission is better placed to explain that during consultation meeting with the communities.
	He recommended the project to allow the community to come up with a local committee that will help in recruitment of the unskilled labourers as the contractor recruits the skilled personnel	Comment noted
[redacted] **-women representative**	[redacted] argued that there is no way that all the graves will be micro aligned there is a possibility of some households will be affected during construction, trees will be destroyed and also graves will be affected	Philip replies He explained to the community that this is a transient community, there will be temporary impacts on people during pipeline construction after that normal activities will continue, and compensation of the displaced will be based in international standards, performance

Commentator	Issue/Question/Comments	Response
	How will the affected household be compensated	standard number 5 which states that there will be no involuntary resettlement.
	[redacted] sort a clarification on 2400 employment opportunities that were mentioned earlier if they are opportunities for kaputir alone or the entire country	**Mr Bethwel replies** He explained to the that this number covers entire projects, all jobs ranging from skilled ,semi-skilled and unskilled in entire country, he further notified them that there will be a national and local content policy that will help to maximise the impacts of jobs locally and nationally Employment will be done in consultation with the community and in a more transparent way.
	She was concerned that Lokichar had earlier benefited from the project than kaputir, she requested the project to be keen in considering their location as well in business opportunities and employment She was more concerned about employment opportunities for youths	The comment was noted Mr Bethwel had earlier explained exhaustively how business opportunities and employment will be distributed

Commentator	Issue/Question/Comments	Response
	She repeated that there should be a local committee which will help in recruitment of unskilled workers	Comment noted
[redacted]	[redacted] was seeking to know if the workers will be insured just in case of any accident or sickness or death in the course of project work	**Muthoni replies** On accidents the proponent will develop emergency plan and procedure that will handle such cases.
	He still insisted in formation of local committee to assist in local employment of unskilled personnel	Comment noted
[redacted], **Representing Professionals Association**	[redacted] was so eager to get feedback of the memorandum that was submitted to POK During the ESIA disclosure meeting, He added that they wanted to hear the feed of previous concerns	[redacted] clarified to the community that the has team noted all the concerns, he informed them that the most important thing is to acquire a license for the project ; All the concerns will feed in field development plan.
	He pointed out during EOPS children from other locations such as LOCHWAA benefited	Comment noted

Commentator	Issue/Question/Comments	Response
	some much from the project ,school fees was paid ; He requested that the same should happen to their location	
	[redacted] was so much concerned with the activities downstream; he wanted to know if drawing water for the project will affect water level in turkwel dam which might later endanger farming activities and domestic use:	**James kambo replies** He informed them that water pipeline will have a different ESIA, he asked them that those concerns will be handled when that time comes.
[redacted] [redacted] **village**	He wanted to know what the project will do to ensure the safety of livestock and people during construction; he referred to trenches and electrical fences; how will accident be avoided.	**Philip replies** He informed the community that the proponent has been advised to prepare social management plan and emergency plan that will cater for accidents; common practices such as warning sign such as tapes and signage will be put in construction sites for people to know that construction is ongoing, this will help to minimise accidents. There will be work place training as well.
	How will the affected be compensated?	**Mr Bethwel replies**

Commentator	Issue/Question/Comments	Response
		The proponent will have construction management plan That will give procedure on how work will be done on construction sites Grievance mechanism will also be put in place in order to record grievance. **On land matters Mr Bethwel** clarified to the community that there will be a separate ESIA for water pipeline. When that time comes NLC, county government will come and do a consultation with the communities on land acquisition.
[redacted]	[redacted] wanted to know where the operation camp will be during the construction of water pipeline	**Philip replies** We don't know about the operation camp because we don't have the design we are only aware of the well pads.
	He also wanted to know the exact place where water off take point will be situated	**Mr Bethwel replies** He told them that the contractor doesn't know the exact place where water off take point will be in Kaputir.

Commentator	Issue/Question/Comments	Response
		It is the work of the county government to consult with the community and decide where it will be**.** **Philip replies** He replied to them that there will be a decommissioning plan; the proponent will be advised to have a land restoration plan that has been prepared according to international standards and Kenya law. The normal procedure will be followed similar to those followed during license acquisition. Upon proper land restoration and decommissioning the project will be issued with a license of completion**.**
	He asked if the 5% community share of revenue is still there.	**Bethwel replies** He replied to them that the benefit will be after the sale of the crude oil, the revenue will be divided among the national government 75 percent, county government 25 percent and the community which will get 5 percent. All tis benefits will not be shared until the project starts and the crude oil sold to market.

Commentator	Issue/Question/Comments	Response
[redacted]	He wanted to know if the community will be allowed to utilize land after project completion and decommissioning of land.	**Mr Bethwel replies** He informed the community that the decommissioned land will be reposed by NLC because people were compensated The decision on land use after decommissioning will lie upon the ministry of petroleum and mining.
[redacted]	[redacted] appreciated the fact that Tullow has been empowering women in Lokichar by giving the tenders on supply of items ;she requested the project to consider their women groups as well by giving them tenders on supply of eggs and eggs because they are also capable, she Also requested the projected to establish a market for them in kaputir to help in selling their farm produce.	Comment was noted
[redacted] **HSC**	She claimed that Tullow promised to construct an education centre in Kaputir but it has been in vain.	

Commentator	Issue/Question/Comments	Response
	He pointed out that the presentation on biodiversity has missed out to present other animals, he complained that there are elephants roaming around destroying their farms he added that they are a threat, he requested for a conservancy to be established in the area and that will be of great help to the community.	Mr Philip replies He replied to them that to avoid human and animal conflict during water pipeline that has been noted.
[redacted]	He wanted to know if the construction of the pipeline will affect pastoralism	Philip had earlier explained that pipeline will have temporal impacts during construction that is when movement will be restricted, after construction normal activities will continue on land.
	He wanted to know if the water pipeline will affect water level in Turkwel dam which might be a threat to downstream activities.	This was noted and the community members were informed that it will be handled during water pipeline ,since the pipeline will have a different ESIA;
	He also wanted to know how the elderly will benefit in the project in terms of employment opportunities ,he referred on how TULLOW used to engage them during EOPS;	**Mr Bethwel** had earlier stated that there will be employment for the skilled, semi-skilled and unskilled and there will be a national and local content policy that will aid in employment.

Commentator	Issue/Question/Comments	Response
	The literate will benefit from employment what will happen to the illiterate	
	He stated that pastoralist communities have their original land or ancestral ,and this is signified by abandoned animal pens and graves, What will happen if the project operation or construction passes through such land will the owners be compensated?	**On land matters Mr Bethwel** clarified to the community that there will be a separate ESIA for water pipeline. When that time comes NLC, county government will come and do a consultation with the communities on land acquisition.

Action Item

ESIA consultation materials were handed over to [redacted] and [redacted].

SUMMARY

[redacted] director administration petroleum and mining summarised the meeting by clarifying the key issues that were arising during the meeting.

He informed the community that water uptake in turkwel dam will not affect activities downstream because water will be derived from the headdress and not the dam, he added that it is the mandate of the government to protect the rights of citizens.

On land matters he educated that any resource beyond six feet's down belongs to the government, it's therefore the responsibility and mandate of the government to protect and conserve.

He also informed them community that Turkana Land is communal, this means it is not registered the process of compensation is different from registered land where land value is paid to the owner.

He notified them that town planning has only taken place in nine centres in Turkana County, he further explained to them that there is a taskforce that has been formed to ensure that communal land has been registered.

He said that it is his believe that land registration is fast-tracked before the projects begins.

He notified them that at the moment the project has not begun, all the views collected will be incorporated in full field development plan.

Adjournment:

There being no other issue to be discussed, the meeting was adjourned by word of prayer from [redacted] at 13:34 Hrs.

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Location: Kalemngorok

TIME: 10:49 AM-14:18hrs

DATE: 6/8/2021

Team Participants

- Muthoni Koinange –Golder
- Philip Abuor-Eco-science
- Grace Lotoom-Golder

ESIA SUPPORT TEAM

- Bethwel Sang -Tullow
- Linda Were –Africa oil
- James Kambo-Africa oil
- Ann Wanjiru- Africa oil
- Emase Lodungo –Africa Oil
- Lochaman Emoit Wilfred –Africa oil
- [redacted]-Environmental resource management
- [redacted]- Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted]-Ministry of Petroleum and Mining
- [redacted]- Ministry of Petroleum and Mining

Observations

More questions were on land, employment and water pipeline and insecurity issues.

The meeting was attended by both men and women.

Preliminary

The meeting was called to order by Assistant chief [redacted] and the meeting opened with a word of prayer from [redacted]

Chief [redacted] informed the community the objective of the meeting and invited Mr Bethwel sang to further explain the objective of the meeting

Mr sang acknowledged the presence of the entire ESIA support team and the community at large, he later reminded the community of the ESIA disclosure that took place three weeks ago and the progress of the project since EOPS, he further informed them that the project is at a decision making phase and it this phase there are requirements needed for the project to begin.

He informed them that land is one of the requirement, he however told them that because Turkana land is communal and held in trust by the county government there are procedures that must be followed in order to acquire land.

He also notified them that water will also be required and according to research was done a decision was reached to draw from Turkwel Gorge, water will not use by the project but by the community as well, Mr Sang also notified the community that oil pipeline will also be required to transport crude oil from the Central processing Facility to Lamu;

Mr Bethwel reminded the community that water pipeline ESIA will be different and when that time comes there will more consultation on that

Mr Bethwel later invited [redacted] from Ministry of Petroleum and Mining who introduced ESIA support team and continued to give a recap of what was discussed during ESIA disclosure.

Linda Were was later given a chance to do recap on project overview as discussed during ESIA disclosure, she informed the community that Golder associate is present to inform the communities of the impact of the project and recommended mitigation measures , Linda invited Muthoni Koinange from GOLDER ASSOCIATE to introduce the rest of the team and continue with the presentation, as she proceeded with consultation she clarified to the community that GOLDER is not NEMA it is an independent organization that is doing ESIA consultation.

She further gave the history of Golders work since 2015 to date and their role in the current exercise, Muthoni reminded the community members to register their feedback in the forms that were distributed with the ESIA consultation document.

Muthoni later invited Philip Abuor to take the community through the environmental impact of the project and mitigation measure as she later present the social impact of the project and mitigation measures.

Question and Answer session was moderated by Muthoni Koinange.

Table 1: Identified Issues, Questions, Comments and Responses

Commentator	Issue/Question/Comments	Response
[redacted]	[redacted] was requesting the project to consider providing the community with water first.	**comment noted**
	He appreciated the presentation ,but he fears if the project will implement the recommendation Probably the project will not consider settlement, sacred places and graves. he recommended that there should be monitoring or tracking of performance to ensure that the proponent adheres to the recommendations	**Muthoni replies** She informed the community that the ESIA draft is for the community it is a legal document that will be used to track performance of the project, after ESIA consultation the document will be sent to NEMA For review. **Mr Sang replies** He told the community that golder will submit the document to NEMA on behalf of the proponent, the licence will come be given to the proponent will conditions and regulations that must be followed. NEMA will also be doing annual audits to ensure that the commitments are implemented.
	[redacted] was surprised that this policies are only practical in Turkana but not in other places, he cited an example of a certain factory in Nakuru that only employed people from that area and not from other place:	

Commentator	Issue/Question/Comments	Response
	He referred to local content policy that defines how people will be hired. he was also surprised with a policy that say any resource beyond 6 feet's it belong to the government, does it mean any investment on land beyond six feet does not belong to the owner.?	
	[redacted] also requested the project to come up with procedures on how orphan will be assisted.	comment noted
	[redacted] requested the project to consider employing the locals because most of them are qualified. The project should also consider doing more consultations with the community for proper understanding and good working relation.	comment noted
	referring to feedback form he warned the community to be keen on signing documents because they might end up signing documents that will prompt their land to be acquired without their knowledge	**Muthoni Koinange** She informed the community that signing of that document is not land acquisition agreement ,it is a feedback form that will show that golder were here and consulted with community; no one will make community to sign off their land without consultation and agreement with the affected individuals.
[redacted] **opinion leader**	[redacted] appreciated the presentation but he was so much concerned with the issues that were raised during ESIA disclosure, he wanted	**Muthoni Koinange** She further added that the questions and concerns that were raised during the ESIA disclosure have been well covered in the draft; pertaining jobs and other benefits she informed them that the project has not yet begun.

Commentator	Issue/Question/Comments	Response
	those questions to be answered first.	
	He alleged that all this recommendations are meant to entice them to give land for the project.	
	[redacted] wanted to know if the members of parliament and members of the count government have been engaged and if so what is their opinion?	
	[redacted] requested the project to do proper consultation and engagement in the community for efficient delivery of work in future, he laments that if consultations are not done properly the project might experience difficulty in delivery. He also added that there should be feedback of the earlier raised issues, feedback will build trust between the communities and the proponent.	
	[redacted] further asked the project to consider providing water because it is a vital resources	Comment noted. **Bethwel Sang**

Commentator	Issue/Question/Comments	Response
	that is required for survival. He wanted to know where the off take points will be. He claims that during EOPS flaring caused women to give birth to disabled children ,what will haven in case the same scenario happens are there channels of submitting their grievances .?	the design for water pipeline is still ongoing, NLC has already identified and gazetted the land that will be required but the size and the design is still with the engineer, on water off take points we have already received from Turkana county. He informed the community that water pipeline will have a different ESIA and we will come for consultation the same way have come for mid-stream ESIA consultation. he informed them that the project will have three ESIAs,for upstream; mid-stream and land; He informed them that will still have time to consult on water pipeline.
	He claims that during EOPS flaring caused women to give birth to disabled children ,what will haven in case the same scenario happens are there channels of submitting their grievances .?	**Bethwel Sang** he told them that those are just claims because the research has been done by different people, the county government and NEMA have been going round the communities to ascertain the truth about this allegation.it was discovered that it is just claims and not theoretical, there is no relationship between

Commentator	Issue/Question/Comments	Response
		waste disposal and birth defect, people were also asked to register their complains on the same but nothing has been reported so far. The findings of NEMA were shared with the county government.
	[redacted] requested the project to consider taking some of the youths to tertiary colleges so that they can be prepared for the jobs that will be offered during the project implementation. He also added that tertiary colleges should be constructed in the area to help the transition.	[redacted] He notified the community that their concerns will feed into full field development plan because the project has not begun.
	He fears that the project may be affected by the countries politics and elections, he also added that insecurity between Turkana and Pokot may also be another factor.	comment noted
	He directed his question to director for administration petroleum and mining [redacted], he wanted to know the plan that the government has toward restoring peace	the question was answered By [redacted].

Commentator	Issue/Question/Comments	Response
	between Turkana and Pokot.	
	He requested Golder that there should be a procedure of employing the locals; those procedures should be outlined and given to community leaders to act as a checklist for project performance in employment and other benefits.	**Bethwel Sang** He informed the community member that the project has not yet begun, the proponent has been recommended to put a local content policy in place that will help in hiring people based on their capabilities. The project is keen to ensure that the locals benefit from the opportunities; he informed the community that during EOPS there were jobs that required expatriates and that necessitated the project to hire expertise from other countries.
	[redacted] wanted to know what will happen in an event that the proponent does not implement compensation of affected people and sacred places during the project implementation.	
[redacted]	He appreciated golder for the presentation and said he was among the team that was doing a baseline survey He explained that the expertise have done their	**Philip Abuor** he informed the community that implementation plan has been put in place There will be monitoring and auditing of the project

Commentator	Issue/Question/Comments	Response
	work well but the problem lies with the proponent who is supposed to implement.	activities and the report shared with NEMA, County government and the community ,the community will also have a responsibility of holding the project accountable
	He suggested that the consultation process should have shared the content earlier for people to have enough time to interrogate the document ; the comprehension of the community is very different from the learned comprehension; he complained that it is not fair to mobilise the community in the morning and expect response immediately; He complained that in this presentation it is indicated that flaring will not be done but if you check the detailed report it show that flaring will be done and there will be minimal effects. He is concerned that accident is inevitable just in case the gases are emitted people will be affected.	**Philip Abuor** he informed them that this is just the begin of consultation process there is more time to go through the document and interrogate it **Philip Abuor** He further informed them that gas flaring is not in the design ,gas will be re injected back to stabilize the well and produce power; it will not be in the mode of operation ,it will only happen during emergency air modelling dispersion report is still in progress and when it will be completed it will be shared ;

Commentator	Issue/Question/Comments	Response
	He observed that we are here for ESIA disclosure yet the issue of land has not been dealt will, he complained that NLC representative should have been among the team to explain on matters of land. He said that what matters most is the issue of land, there so many hidden laws in land acquisition that the community is not aware of, policies are constantly implemented yet the community is not informed. He requested to know the exact place where the water pipeline will be so that the community is prepared earlier. the community should be informed of such policies to avoid conflicts and demonstrations that were experienced during EOPS:	comment noted **Philip Abuor** He told the community that the matter of policy is governance, policies are always drafted in consultation with people or representatives of the people.
	He recommended the government to do more engagement and consultation with the community before commencing on the project,	comment noted

Commentator	Issue/Question/Comments	Response
	making decisions hurriedly will bring more problems in future. he gave an example of Uganda which did their consultation slowly and ensured that policies of working are in place and there is enough man power and later embarked on the project	
	[redacted] complained that the project will affect grazing field and migratory routes. he informed the project that there is places called AROO in kalemngorok where all livestock converge during drought ,if such places are depleted because of overstocking Livelihoods will be affected, he foresaw a scenario of people turning to alternative livelihoods that might destroy the environment. He overlooked the idea of preserving and protecting the birds and toads that were shown during presentation, he claimed that those are of no importance because they cannot be sold or eaten.	**Philip Abuor** He explained to the community that the project will not affect grazing fields and migratory routes permanently, the impacts will be temporary during the time of construction because the pipeline will be buried underground, and disturbance will be short term. Normal activities will resume to normal after construction. The proponent has been recommended to come up with land and livelihood restoration plan. grazing land will not be interfered with ,there will be a very small impact ;he emphasized on protection and preservation of other biodiversity for the sake of future

Commentator	Issue/Question/Comments	Response
		generations moreover biodiversity has a role it plays In the environment Compensation of land will be according to international standards and Kenya law moreover there will be consultation with the community.
	He also cited dishonesty in the process of engagement, he noted that it is unfair to call stakeholders from farfetched areas and fail to facilitate them with transport and accommodation.	comment noted
	[redacted] noted that parallel implementation of activities is suspicious, he cited the inmplemation of land acquisition by NLC and other functions by different stakeholders.	comment noted
	He complained that the water pipeline will increase the conflict that is between the Turkana and Pokot, he claimed that Pokot	

Commentator	Issue/Question/Comments	Response
	have already encroached Turkana land. Project implementation should be based on current affairs between the two communities. [redacted] was opposed to the idea of giving the county the responsibility of providing water to the community because the performance record illustrates that it is incapable. He recommended the project to provide water to the community although the county government is a mandate holder.	
	He also recommended reduction of mechanical work to create employment opportunities to manual workers and youths	
	[redacted] recommended the well to be named after the know streams, if a well is called Etom or Amosing how will the people know the geographical position such well . He gave an example of kodekode, if a well is called kodekode it is easy to recall and know the	**Philip Abuor** The proponent will be advised.

Commentator	Issue/Question/Comments	Response
	exact location of the wells.	
[redacted]	[redacted] reminded the POK of the promises they made on employment ,she claimed that they were told all people will be employed and that did not happen	
	She also complained that they were told that they will receive a share of oil revenue. She requested to do know what happened to those commitments. [redacted] complained that they have not been receive feedback pertaining the project They are surprised that the project is almost starting again yet they don't have any information about the project.	[redacted] He informed the community that the project that was there was early oil pilot scheme, the project was a trial that informed project viability. the policy of revenues sharing is stipulated in petroleum act ,the community share will be used for development
	She is requesting the project to consider employing the youths because most of them are skilled. She complained that during EOPS the project had employed more people from outside the	comment noted **Bethwel Sang** He informed the community that there will be a local content policy that will outline how locals will hired.

Commentator	Issue/Question/Comments	Response
	county than the locals.	
	[redacted] also requested the project to consider providing water to the community.	Comment noted

Action Item

ESIA consultation materials were handed by Muthoni Koinange over to [redacted] and [redacted] received the materials on behalf of Professionals

Summary

He acknowledged the community for turning up in large numbers to attend the meeting.

He also acknowledged the effort of His Excellency governor [redacted] for consulting with the governor of west Pokot on encroached land.

He also informed the community that two weeks ago the ministry of Interior had planned the meeting that brought all the governors of pastoral communities, count commissioner and police commander together in bid to restore peace.

He also commended peace to begin from within,

He clarified to the community that there are functions that is a mandate of the county government and the national government cannot override that

It the mandate of the county government to provide water for the communities

He also notified them that 220,000 barrels of water will be required by the project, a half of it will be for the community.

The national government requested the county of Turkana and West pokot to provide water off take point

He notified them that details on water pipeline will be discussed in-depth during water pipeline ESIA

[redacted] also explained to the community the status of land acquisition process, he told them that the required land has been gazetted and that does not imply that the land has already been acquired, it is notice of intention.

[redacted] also informed the community that it is the mandate of the government to ensure that peace is restored within the Pokot and Turkana people.

The community was also informed that water for the project will be drawn from River Turkwel in the headdress, he clarified to them that activities downstream will not be affected by the project.

[redacted] notified the community that their concerns will be incorporated in full field development plan he promised that the project will be in regular consultation with the communities.

Having no other business the meeting was adjourned with a word of prayer from [redacted] at 15:14 hrs.

He further educated them on land policy, he notified them that any resource beyond six feet's belong to the government land will not be acquired without consultation with the owners, displaced people will be either compensated or resettled In another piece of land within that locality, for community land, land value will be paid to the special account in the county government.

He further notified the community that so far nine centers have been planned in Turkana County to receive tittle deeds;

Katilu,Lokori,Kalokol,Kibish ,Lokichoggio,Lokitaung,Kakuma,Lokichar and Kainuk,the rest is communal land, His Excellency Governor[redacted] has formed a taskforce that is sensitizing people on land survey and registration.

He informed them that the ministry of Petroleum will be in consultation with the communities on matters of land acquisition.

ESIA CONSULTATION MINUTES

Stakeholder Engagement: Esia consultation meetings

Location: Lodwar

TIME: 11:00 AM-15:38hrs

DATE: 9/8/2021

Team Participants

- Muthoni Koinange –Golder
- Philip Abuor-Eco-science
- Grace Lotoom-Golder

ESIA SUPPORT TEAM

- Bethwel Sang -Tullow
- Linda Were –Africa oil
- James Kambo-Africa oil
- Ann Wanjiru- Africa oil
- Emase Lodungo –Africa Oil
- Lochaman Emoit Wilfred –Africa oil
- [redacted] Ministry of Petroleum and Mining
- [redacted]– Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted]Ministry of Petroleum and Mining
- [redacted] Ministry of Petroleum and Mining
- [redacted] –National Lands Commission

Members of the county assembly

- [redacted]-Loima Ward
- [redacted]-Lokichar Ward

Observations

- **The turn up for the meeting was low**
- **There were only two members of the county assembly in attendance**

- **Civil society organizations from Turkana south were a majority in the meeting**
- **Most of the questions centered on waste management, land acquisition and employment opportunities**

Preliminary

The meeting was called to order by Mr James Kambo at 11:00Am

[redacted] from Ministry of petroleum and Mining opened the meeting with a word of Prayer

Mr Kambo invited all the participants and gave them room for all the participants to introduce themselves

He acknowledged the presence of the members of the county assembly and civil society organizations that were in attendance.

He later reminded the participants of the project disclosure that happened three weeks ago and reminded them of the discussions that were done.

Mr Kambo went further informed the participants the objective of the meeting and the importance of the process that is being undertaken by the independent consultant;

He told the according to the EMCA 1999 for any project to be carried out ESIA process has to be done to assess the potential impact of the project and recommended mitigation measures

He explained to them the reason why consultation has to be done is to get contributions and concerns from stakeholders that will add more input to the document

He clarified to them that at the moment there is no project, the project is the decision making phase.

He then did a presentation on project overview and projects features

Mr Kambo reminded the participants of the project requirement: water, land and pipeline.

He further notified them that a decision has already been made on the source of the water project; the water pipeline will have a different ESIA;

He told them that there will be 2400 job opportunities featured in the project that will cover the skilled, semi-skilled and unskilled.

After giving brief summary on project overview he then invited Muthoni Koinange from Golder associates to introduce the Golder and Eco-science team participants and carry with presentation.

Philip Abuor took the participants through the possible impact of the project activities on the environment and recommended mitigation measures.

His presentation was on the following aspects:

Air, Noise, Dust, Water quality and quantity; soil, geology and geohazards, biodiversity, eco-system services, emergency accidents and non-routine events, landscape and visual:

Muthoni Koinange did a presentation social aspect of the environment:

Cultural heritage, economics and employment; land and livelihoods, community health; safety and security;

Question and Answer session was moderated by Muthoni Koinange

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted] **elders lokichar**	What does POK mean? Does it mean that this is the government project?	**Mr James replies** He informed the participants that the resource found in Kenya belongs to the government of and exploited through the contractors, the process is shared ,the role of the government is what led to branding project oil Kenya; Joint ventures do business and the proceed is shared with the government in the following order 75,20,5. The government, county government and the community share. POK is an embodiment of oil exploration in south Lokichar land will be acquired by the government through NLC ,which still puts the government in the centre of the of the process, the government will also support the project in other ways to ensure that the project goes forward hence the branding project oil Kenya . **Mr Sang**

Commentator	Issue/Question/Comments	Response
		POK is a brand names that brings all the actors together(MoPM,KJV and the county government ; initially during EOPS people were not aware of other stakeholders apart from Tullow, people were not aware of the government as a licensee and Turkana county government having a stake in the project
	What are the grievance redress mechanisms that have been put in place?	**Mr James Kambo Replies** There will be a grievance redress mechanism that will be there to ensure transparency and accountability in all channels of communication between the contractor, the community and the government. **Mr Sang replies** Grievance mechanism will be there to handle grievance and complains from the community; however there are some grievance that may not impact or affect the project directly but may affect project delivery for instance insecurity ,this is what led to formation of Turkana grievance body that its office tenure ended last year;

Commentator	Issue/Question/Comments	Response
		It is upon the government to evaluate the performance of that body and improve in areas that it failed to deliver.
	He appreciates the presentation and recommendations made to the proponent; He request that the recommendation should be ascended to law so that if the proponent fails to implement he is held accountable.	**Muthoni Koinange replies** The report will be handed to NEMA which will also give its conditions ,if the document is approved then it becomes a legal document that can be used to hold the contractor accountable in case they fail to implement the commitments **Mr Philip** On ascending the document into law he encouraged the county government of Turkana to come up with a policy and make by laws on devolved functions such as noise and air and waste. The county can come up with the frequency on how the aspects are going to be monitored. He cited the air quality standard that have been set in Louisiana and New York city because of different geographical conditions.
	He wanted to know the study of the health professionals on gases that will be emitted during operation stage of the project.	**Mr Philip**

Commentator	Issue/Question/Comments	Response
		He informed the participants that the baseline was done on noise, dust and all were good. He further informed them that hydrocarbon handling is not different from what happens in petrol station or filling stations. It depends with the magnitude of exposure to the gases. The mitigation measures for the impacts are incorporated in the design and will happen at the source, the technology used will not allow emission of gases, and the gases will be re-injected back to stabilize the wells and part of it used to produce power. If it is not released to the atmosphere it will not cause health problems We also encourage the community to be vigilant, there will also be monitoring of the elements to ensure that they do not exceed the baseline data collected.

Commentator	Issue/Question/Comments	Response
	He is so much concerned with the conflict that is between the pokot and Turkana on boundaries; he further explained that according to old maps the boundaries are known he pointed out that some of the current residence of the pokot sits on Turkana land. He recommended that Turkana leaders and pokot leaders should be brought together in such consultative meetings to end this conflict He pointed out that the idea of engaging the two tribes differently is a problem. He asked the role of the ministry in ending this conflict.	[redacted] **in his closing remarks informed** the participants that the government is making all efforts possible to ensure that peace has been restored back between the communities in conflict; he further added that there are a number of meeting that have been ongoing and chaired by the ministry of interior in the past month. The government is aware that insecurity affects development. On issue of encroachment the two communities have to find way of co-existing peacefully.
[redacted] – **Lobokat development group**	He wanted to put his inputs on the draft referring to pg. 27: He lauded the baseline data that has been done yet pointed out that little study has be done on the impact of the project to social amenities such as schools and health facilities	**The comment was noted.** [redacted] notified the participants that there is no project at the moment, the matters of cooperate social responsibility will be considered when the project begins, it will be done in consultation with the county government to ensure sustainability and continuity of the projects.

Commentator	Issue/Question/Comments	Response
	And the culture of the people in the area of project influence, he requested that to be captured in details. What the consultant has proposed is education policy and strategy to be put in place He also recommended inclusion of deliberate effort to put Cooperate social responsibility in place so that the benefits of the project is felt earlier before the project begins CSR should be defined well and be one of the component of the project.	He informed the participants that the project is keen not to repeat the mistakes that were done during EOPS ;
[redacted] **–Diocese of Lodwar**	He observed that most of the impacts are referred to as Negative and minor Does it mean that the impacts of the project will not affect the community?	**Mr Philip** He referred the participants to page 13 he reiterated that the consultants are not down playing the impacts of the project. He informed the participants that ,the use of minor ,major, negative is a process and a way of classifying impacts, and impacts are classified according to phases, He made a reference of page 15

Commentator	Issue/Question/Comments	Response
		If noise is serious and has a high magnitude it is referred to as major. When all this aspects are not mitigated we say they have a major impact, after mitigation the impacts become minor .
	He also wanted to know how the effect of flaring will be mitigated, he pointed out that previously during EOPS flaring affected people.	**Mr Philip replies** He Informed the participants that there will be no flaring ,the mitigation measures are in cooperated in the design ,the gases will be re-injected back to stabilize the well and part of it to produce power; flaring will only happen in emergency.
	[redacted] sorted to know how waste will be handled by the proponent ,he complained that the way waste way handled previously was very dangerous; waste was transported from one well to another.	**Mr Philip replies** He informed the participants that in projects features there is an integrated waste management facility that is capable of handling all sort of waste;there is a landfill that will treat synthetic materials The proponent has been advised to utilize the facility.
	[redacted] was much curious to know how the project arrived to a decision of drawing water from Turkwel, He explained that the source of	Mr Sang replies A decision on drawing water for the project was reached to after exploring many options

Commentator	Issue/Question/Comments	Response
	water for Turkwel is Suam river bearing in mind climate change effects on sources of water how sustainable is this? He noted that water uptake from Turkwel will be 220000 barrels a day yet water required in the central processing facility is 330000 barrels a day can it be explained in lay man language where the extra 110000 barrels came from.	The project considered the cost and practicability ; Most of the options were eliminated on the basis of priority and deliverables in terms of cost and practicability: On climate change issues That will be handled during water pipeline ESIA; More study has been done catchment areas, disiltation, recharge and discharge rate and decided to get water from headdress and not River Malmalte so that activities downstream are not affected. He clarified on 330000 barrels of water that will be used in the central facility area, he informed them that the extra 110000 barrels will be the amount that will be re-injected back into the wells.
	He sorted to know if the pastoralists have been consulted on land acquisition because they will be directly affected. And how was 1500ha arrived at? He also wanted to know how pastoralist have been consulted in this engagement meetings	[redacted] from National commission informed the participants that the community has not been consulted there was a halt in step three of lands acquisition

Commentator	Issue/Question/Comments	Response
	,people in town centres should not be engaged on of pastoralists because they may be having their cultural views on the subject of discussion.	What was given is a gazette notice to notify the community the intention of acquiring land earmarked for the project. Identification of all the affected people will be done by a multi-agency team. The process will start again before the end of the year. He informed them that land acquisition is a consultative engagement. Mr Sang on engagement He informed the participants that is details on stakeholders engagement in the document , the most impacted and how all the category of stakeholders will be engaged Classification is based on the impact of project. On how to achieve engagement with various groups has remained a challenge because of COVID 19 PANDEMIC;

Commentator	Issue/Question/Comments	Response
		We have tried to meet with the county government and county commission on how to conduct the engagements. He also notified them that stakeholders were mapped according to the influence of the project.
	[redacted] wanted to know how and who will train the Turkana people their culture	Mr Philip clarified that it is not the community that will be trained but the employee who will work in the area of project influence
	He noted that the word community has been used to undermine people; he pointed out on how community has been defined differently in land act 2016, mining act 2016, in petroleum act.	**The comment was noted**
	He complained that the main emphasize on cultural heritage has been on graves alone ;he notified that consultants that even trees and the bare ground itself has cultural value; little has been done on cultural heritage.	**Muthoni replies** **S**he informed the participants that the document is over 800 pages and more detailed; what has been captured is part of it once the document is approved it will be available in NEMA and can be accessed by anybody who wishes to interrogate the document further.
	On matters of job opportunities he said the number is seductive; employment aspect is very important to the investor and seeks to convince the community a lot with the number, does this number include the pastoralists.	**Mr Sang replies** He informed the participants that there are lesson that were learnt during EOPS on how to share employment opportunities ,at times it's hard to

Commentator	Issue/Question/Comments	Response
	He cited the back to back mode of employment and questioned it is sustainable	achieve this because the community also dictate on the sharing ,it becomes a community led process Sometimes there are few opportunities that cannot be enough for everyone and the process become compromised Local content is a critical converstion;as we think of the project positive impact structu**res** of engagement should be put in place in order to maximise the impacts that will be created by the project
	He also pointed out that in every project there are always impacts ,although in the draft he is seeing some impacts are minor and negative, he sort to know how the degraded environment will be restored;	**This was answered exhaustively by Mr Philip.**
[redacted]**-CSO**	[redacted] appreciates that the document has been drafted well. He told Mr [redacted] that he is waiting for the policy that will help in governance.	**Comment was noted**
	[redacted] complained that he has not come across in the document how silicate will be management; does it mean that there will be waste generation in the well pad he cited a scenario of waste that is held in Twiga well.	**Mr Philip replies** He informed the participants that in projects features there is an integrated waste management facility that is capable of handling all sort of waste;there is a landfill that will treat synthetic materials

Commentator	Issue/Question/Comments	Response
		The proponent has been advised to utilize the facility. This was earlier answered by philip
	He wanted to know the sustainable way of waste management. He complained that the company that is currently consolidating waste is not doing it in the right way; the trucks are not well covered a situation that is causing waste to drop from the vehicle.	**Mr Sang replies** on waste consolidation He informed the participants that they consulted the county government and NEMA on the decision to consolidate waste in Twiga and this was to ease monitoring exercise; ECCL was earlier consulted to do the exercise but they failed to act quickly; TAI was approached and they agreed, their trucks were inspected and met the requirement, we received the complains on the same issue and promised to advise the company to rectify what was not done right.
	[redacted] wanted to know the approximate distance people are supposed to move from the fence line of the operation sites as a mitigation measure to Noise and dust.	**Mr Philip replies** He informed the participants that Air Modelling and noise modelling design indicates that people should move 250m from the fence line although the process is still under validation.
	He wanted to know the stage where the national and local content is currently. What is the definition of local and expatriate in the community context?	**Mr Sang** He reiterated that local content is a critical conversion that requires stakeholders to sit and discus in depth and put structures of engagement in place in order to maximise the impacts that will be created by the project.

Commentator	Issue/Question/Comments	Response
	He reiterated that the local and national content policy has always been a bond of contention.	
	[redacted] also wanted to know the frequency of reviewing the aspects that haven been presented by the consultant. Water, air quality biodiversity and other environmental and social aspects and what are the recommendations.	**Mr Philip replies** The frequency of monitoring is a choice but according to the law of Kenya air regulation policy 2014 air quality should be monitored on quarterly basis. Monitoring of this aspects will be done daily but the report be submitted on quarterly basis in NEMA approved Laboratories**.** The law says environmental audits should be done annually to ensure compliance Audits should be done by an independent auditor and reports be made available in NEMA Website and also shared with Turkana **C**ounty.
	He recommends that project oil Kenya should not overshadow the contractor POK office should be in Lokichar that constitute NEMA, NLC; a multi stakeholder office.	**Comment noted**

Commentator	Issue/Question/Comments	Response
	Grievance redress mechanism should be free from the operator because the previous one failed.	
	He also wanted to know where the grievance redress mechanism will sit because the previous one was under the county government and failed to deliver until its office tenure ended.	
	He pointed out that during ESIA disclosure meeting only nine communities came up with community memorandums, he recommends that ministry of petroleum should adopt an act similar to the one that has be prepared by the department of mining(the mining act, that will enable community to enter into a beneficial agreement with the project.	**Mr Sang replies** He informed them that we have no clear path on how community development agreements can be in cooperated in the project Petroleum act is silent on community development agreement unlike in mining act**.**
	He lauded the act of planting trees in the well pads	**Comment noted**
	He also wanted to know the plans that are there to restore the abandoned well pads	**Mr Sang**

Commentator	Issue/Question/Comments	Response
		He notified the participants that trees were planted in some well pads but there is no intention of restoration because those wells will be under development
	He complained why KK security company was given a contract of clearing the sites instead of using a local company.	**comment noted** **Mr Sang** informed the participants that it was a recommendation from NEMA to do site cleaning and this was done by KK through the locals.
	He was concerned why the comment in the feedback form are directed private company and not POK or Tullow.	**Mr Sang replies** He told the participants that it was synergized way of bringing all capable partners together and activities share among partners in order to progress together as KJV and also cut cost. It was based on understanding on how to deliver efficiently but Tullow remains as an operator.
[redacted] [redacted]- **CSO**	He wanted to know the mechanisms that have been put in place to ensure performance tracking.	**Mr Philip replies** he informed the participants that the document will be a legal document upon approval, the proponent will be sued if the commitments are not implemented

Commentator	Issue/Question/Comments	Response
	He also noted that the issue of resettlement and compensation of land has not been well articulated in the document.	Mr James Replies on resettlement he explained to the participants that as along as land has been identified for development displaced people will be compensated fairly resettlement act 2019 The act stipulates that one can either be resettled in the same location in order to access all the services or monetary value. one cannot be compensated twice its either land or money land compensation will be based on improvement done on land ,land value will be paid to the special account in the county government while improvement value will be paid to the owner
	He also pointed out that the issues of land encroachment by the pokot and insecurity has not been in cooperated in the document He reiterated that if this issue is overlooked it will bring problems.	**Mr James replies** He explained that the matters political boundaries can be handled well with IEBC and administrative boundaries with the ministry of interior, the authorities involved are in a better position to handle the matter.
[redacted] **LOIMA**	[redacted] wanted to know the validity of the baline study done on dust, he wanted know	**Mr Philip replies** dust is categorized as settleable and inhalable

Commentator	Issue/Question/Comments	Response
	when the samples were collected owing to the fact that when it rains dust can be washed away from the surface.	baseline was done in 2016-2017 it was done monthly because of seasonality it was validated in 2019 to 2021 may ,data was collected during the rainy and dry season and the data took care of seasonality : Another instrument collected inhalable dust for a whole year until early this year. This was 24hrs data and collected according to international standards.
[redacted] - **MCA LOKICHAR**	[redacted] stood to question the silence of the county government on the entire process He observed that the project is more of the national government than the county government. He pointed out that if the county government is absent in the process how will it support the county government to come up with the polies that have been mentioned in the process.	The comment was noted

Commentator	Issue/Question/Comments	Response
	He recommends that communication strategy should be improved to ensure proper mobilization.	

Action Item

The consultation materials were handed over [redacted] council of elders Lokichar and the member of county assembly for Loima –[redacted] and [redacted] MCA-Lokichar.

SUMMARY

[redacted] Director for administration, petroleum and mining appreciated all the participants for attending the meeting.

He informed the participants that the government is currently keen on issues of insecurity among the pastoral communities, it is making an effort to ensure that neighboring communities coexist in harmony.

Several meeting have been undertaken by the ministry of interior and governors from pastoral communities to consult on how peaceful coexistence can be achieved

On boundaries he reiterated that the two communities should find ways of living together peacefully

He informed the participants that water is a national resource the decision to draw water for the project was reached after exploring many options that were not practical and cost effective

On CSR he informed the participants that the project is not there, CSR will be considered and incorporated in full field development plan.

The cooperate social responsibility should be done in consultation with the county government because most functions are devolved and if the county government is not consulted there will be no sustainability and continuity of the projects ,the project is keen not to report the previous mistakes

He promised that communication mechanisms will be improved for proper mobilization of stakeholders

He requested the [redacted] and [redacted] –MCA Lokichar to accompany the team to West Pokot for ESIA consultation meetings.

Having no other business the meeting was ended with a word of prayer from [redacted] at 15:38Hrs

ESIA CONSULTATION MINUTES

Stakeholder Engagement: Esia consultation meetings

Location: Lorogon

TIME: 10:30 AM-14:18hrs

DATE: 10/8/2021

Team Participants

- Muthoni Koinange –Golder
- Philip Abuor-Eco-science
- Grace Lotoom-Golder

ESIA SUPPORT TEAM

- Bethwel Sang -Tullow
- Linda Were –Africa oil
- James Kambo-Africa oil
- Ann Wanjiru- Africa oil
- Emase Lodungo –Africa Oil
- Lochaman Emoit Wilfred –Africa oil
- [redacted]- Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted] – Ministry of Petroleum and Mining
- [redacted]-Ministry of Petroleum and Mining
- [redacted]- Ministry of Petroleum and Mining

Observations

- The community was very receptive.
- People were very happy the project has eventually involved them in engagement
- More concerns revolved around employment opportunities and land.

Preliminary

The meeting was called to order by assistant chief [redacted]

He later invited [redacted] to open the meeting with a word of prayer.

The chief appreciated POK team for remembering Lorogon In consultation meetings and encouraged the community members to be active and raise more questions as possible.
He later invited Mr. Sang who did a recap of ESIA disclosure and did the project overview as well.
Mr. Sang explained further to the community the requirement needed for the project to begin, he informed them that a lot of water will be required for the project and that decision has already been made for water to be derived from Turkwel Dam.
Mr. Sang clarified to the community that water will be used for the project and the communities as well; water off take points have been given by Turkana the project is yet to receive water off take point for west Pokot.
He also informed them that this is just a consultative meeting to notify them of water pipeline but ESIA for water pipeline is different, when that time comes there will more engagements with the two communities.
He further explained to them that the current ESIA consultation is for upstream.
He notified them that for the project to get a license ESIA process is mandatory and that's why the team is here today.
Mr. Sang informed the community the objective of the meeting and invited [redacted] from ministry of Petroleum and mining to introduce the rest of the team.
After introduction [redacted] invited Muthoni Koinange who gave introduction of GOLDER team and clarified to the community that GOLDER is independent and is different from NEMA, she informed them that GOLDER is sharing the impacts of the project and mitigation measures that the proponent has been recommended to implement; she further encouraged them to raise more issues and questions of concern that will further enrich the draft.
Muthoni Later invited Mr. Philip Abuor who took the community through the environmental impacts of the project and mitigation measures;
Muthoni Koinange was later recalled to do a presentation on social impact of the project and its mitigation measures.
Question and answers session was moderated by Muthoni Koinange

Table 1: Identified Issues, Questions, Comments and Responses.

Commentator	Issue/Question/Comments	Response
[redacted]	[redacted] complained that they were informed earlier that the water pipeline will pass through Lorogon ,they were certain that the water pipeline will help the community in farming ,they were later surprised to hear that the pipeline will not pass through Lorogon	**Mr Sang** informed the community nobody knows where the pipeline will pass through, it is the work of the engineers how the pipeline will be designed, the engineers are not even aware of the communities that are living in the project area of influence. The design will based on scientific and engineering ability. He informed the communities to be concerned of employment opportunities and water off take points. **Muthoni replies** She informed the community that the report will be taken to NEMA, NEMA will come back for public participation. She further notified water pipeline will have a different ESIA.

Commentator	Issue/Question/Comments	Response
[redacted]	[redacted] wanted to know if there will be compensation just in case the pipeline passes through their land and sacred places and trees are destroyed. He also requested to know the mode of compensation because Turkana land is communal and people are not in possession of tittle deeds	[redacted] explained to them that the law is what states that, the county government is holding the land in trust because it is not registered;incase the land is registered before the project begins the owners will receive compensation.
[redacted]	She wanted to know how the community will benefit from the project.	**Mr Sang informed the** community that when the project begins there will be a local content policy that will outline the details on how locals will benefit from the project.
	She also requested to know where pipeline will pass through for better planning of their land. Planning of social amenities such as schools and hospitals.	comment noted
	[redacted] also wanted to know if the wanted pipeline will affect fishing, agriculture and gold mining activities.	Mr Sang informed the community that the water that will used for the project is very little and will not affect livelihoods downstream. The water will be drawn from the headdress and not from the river.
	she further wanted to know what will happen to wild life and forest if the water pipeline passes through the conservancy ,will people be employed to take care of wildlife	**Mr Philip replies** He informed the community that in the report the consultant has recommended Kenya wild service

Commentator	Issue/Question/Comments	Response
		and Kenya forestry research institute to be involved during the process to ensure that species of conservation concerns are protected. The baseline will be done during water pipeline ESIA.
	She requests the project to use cash voucher system for people to benefit from oil revenue.	[redacted] replied that the revenue will be shared among the national ,county government and the communities under the influence of the project, the community revenue is what will be used for development if the cash voucher system is used then this means that development will not take place in communities:
	She also added that the project should consider employing both the skilled and unskilled to benefit from the project.	comment noted
	[redacted] complained that the previous concerns that were raised during project disclosure were not answered.	comment noted
[redacted]	she explained that this is a conflict prone area, they have been in constant conflict with their neighbours and are experiencing peace in a short moment, she informed GOLDER associates that there concerns should reach the government; she appreciated the fact that Kenyan citizen have a	comment noted

Commentator	Issue/Question/Comments	Response
	right to settle anywhere in Kenya, but boundaries should be well defined to avoid conflict.	
[redacted]	[redacted] explained that there are many orphans and widows who are victims of war in Lorogon how will they benefit from the project. How will the elderly benefit as well?	**Mr Sang informed the** community that when the project begins there will be a local content policy that will outline the details on how locals will benefit from the project
	He wanted to know if children from Lorogon will benefit from scholarships the same way children from Lokichar benefited during EOPS	comment noted
	He is claimed that during Early Oil Project Scheme (EOPS) grazing fields were depleted and livestock suffered a lot, if the same scenario happens during project how will the affected be helped?	
	[redacted] requests the project to expand the health facilities in the area.	comment noted [redacted] **informed them that** the project has not yet started, when the project starts POK will engage will the county government because most of the functions mentioned are devolved, it's the mandate of the county government to implement such functions
[redacted]	He is appreciated the presentation and reiterated that it is an eye opener to the community	the comment noted comment noted: [redacted] **informed** them that the project has not yet started all the concerns from the communities will be put in the field development

Commentator	Issue/Question/Comments	Response
	He raised concerns that their view and that were raised during the disclosure have not been answered. he informed the POK to consider receiving their written memorandum before the project begins because they fear if the project will implement most of the commitments ; He cited an example of KENGEN that started the project in the area but has not benefited the community in any way, he said that it is a great lesson to them as a community. He added that the project is enticing them to accept the project but once it has started operation their commitments will be forgotten.	plan ,what we are doing today is a process of acquiring license from the government ,there are also other requirement like land that has not yet been acquired. The project is at decision making phase.
	[redacted] also wanted to know what will happen to biodiversity in case their habitats are destroyed during the construction period.	**Mr Philip replies** He informed the community that in the report the consultant has recommended Kenya wild service and Kenya forestry research institute to be involved during the process to ensure that species of conservation concerns are protected.

Commentator	Issue/Question/Comments	Response
		The baseline will be done during water pipeline ESIA.
	[redacted] requested to know where the community will take their grievances just in case the proponent fails to implement the recommendations.	Informed there will be a Grievance Mechanism.
[redacted]	He appreciated the presentation and said that most of their questions has been answered. he was also concerned why their previous concerns have not been answered	comment noted: [redacted] **informed** them that the project has not yet started all the concerns from the communities will be put in the field development plan ,what we are doing today is a process of acquiring license from the government ,there are also other requirement like land that has not yet been acquired. The project is at decision making phase.
	he complained that Lorogon he been by passed in many engagements during the EOPS and during the water pipeline baseline While their neighbours were engaged, he added that it is until they complained is when engagements were brought to Lorogon.	comment noted **Mr Sang** informed them that they were not engaged earlier because the ongoing project by then was not on water pipeline but on Early Oil Pilot scheme; and they were not impacted in any way ,he told them that they will now be engaged

Commentator	Issue/Question/Comments	Response
		because of the water pipeline that have an impact them .
	He requested to know the measures that have been put in place to ensure that biodiversity is not destroyed during construction and operation.	**Mr Philip replies** He informed the community that in the report the consultant has recommended Kenya wild service and Kenya forestry research institute to be involved during the process to ensure that species of conservation concerns are protected. The baseline will be done during water pipeline ESIA.
[redacted]	[redacted] is fearful that the project will bring more conflict between their them and their neighbours if benefits will not be divided equally He remembers very well that during EOPS for concerns to be heard, people in Nakukulas used to barricade roads and cause chaos. He was opposed such happenings because it will create more tension between them and their neighbours. He recommends a well-defined way of redress mechanism.	comment noted **Mr Sang replies** that barricading the roads is not the right way of seeking to be heard by the proponent and the project is also opposed to that behaviour, there are other channels that will be put in place for grievance handling , he informed them that during EOPS such mechanisms were also in place

Commentator	Issue/Question/Comments	Response
	He also complained why the county government should receive compensation on their behalf because they are not directly affected by the project activities.	Comment noted. [redacted] explained to them that the law is what states that, the county government is holding the land in trust because it is not registered;incase the land is registered before the project begins the owners will receive compensation.
	He was fearful that this commitments will not be implemented because their previous concerns during disclosure were not answered.	[redacted] informed the community that the project has not yet started all the concerns will feed in field development plan.
[redacted]	[redacted] is concerned with the disabled, he says that disability is not inability, how will the disabled benefit from the project owing to the fact that many are illiterate.	Mr Sang replies He replied that the project will not segregate the disabled, there a local content policy that will be used to share opportunities; people will be hired according to their ability and capability. He informed the community that during EOPS the project had employed people abled differently.
	He also wanted to know the measures that have been put in place to mitigate accidents and cater for victims.	
	[redacted] was also concerned of the biodiversity habitats, he asked if resettlement will be done to the displace wildlife.	**Mr Philip replies**

Commentator	Issue/Question/Comments	Response
		He informed the community that in the report the consultant has recommended Kenya wild service and Kenya forestry research institute to be involved during the process to ensure that species of conservation concerns are protected. The baseline will be done during water pipeline ESIA.
[redacted]	[redacted] wanted to know where the employees will camp during construction, he requested the project to consider putting the camp closer to people for convenience.	**Mr Sang replies** he informed the community that during water pipeline ESIA more details will be shared on project features and opportunities : Those questions will be answered during water pipeline ESIA consultation**.**
[redacted]	[redacted] wanted to know if displaced people will be compensated and what the mode of compensation?	[redacted] replies he informed them that anybody who will be affected will be compensated .however there two ways of compensation, there will be resettlement to another piece of land of similar value and there will be monetary compensation:

Commentator	Issue/Question/Comments	Response
		its either one of the methods no one will be compensated twice, for the case of community land ,land value will be paid to the special account in the county government will land improvement will be paid to the owner of the land ,land value will be paid back to the owner of the land upon land registration.

Action Item

ESIA consultation materials were handed over to [redacted] and [redacted] representing the youths

Summary

[redacted] the community to be patient on insecurity issues because the government is making all efforts possible to ensure that peace is restored in war tone areas

He further added that there is an ongoing consultation between the governor of Turkana county and West Pokot.

He also notified the community that all their concerns will be in-cooperated in field development plan at the moment the project has not yet begun ;on compensation he told them informed them that the discussion will be valid during the water pipeline ESIA.

He further notified the community that any resource beyond six feet's is the government resource, however compensation of land and any improvement on Land is categorized into two; monetary compensation and resettlement, and individual cannot benefit twice; either of the two applies.

He clarified to them that gazette notice does not imply that land has already been taken, it is a notice of intention to the public.

[redacted] also stated that cash voucher system will not be used because community revenue will be used for development purposes.

He further added that the county government is mandated by the national government to perform some functions which the national government cannot come and duplicate again, he reiterated that it will be conflict between the two governments, he however noted that the two will be in consultation on how to discharge those responsibilities.

He also added that the project will ensure that cultural heritage of the communities is protected and preserved.

Having no other business the meeting was adjourned with a word of prayer from peter [redacted] at 14:18Hrs

ESIA CONSULTATION MINUTES

Stakeholder Engagement: ESIA consultation meetings

Audience: Riting community

Venue: Riting Centre, West Pokot

Time: 11:48am - 15:37pm

Date: 11/08/2021

ESIA Team Members:

- Muthoni Koinange – Golder
- Philip Abuor - EcoScience
- Alice Charem - Golder

Supporting Team Members

- [redacted], Director – Administration, Ministry of Petroleum & Mining (Head of delegation)
- [redacted] – Ministry of Petroleum & Mining
- [redacted] – Ministry of Petroleum & Mining
- Bethwel Sang – Tullow Oil
- Linda Were – Africa Oil
- James Kambo - Africa Oil
- Ann Wanjiru- Africa Oil
- Jonathan Domoo- Africa Oil
- Moses Atupomoi – Africa Oil

OBJECTIVE OF THE MEETING

- To do a project disclosure since Riting Village was left out in the disclosure meetings held in July.
- To present ESIA process and key environmental and social impacts and proposed mitigation measure: the process will collect stakeholder issues; register comments and responses.

Key observations:

- The meeting was well attended with representatives from many villages both from West Pokot and Pokot North Sub counties
- Women, Youth and Men well represented in the meeting.
- POK team consulted before the meeting and agreed to do a project disclosure before Golder ESIA consultation.
- The community members were very attentive.
- The local administration was very supportive as he guided the community members on the importance of the meeting. He acknowledged the presence and importance of Golder which was an independent consultant.
- Most of the issues raised were on job and business opportunities, CSR projects historic injustices(unfulfilled commitments) regarding the dam.
- The community and leaders expressed their satisfaction with an independent consultant on board.

PRELIMINARY

- The area [redacted] welcomed the Community, POK and Golder team for the meeting**.** Argued the community to be attentive during the presentation so as to ask valid questions and also give feedback**.**
- [redacted] gave an overview of the history of Oil exploration to discovery in Kenya. Also explained the Early Oil Project Scheme and gave a comparison on the volumes that was transported by road compared to what can be transported through the proposed Oil Pipeline**.**
- He further explained the use and volumes of water needed to displace the Oil from the ground.
- He mentioned the three key components that the investor will need (Land, water and ESIA licence) so as to reach FID.
- **He mentioned the role played by different government departments including NLC for land acquisition. He enlighten the community on the two**

forms of compensation by NLC(cash or land for land). The engagements on land will be led by NCL.

- He further noted the job and business opportunities that will come along with the project. He reminded the community that the success of the project will depend on the cooperation from all stakeholders within the project.
- **Linda Were from AOC** gave a project overview and emphasised that a separate ESIA for water was underway. The project will have continuous engagements while adhering to the Kenyan constitution. Called on Golder consultant to give their presentation.

KEY EXPLANATIONS

- **Muthoni Koinange, from Golder,** gave an introduction of Golder and its Local partner Ecoscience Engineering**.** She further gave an overview of all the consultations and surveys on the project that have been carried out since 2015. She mentioned the role of Golder was to advise on mitigation of impacts as an independent body.
- **Philip Abuor, Ecoscience engineering** categorized impacts into direct and indirect. The project must meet international standards, NEMA and the Kenyan Constitution. Gave an overview on Air quality, dust, waste management, water quality and quantity and accidents while mentioning the proposals on mitigation to the project.
- **Muthoni Koinage**, gave an overview on Culture and heritage, graves and sacred trees/sites, education strategy, Economy and livelihood, Community Development Plan, National and Local content plan, Community Health and safety.

- [redacted] narrated the history of oil and gas exploration in Kenya from 1940 to 2012 when Kenya made its first discovery
- He narrated the origin of Early Oil Pilot Scheme (EOPS) - why it was conducted, and the lessons learnt from it.
- He explained how the project explored several water options and finally arrived at Turkwel dam as the most appropriate and suitable water source
- He explained how land, water and NEMA approval is crucial for the project.
- He mentioned that the ESIA consultation meeting is the process of acquiring NEMA approval.

Question and Answers Session

Commentator	Issue/Question/Comments	Response
[redacted] - **Riting Elder**	He lamented the unfulfilled commitments made to the community during dam construction. He raised concerned on the number of animals which have been eaten by crocodiles in the dam with no compensation. He requested the project to consider monthly cash transfer to the community member who were displaced by the dam.	[redacted]; Appreciated the questions and informed the public the KWS was in charge of compensation when crocodiles eat their animals and not KVDA.. He further said it was impossible to fence the entire dam unless they only fence the areas around settlements.
[redacted] - **Kudung'ole Village Elder**	He raised the concern of the community being displaced from their farm land during dam construction with no compensation.	[redacted]; He acknowledged that compensation were made during displacements as per government rates and they have the records in government records. On community benefits, he explained that KVDA had done some CSR like building of Riting Primary School, promoting fishing despite the decrease in fish but plans are underway to increase the fish. He confirmed that Area chief knew about plans to add more fingerlings into the dam.
[redacted] **-Chepokachim Village**	He emphasised the value of water to be equivalent to Oil and asked POK to treat the Pokot community like the Turkana when it comes to allocation of opportunities.	Comment Noted.

Commentator	Issue/Question/Comments	Response
	He requested for the scholarships that were given during exploration to also be given to the Pokot. He requested POK to consider helping the community build and equip schools like Samum, Reres and Chepokachim Primary Schools which fall in the upstream of the dam. He also requested the construction of a hospital in Kudung'ole.	
[redacted]	He wanted to know when the actual project would commence. He inquired why the 6 feet deep underground is a government resource. He asked whether land will be compensated for those who will be affected by the water pipeline. He further asked what will be done in the case of trees that community does not want to be cut or graves which should not be disturbed. He urged POK to commence CSR projects like irrigation schemes as the project work commences.	[redacted] He said the actual project will only commence after land, water and NEMA license for the project are acquired. He said that the contractor has projected that they will acquire Field Development Plan (FDP) by the end of this year then Final Investment Decision by the end of 2022. Community concerns and requests will be incorporated in the FDP. He explained that the constitution stipulates that any resource found 6 ft deep under the ground is a government resource and will benefit the citizens through government projects. On compensation, he promised the community that the due process will be followed in a consultative manner as per the constitution of Kenya. Land engagements will be led by NLC and they already gazette the project area.

Commentator	Issue/Question/Comments	Response
		Muthoni Koinange; On trees and sensitive cultural sites she informed the community that Golder has advised the project to work closely with the community to identify such sites.
[redacted]**-Ass. Chief Kachawa Sub-Location**	He asked whether POK will consider CSR such as school infrastructure further upstream of the dam. He also asked whether schools can benefit from water piping since children risk getting water direct from dam. He requested that hospitals be built around the dam adding that people get sick by using dirty water from the dam.	Comment Noted.
[redacted]**- Chief Endough Location**	He noted that those indirectly affected by the project are the majority and sought to know if and how they will benefit from the project. He sought to know what plans POK had education, health and road infrastructure in the area. He asked if the project has any plans for the upstream communities to benefit.	Comment Noted
[redacted]**University Student**	He wanted to know the criteria that will be used to advertise for jobs during the project. He asked whether local communities will be prioritized. He asked if KVDA has had bursaries and	**Bethwell Sang;** He said that to maximize benefits for the community, Golder has advised the contractor to put in place Local Content Development plan. He added that this will maximize opportunities for local communities.

Commentator	Issue/Question/Comments	Response
	scholarships for students from the community.	He added that the Local Content Plan will inform the criteria of advertising and recruitment of local community members. [redacted] KVDA doesn't offer scholarships under its CSR.
[redacted]	She appreciated that NLC will be identifying impacted settlements along the proposed water pipeline route. She requested that students be given bursaries when the project commences. She also requested for CSR citing what KenGen did to benefit community.	Comment Noted.
[redacted] **Sirwach Village**	He urged POK to expedite progress of the project for the community to start benefitting just like the Turkana have benefitted. He asked whether POK is working with KVDA adding that KVDA did not compensate the community.	[redacted]; He urged the community members to leave legacy issues aside and concentrate on the ESIA consultations arguing that the meeting is about project impacts on the ecosystem and the benefits to the community. He reminded the gathering that KVDA is only a key stakeholder in the project just like the community is. He said that report by Golder will cushion the community from project impacts.
[redacted]**Youth Korpu Sub-Location**	He said that since the water will benefit the government and the Turkana, the community should get their stake through construction of a university or a college in the area. He also	Comment Noted.

Commentator	Issue/Question/Comments	Response
	requested that bursaries should be given to students in the area. He added that by doing so, it would be easier for POK to get water for the project. He inquired how the 2400 jobs will be shared and requested that they be shared between Pokot and Turkana equally.	
[redacted] **Former Councilor**	She reminded the gathering that Golder is an independent consultant from KJV and POK and urged community to put emphasis on the ESIA Presentation. She applauded Tullow for supporting the two conservancies in West Pokot(Pelow and Masol). Urged POK to resume the funding for the reformed warriors to be kept busy and earn a living. She encouraged POK to engage communities from both Kacheliba and Kapenguria constituencies since the dam covers the two. She disagreed with the aspect of closed camps since they expect to do business with the employees during the construction phase of the project. She urged project to prioritize women and youth groups in the project by offering business	Comment Noted.

Commentator	Issue/Question/Comments	Response
	opportunities and job opportunities.	
[redacted] - **KVDA**	He urged the community to work with the project contractors. He promised that KVDA will work together with POK for the success of the project. He commended area local leaders for ensuring minimal deforestation. He wanted to know the qualification needed and type of jobs available needed for the 2400 job opportunities during construction.	**Bethwell Sang;** He explained that there will be skilled, semi-skilled, unskilled jobs.
[redacted] **Turkwel Gorge Dam Chairman**	Thanked [redacted] for fulfiling his promise of having the consultation meeting in Riting village as promised during project disclosure in Turkwel. He requested POK to set up community resource offices in Turkwel and Riting. Encouraged the POK team to tour the dam for familiarization. He requested for fair consideration in employment during the project considering illiteracy levels are still high in the area.	Comment Noted.
[redacted] **Office of Area M.P**	He urged the community members to be systematic when requesting for CSR project. He noted that there are those directly impacted	[redacted]**;** Community land can be registered and the community will be compensated not individuals. He

Commentator	Issue/Question/Comments	Response
(Kapenguria Constituency)	by the water pipeline and those who live upstream who are indirectly affected. He requested to know how both groups will benefit from the project. He asked about tree felling especially in grazing areas where land is communally owned and inquired how such will be handled during compensation.	added that if community has not registered their land, the compensation will be given to the county government which will in turn assist the community. He argued that it is the community which will identify the projects to prioritize. He reiterated that no individual will be given community land compensation. He said that CSR will be done in partnership with national and county governments.
[redacted]	He noted that the upstream community is large and need CSR like roads and school infrastructure.	Comment Noted.
[redacted] **Youth Riting**	He was concerned that many people were left out during the snap shot social survey and that the exercise should not be restricted to two hundred meters from the proposed route.	**Bethwell Sang;** He noted that what was conducted was a baseline survey to identify settlements, schools, hospitals, game reserves along the proposed pipeline route. He reiterated that the data collected was not for compensation purposes. NLC will conduct a survey on the pipeline route and negotiate with the impacted community or individuals.
[redacted]	He lamented on the meeting mobilization strategy since most villages from Pokot North were left out. He urged the POK Team to familiarize itself with the entire area around the dam even	[redacted] The Chief argued that all chiefs from North Pokot knew about the meeting but only a few opted to attended. He urged North Pokot residents not to feel neglected and to feel free to attend meetings.

Commentator	Issue/Question/Comments	Response
	extreme upstream.	

NB; Some responses apply to more than one question.

Closing Remarks

Bethwell Sang;

He assured the community that their views and requests were all noted and will inform the prioritization of CSR and partnerships during project. He added that CSR projects change according to community priorities. He further outlined the CSR projects done so far for the community which included scholarships for vocational training, School Greening Challenge Initiative in partnership with KenGen, Bursaries and employment opportunities through NRT.

[redacted];

Thanked the community for attending the meeting and asked Muthoni from Golder to hand over a folder containing the non-technical summary, BID and the ESIAs Key Committments to the area chief and community representatives.

Closure of the meeting

There being no other agenda to be discussed, the meeting was adjourned with a word of prayer from [redacted] at 1612 Hrs.

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ANNEX II

C

Resettlement and Livelihood Restoration Framework

1 Resettlement and Livelihood Restoration Framework

PROJECT OIL KENYA

UPSTREAM RESETTLEMENT AND LIVELIHOOD RESTORATION FRAMEWORK

WORKING DRAFT

September 2021

CONTENTS

Annexes:

Executive Summary

Project Oil Kenya is an overarching term to encompass the development, production and export of crude oil from the South Lokichar oil fields in Turkana County (the Upstream Project), along the heated, insulated and buried crude oil export pipeline the Lokichar to Lamu Crude Oil Pipeline (LLCOP - the Midstream Project) of approximately 823 kilometres in length and 18-inch-wide, to the Lamu Marine Terminal for export. This Resettlement and Livelihood Restoration Framework (RLRF) focuses on the Upstream Project only. A separate document is prepared for the Midstream.

The Upstream Project will produce oil from production wells located on multiple well pads. The National Land Commission, on behalf of MoPM, will acquire "polygons" of land across the different oilfields. In order to minimise the impacts of land acquisition, land not required by the Project within the polygons will continue to be available for community use.

This Resettlement and Livelihood Restoration Framework sets out:

- The Upstream Project's land requirements, the nature of displacement impacts arising from Project land use and efforts made to avoid and minimise these impacts.
- The legal and policy framework for Project land acquisition, involving the national legal framework and international lender requirements per IFC Performance Standards, notably *IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement (PS5).*
- The Project land acquisition process involving the statutory process to be undertaken by GoK to make land available for the Project and supplemental work to be undertaken by the Project to meet additional IFC requirements.
- The statutory and supplemental entitlements of affected communities and persons, including compensation, assistance and livelihood restoration support.
- Plans for building on this Framework in preparing and implementing the Resettlement and Livelihood Restoration Plan.
- Plans for stakeholder engagement as part of the land acquisition process.

This Framework builds on an Upstream Land Assess Strategy prepared in March 2020 by Project partners and shared previously with IFC for comment[1], with IFC comments reflected in this Framework. In future this Framework will be developed further into a Resettlement and Livelihood Restoration Plan, which will contain further detail of displacement impacts and the entitlements to be provided. This sequence of documents is summarised as follows:

- **Draft Upstream Land Access Strategy** – prepared in March 2020, the Strategy provided an initial overview of the approach to land access for the Upstream Project. IFC provided comments on the Strategy in September 2020.
- **Development of a Resettlement and Livelihood Restoration Framework** – The framework builds on the Land Access Strategy and includes further details of Upstream Project land requirements, potential displacement impacts, the land acquisition process and compensation and entitlements to be provided. The Framework document sets out a roadmap of preparatory activities to be undertaken prior to Final Investment Decision (FID) and will feed into stakeholder engagement relating to Project land access.
- **Development of a Resettlement & Livelihood Restoration Plan** – This will be developed following submission of the ESIA and prior to FID. This will provide a record of work and studies done to date and set out the detailed plans, schedule, roles and responsibilities etc. for implementation post-FID. The Plan will be disclosed in line with national and IFC requirements.

[1] IFC comments dated 10th September 2020.

- **Implementation of the Resettlement & Livelihood Restoration Plan** – Implementation will be required to commence immediately following FID, but some early works related to resettlement activities may be required to be undertaken prior to FID to support the construction schedule (to be confirmed).

IFC Performance Standards recognise there are situations where the Government will lead resettlement activities. In these cases, the Project will collaborate, to the extent permitted by the responsible agency, to achieve outcomes that are consistent with the IFC Performance Standards.

Data from the Government-led statutory acquisition process is required to feed into and complete the planning and implementation of additional activities required to meet IFC Performance Standards.

This Resettlement and Livelihood Restoration Framework explains how the statutory land acquisition process and the Project's supplemental activities will be delivered in a coordinated manner to provide Project land access and compliance with national legislation and IFC Performance Standards.

1 Introduction

1.1 Project Context

Project Oil Kenya is an overarching term to encompass the development, production and export of crude oil from the South Lokichar oil fields in Turkana County (the Upstream Project), along the heated, insulated and buried crude oil export pipeline the Lokichar to Lamu Crude Oil Pipeline (LLCOP - the Midstream Project) of approximately 823 kilometres in length and 18-inch-wide, to the Lamu Marine Terminal for export. Figure 1 presents a schematic of the currently planned main elements of Project Oil Kenya, although this is subject to change as the Project design is developed in 2021.

Project Oil Kenya is a Joint Venture between the following Project partners:

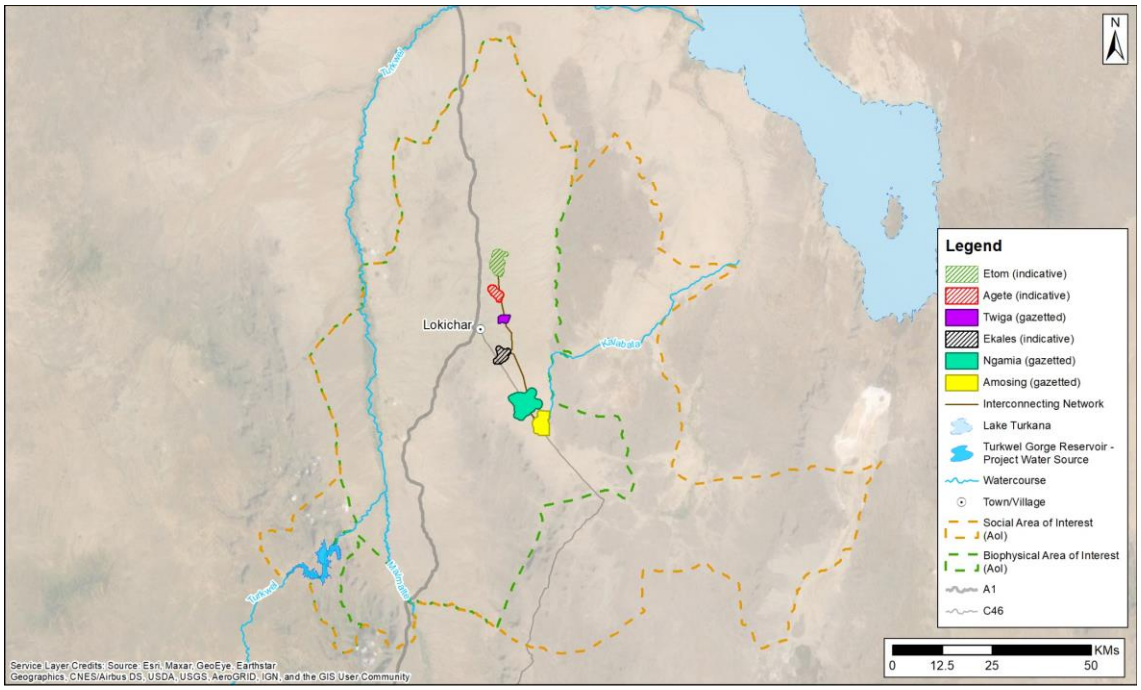
- The Government of Kenya;
- Tullow Kenya B.V (TKBV);
- Africa Oil Kenya (AOK); and
- TOTAL.

Tullow, Africa Oil and Total are collectively referred to as “the Project” in this Resettlement and Livelihood Restoration Framework, but are formally “the Contractors” under the Production Sharing Contracts (PSCs).

The Upstream Project (the South Lokichar Foundation Stage Development Project) entails construction of 61 wellpads (plus 12 contingent wellpads) across the Twiga, Amosing, Ngamia, Ekales/Agete, and Etom fields, the Central Facility Area (CFA) located within the Ngamia field and a buried water pipeline from Turkwel dam to the CFA. The Upstream Project will require land for roads, well pads, the Central Facility Area including an Integrated Waste Management Facility, a landfill, interconnecting infrastructure such as buried flow lines and overhead power transmission lines, the buried water pipeline from Turkwel Dam to the CFA and temporary construction camps.

As illustrated in Figure 2, the Project land requirements for the well pads and interconnecting infrastructure are in multiple smaller parcels of land spread over a large area. As a result, the GoK decided to acquire the larger “polygons” of land within which the well pads and interconnecting infrastructure in each field would be located. The polygons of acquired land would not be fenced and only specific facilities within the polygons, such as well pads and the CFA, would be fenced. Communities will still be able to cross and access land which is not used by Project facilities within the polygons. The location of the well pads and interconnecting infrastructure was designed to keep the size of the field polygons to a minimum. Outside of the field polygons, land will be acquired for the water pipeline and interconnecting infrastructure.

Figure 1: Map of Upstream Project Land Footprint



The total Upstream Project land to be acquired by GoK is approximately 11,000 ha. However, the Project will only require a fraction of this land area for its activities - approximately 1,450 ha. Project land requirements are set out in **Annex A**.

The Upstream Project and the Lokichar to Lamu Crude Oil Pipeline (the Midstream Project) are being developed on coordinated basis and are structured to support Project financing for the Midstream Project. The approach to land acquisition is consistent between the Upstream Project and the Midstream and a separate Resettlement and Livelihood Restoration Framework and Plan is being prepared for the Midstream.

1.2 Purpose & Scope

The purpose of this Resettlement and Livelihood Restoration Framework is to set out how land will be provided for the purposes of the Upstream Project.

This framework document will be developed further into a Resettlement and Livelihood Restoration Plan.

1.3 Land Access & Resettlement Principles

As envisaged in the Production Sharing Contracts (PSCs) land access for the Project will involve Government-led land acquisition in line with national statutory land acquisition processes set out in Kenyan law and Project-led supplemental activities to meet International Standards.

The key principles which inform this Resettlement and Livelihood Restoration Framework are:

- **GoK-Led Land Acquisition Process** - in accordance with the provisions of the PSCs, GoK will acquire the Project Land in accordance with Kenyan Law and avail it to the Upstream Project.
- **Monetary Compensation** – Monetary compensation for land and assets, in accordance with the provisions of Kenyan law, will be the sole responsibility of GoK, including conducting associated activities such as asset surveys and valuations.

- **Responsibility for relocation**: GoK will conduct resettlement in accordance with Kenyan law. The Project will carry out supplemental activities to assist relocation of households and meet international standards.
- **Information Sharing** – The GoK will ensure timely sharing of appropriate information from the statutory land acquisition process with the Project to enable the Project to define necessary supplemental activities to meet International Standards.
- **Compliance with International Standards** – Project activities related to land access will comply with IFC Performance Standards as well any other internal requirements of Project partners (all together referred to as the "**International Standards"**).
- **Impact Minimisation** - The Project will seek to minimise use of the land acquired by GoK such that only land required for Project Facilities is used exclusively by the Project, (ie. with access restricted by security fencing). This will mean that existing land users will be able to continue use of land within the polygons until and unless it is required.
- **Stakeholder Engagement –** GoK will be responsible for engagement with stakeholders and land and asset owners in applying the statutory land acquisition process. The Project will undertake supplemental stakeholder engagement in a culturally appropriate manner to enable informed and appropriate consultation and participation of stakeholders and affected communities.
- **Transparency and Accountability** – The Project will work with GoK and County Governments to provide timely and accurate information to stakeholders on the resettlement and livelihood restoration process.
- **Disclosure** – GoK will provide disclosure regarding the statutory land acquisition process in line with national regulations. The Project will be responsible for disclosure of the Resettlement and Livelihood Restoration Plan in line with international standards.

1.4 Structure of this Framework

This Framework is structured as follows:

- **Section 2 Project Land Requirements and Context -** describes the Project land requirements, measures taken to avoid or minimise displacement impacts, the existing land ownership and land use context and overview of anticipated impacts arising from Project land use.
- **Section 3 Legal and Policy Framework** – summarises the Kenyan legal framework and IFC requirements relating to land acquisition, with further details provided in Annex B.
- **Section 4 Land Acquisition, Resettlement and Livelihood Restoration Process** – describes the processes of GoK land acquisition, as defined in Kenyan law, and the Project's supplemental activities to meet IFC requirements, including in relation to resettlement assistance, livelihood restoration and support for vulnerable persons.
- **Section 5 Eligibility & Entitlements Framework** – sets out the draft entitlements for persons affected by land acquisition, including statutory compensation and allowances and supplemental entitlements to meet international standards.
- **Section 6 Development of Resettlement and Livelihood Restoration Plan** – provides the plans for preparation of the Resettlement and Livelihood Restoration Plan, which will build on this Framework and include more data, including from the GoK land and asset surveys and valuations.
- **Section 7 Stakeholder Engagement** – describes the plans for engagement with stakeholders and affected persons relating to Upstream Project land acquisition.
- **Section 8 Implementation Plan** – provides an initial outline of plans for RLRP implementation, including roles, schedule, monitoring and evaluation.

In addition, the Annexes provide further details on:

- Annex A – Upstream Project Land Requirements;
- Annex B – Legal & Policy Framework;
- Annex C – Land Use and Socio-Economic Context
- Annex D - Key Land Acquisition Data from GoK

2 Project Land Requirements and Context

2.1 Project Land Requirements

Land component	Specific land	Estimated Land Requirement (ha)
CFA	CFA	250
Wellpads	Wellpads	540
Landfill	Landfill Ngamia	40
Interconnecting Network (Oil gathering network, infield-OHTL and Road network)	Oil gathering network, infield-OHTL and Road network	620
	Total	**1,450**

2.2 Minimization of Land Use and Displacement Impacts

The Project has sought to avoid and minimize displacement impacts and to minimise the amount of land required for Project facilities. While MoPM will acquire “polygons” of land, within those polygons, the Project has identified a defined footprint of approximately 1,450 hectares which will be required for Project facilities versus the polygon land area of approximately 11,000 hectares.

The areas identified as required for Project facilities include well pads, Central Facilities Area and a landfill, and also includes any necessary safety buffer zones. Land not required by the Project within the polygons will continue to be available for community use.

2.3 Land Use and Ownership in the Upstream Project Area

2.3.1 Land Use and Land Based Livelihoods

As described in Annex C and reflecting the arid and remote location of the Upstream Project area, the predominant land use and source of livelihoods in the Project area is livestock pastoralism, particularly goats, camels, sheep, donkeys and some cattle.

Pastoralist livelihoods are typically supplemented by small-scale income-generating activities such as the sale of firewood and charcoal, weaving of mats and baskets and other small-scale business activities. Emergency relief in the form of food aid or the provision of cash supplements to households continues to supplement traditional livelihoods and is reported to represent an important element supporting the continued existence of traditional pastoralism.

Seasonal patterns of rainfall, quality of grazing and availability of water, mean that the Turkana are nomadic pastoralists. In the Project area they live in traditionally constructed homesteads (see Figure 3) made from tree branches, bark, vegetation and tarpaulins, which are occupied for varying time periods, ranging from long term homesteads used all year round, to short term

(seasonal) homesteads for accessing wet or dry season grazing and very short term (migratory) homesteads used en route to seasonal grazing areas. Typical characteristics of these homestead structures are as follows:

- Long term homesteads typically take around 5 days to build and are occupied all year round by mothers with young children and elderly members of households, whilst the men and youth are away with livestock accessing grazing, often returning to the long term homestead during the wet season.
- Short-term homesteads (seasonal) - typically used for 2-3 months, whilst accessing wet season livestock grazing in an area, and only take one or two days to construct.
- Very short-term homesteads (migratory) – occupied for a few nights en route to other areas, and only take a few hours to construct.

Each of these types of homestead typically have animal shelters next to them (see Figure 4).

Figure 2: Traditional Homestead Structures in the Project Area

Note: Homesteads comprise circular structures with *akai* being for nighttime / sleeping and *ekol* being daytime structures which provide shade. In addition, a homestead usually has temporary animal enclosures nearby for protecting livestock at night, made from thorned branches.

Figure 3: Nomadic Animal Shelters in the Project Area

Although rainfall varies from year to year, the Upstream Project area typically experiences 'long rains' from April to June and 'short rains' around November and December. The wet seasons are interspersed with dry seasons, during which livestock move to areas of dry season grazing, usually to the hills some 10km – 25 km to the south west of South Lokichar towards Kainuk.

2.3.2 Land Ownership in the Upstream Project Area

Land ownership in the Upstream Project area is unregistered community land, which in line with the Constitution of Kenya and national legislation is held in trust by the County Governments on behalf of the communities.

Turkana people recognise that land is a shared resource and common property across all of people of Turkana. Land in the Project area in Turkana is unregistered community land that belongs to all people of Turkana. Similarly, the land through which the 8 km stretch of water pipeline passes in West Pokot from the Turkwel reservoir before entering Turkana County, is also understood to be unregistered community land belonging to the people of West Pokot County.

Elsewhere in Turkana and outside of the Upstream Project area, in addition to unregistered community land, land may be classified or held as either private or public land. The majority of private or public land is located in urban settings such as Lodwar (the County capital) and towns such as Lokichar.

Natural resources on community land, such as trees, grazing shrubs, medicinal plants and water courses are also owned communally.

2.4 Summary of Potential Project Impacts

Potential displacement impacts expected to arise from Upstream Project land are outlined below and further information is provided in Annex C. More detailed analysis of impacts will be included in the subsequent Resettlement and Livelihood Restoration Plan once Project land

areas are confirmed and will be informed by future Project baseline field work and the GoK's land and asset surveys as part of the government led statutory land acquisition process.

Potential displacement impacts arising from Upstream Project land requirements, as reflected in the Outline Entitlements Framework in Section 5, are as follows:

- **Physical displacement**, loss of dwelling, will occur if a household is occupying a homestead structure and is required to move away from a Project area. This is expected to only apply to *occupied* long-term and seasonal homesteads, since people do not re-use homestead shelters that they have vacated unless they have been very recently built and in good repair. Physical displacement would not apply to "very short term" / "migratory" homestead structures, since these are only used for 2 or 3 days and would be vacated in a few days in any case. Directly affected households will be identified as part of the NLC land acquisition process.

  Partial / indicative total for physical displacement: this will be identified as part of the NLC survey process**.**

- **Displacement of Structures Other than Dwellings:** Animal shelters / enclosures which Turkana and West Pokot people construct next to their homesteads will be affected. These are circular enclosures of branches and twigs cut from nearby trees and shrubs, for keeping goats, camels etc overnight. These are temporary structures which are quick to assemble. When the people leave a homestead, the animal shelters fall into disrepair and tend not be re-used due to build-up of dung and risk of disease, animal ticks and other pests. Other private physical assets, which could potentially be affected by Project land use, include dug water holes, though these have not been observed in the three fields in recent years due to the provision of water tanks by the Project.

- **Displacement of Community Structures:** Community facilities or structures which lie within the Project land areas and which may be affected by Project land use include: the new Lokosemikori Primary School located in the Amosing field, constructed in 2018 but not in use in Nov 2019; and community water tanks provided by the Project in the Twiga, Ngamia and Amosing field areas, including the raised metal water tank linked to the piped community water system constructed 2018-19, just north of Ngamia-1.

- **Economic Displacement due to Loss of Communal** Grazing Land: The majority of the Project area is used for nomadic livestock grazing at certain times of year depending on seasonal rains. Wet season grazing in the area typically takes place from April to June and November to December, and at other times of the year pastoralists take their livestock to dry season grazing areas generally located towards hills 10km - 25km south west of the Project area.

  The impact of Project land use on grazing livelihoods, however, is expected to be low in view of the large areas of available grazing land in and around the Project area and the relatively limited area of land directly affected by the Project footprint. Furthermore, for much of the year (especially during dry seasons) livestock is moved to dry season grazing areas outside of the Project area, generally towards the hills 10km to 25km to the south west.

  Because of the arid conditions and sparse vegetation, animals require large areas over which to graze. This means that the Project affected land areas would only support a relatively few number of livestock, again indicating only minor impacts on land based livelihoods.

  Temporary disruption of livestock movement could potentially occur, eg. due to construction of linear infrastructure such as buried flow lines, but in reality this impact is expected to be minimal since only limited stretches of land would be affected at any one time and animals could easily find alternative routes and mitigation could include livestock movement paths through the linear construction areas.

- **Loss of crops and planted trees:** the arid conditions and limited water supplies in the Upstream Project area mean that there is virtually no cultivation of crops or planted economic trees. It is therefore not expected that there will be any impacts on crops or planted trees.
- **Loss of Access to Natural Resources:** As well as using land for livestock grazing, communities in the vicinity of the Project area use a variety of natural resources: wood for fires and construction of homestead shelters, medicinal plants, food (wild fruits and roots) etc. Land clearance for construction purposes will involve the loss of these resources in areas of the Project footprint. However, the actual level of impact on communities is expected to be low due to availability of similar natural resources nearby and the large extent of community land with similar natural resources in the vicinity of Project areas.
- **Impacts on Graves and Cultural Heritage:** Graves are very important to Turkana communities and are located across the landscape, often where people passed away, and not in specific communal burial areas. There is very little experience of grave relocation in the Turkana and during the E&A phase the Project always sought to avoid any identified graves. Although wherever possible graves will be avoided, it is likely that some graves will be affected by the Upstream Project's land requirements, in which case culturally appropriate steps will need to be agreed and taken to relocate graves, including support for reburial ceremonies. Experience from the E&A Phase showed that apart from graves, there are few other cultural heritage sites in the Project area.
- **Impacts on Host Communities:** IFC PS5 defines 'host community' as any community receiving displaced persons. Although Upstream Project land access is expected to result in some physical displacement, there are not expected to be host community impacts because: there are large areas of communal land and similar suitable areas nearby for establishing new homesteads; the nomadic nature of the community means that people already frequently move homesteads from location to location; and the distribution of homesteads across the area is sparse, so affected households will be able to construct new homestead structures nearby outside of Project affected land areas.

3 Legal and Policy Framework

The Kenyan legal framework and IFC requirements relating to land acquisition are detailed in Annex B. This includes:

- Articles of the Constitution of Kenya (2010);
- Key pieces of national legislation and regulations such as the Land Act (2012), the Community Land Act (2016), the Land (Assessment of Just Compensation) Rules (2017) and the Community Land Regulations (2017).
- The key IFC Performance Standards (PS) of relevance to land access by the Upstream Project including:
  - PS1 Assessment and Management of Environmental and Social Risks and Impacts – specifically related to stakeholder engagement;
  - PS5 Land Acquisition and Involuntary Resettlement – particularly related to requirements for private sector responsibilities under Government-managed resettlement;
  - PS7 Indigenous Peoples – particularly related to the requirement for free, prior and informed consent related to the use of land traditionally used by indigenous peoples.
- Gap analysis between Kenyan legal requirements and IFC requirements and the planned approach for addressing these gaps.
- Corporate policies of Project Partners.

4 Land Acquisition, Resettlement & Livelihood Restoration Process

4.1 Overview of Approach

Land acquisition and resettlement for the Upstream Project, will be undertaken in accordance with the provisions of the Land Act (2012), with compulsory acquisition done by the National Land Commission (NLC) as the "acquiring authority" under the legal framework as set out in the Land Act (2012).

Land gazetted by NLC as part of the GoK compulsory acquisition process is based on polygons (outer circumference) that reflect the upstream Project land footprint. Project facilities will be located within these polygons. Areas within the acquired polygons which are not used by the Project facilities or RoW, will still be available for use by the community and the polygons will not be fenced but will be demarcated with marker posts.

The NLC will acquire the land required for the Upstream Project on behalf of Ministry of Petroleum and Mining (MoPM) - the "acquiring body". MoPM will then provide the relevant land rights (via a lease agreement or similar) to the Project in accordance with the terms of the PSC.

As a separate process to the statutory land acquisition work, the Project will undertake supplementary activities required to meet IFC Performance Standards, such as providing livelihood restoration, drawing on data collected by NLC as well as additional socio-economic data collected by the Project.

4.2 Key Assumptions

The land acquisition process for the Upstream Project is based on the following assumptions:

- GoK will acquire land required for the Upstream Project in accordance with the terms of the PSC, following statutory land acquisition processes set out in Kenyan law.
- GoK will provide all necessary information required by the Project in relation to describing the land acquisition process and in planning supplemental; non-statutory land access activities and entitlements.
- GoK and the Project will hold discussions to enable the Project to document the NLC's survey and data gathering processes, valuation methodologies, compensation rates, engagement processes and messaging to affected persons and communities. Details of the GoK / NLC process will be presented in the Resettlement and Livelihood Restoration Plan.
- Fair, just and prompt compensation for compulsory land acquisition will be provided by GoK in line with Kenyan legislation. The Project assumes that this will equate to the "full replacement cost" as set out in IFC PS5 and will work with GoK to demonstrate this in its documentation, including taking into account the statutory 15% disturbance allowance[2] (see Section 4.2.2 below). The Project will hold discussions with GoK to confirm this and document how the GoK approach to compensation equates to "full replacement cost".
- No additional "value-based compensation" will be provided by the Project. Any entitlements to be provided by the Project will relate to supporting the physical process of relocation from the Project footprint (as agreed by NLC), providing additional assistance to vulnerable persons (defined below in Section 5.4.2) and the restoration of livelihoods where these are affected by Project land use.

[2] A 15% Disturbance Allowance is identified in the Kenyan Land (Assessment of Just Compensation) Rules 2017.

- Whilst statutory monetary compensation, disturbance allowances and relocation assistance will be provided to physically displaced households, in-kind replacement house options will not be offered by NLC under the statutory land acquisition process as this is not standard practice. In addition, the cultural norm in the Project area is for households to construct their own homestead shelters.

  Reflecting the nomadic character of communities in the Project area, these homestead structures are temporary in nature, with households periodically moving and re-building them in different locations. Assistance provided to physically displaced households will include relocation assistance from Project affected areas including transport assistance, provision of homestead construction materials (eg. timber and tarpaulins), transitional support (such as food baskets for a period to be agreed) and additional assistance to vulnerable households, if required, for homestead construction. The relocation process will be managed to ensure that affected households have homestead structures ready to move to before being required to relocate from Project land areas. The Project will monitor physically displaced households to ensure that households are not economically or socially disadvantaged by receiving cash compensation for homestead structures or subject to homelessness or hardship resulting from relocation.

- Resettlement and livelihood restoration activities will be planned and implemented in coordination with the National and County Government to ensure that affected persons and communities are provided with access to benefits commensurate with the degree of impact caused by the Project.

- If necessary, to supplement data provided by GoK, an appropriately scoped and focused baseline survey will be conducted to establish the socio-economic characteristics of affected households and identify vulnerable persons, prior to implementation of resettlement and livelihood restoration activities. Such work will not take place prior to the completion of statutory land acquisition within the approval of GoK. However, the Project will aim to agree with GoK for the socio-economic surveys to be undertaken prior to payment of compensation by GoK and prior to affected persons being required to relocate from Project land areas.

- The monitoring and evaluation process developed to assess the effectiveness of measures to restore livelihoods will include independent auditing.

- Statutory appeals and complaints processes will apply to the statutory land acquisition and compensation process. The Project grievance management system will cover Project-related resettlement and livelihood restoration activities and will be available throughout the planning and implementation of these activities.

- Vulnerable people will be identified and the Project will provide targeted measures to assist relocation and ensure that they are not disadvantaged in accessing livelihood restoration support or in sharing project benefits. This assistance will be culturally appropriate and be designed in consultation with stakeholders and affected communities. The Project will take the lead in identifying and providing targeted assistance to vulnerable persons, drawing on findings from the socio-economic survey noted above.

- This Resettlement and Livelihood Restoration Framework and the subsequent Plan will be reviewed and approved by the IESC (when appointed by Project Lenders) and disclosure in line with IFC requirements will take place.

The following sets out the statutory land acquisition process and supplemental activities to be undertaken by the Project to meet IFC requirements. Through discussion with the GoK, and as summarised below and in Figure 5, the statutory process and supplemental activities have been designed to be delivered in a coordinated manner.

Figure 4: Overview of Statutory Process and Supplemental Project Activities

4.3 Key steps in the Statutory Land Acquisition Process

The key steps in the statutory land acquisition process are as follows:

1. The acquiring body (MoPM) submits an application for compulsory land acquisition to the NLC through the relevant Cabinet Secretary, detailing the coordinates and maps showing land requirements for the Upstream Project.

   NLC verifies the application and that the land is required for a public purpose, the list of affected parcels and availability of compensation funds.

2. NLC publishes a Notice of Intention to Acquire Land for Public Purposes in the Gazette, in at least two daily newspapers with nationwide circulation, the County Gazette and at the respective County, Sub County and Ward offices.

   NLC will conduct a public participation process with stakeholders in the affected areas. Public participation will also be implemented throughout the remaining steps of the statutory process.

3. NLC survey of the land and valuation will be completed which entail inspection of the land for mapping and asset valuation purposes.

4. NLC will publish the Notice of Inquiry in at least two daily newspapers with nationwide circulation, and the County Gazette and at the respective county, sub county and ward offices. The notice will set out the date and locations where the NLC will conduct inquiries.

   NLC will receive written claims for compensation in the period preceding the published date of inquiry.

5. NLC will conduct inquiry which entails carrying out due diligence to identify rightful owners and the nature of interest on land e.g. land owner or tenant. NLC also hears the claims and makes an assessment and valuation of the claims to determine the full and just compensation to be payable to the rightful persons.

6. The acquiring body (MoPM) deposits the compensation funds with the NLC in addition to survey fees, registration fees and any other incidental costs.

7. NLC prepares notices of compensation awards for affected persons which include details of the land to be acquired, the value of land and assets and the amount of compensation payable to the persons with interest in the land.

8. NLC holds compensation briefings with affected persons and PAPs communicate their acceptance (or rejection) of the award and thereafter compensation payment is made or in the case of rejection, an appeal can be made to the Land Acquisition Tribunal.

9. NLC makes payment of compensation and issues a Notice of the Date of Intended Possession of land after acceptance of an award.

10. MoL conducts a final survey of the land to produce a survey map and title documents in favor of the acquiring body (MoPM). Upon payment of just compensation and taking possession, the land shall vest in MoPM free from encumbrances. Land Acquisition must be finalized within 24 months from the date of publication of the Notice of Intention to acquire the land. If not, the land acquisition shall lapse.

11. MoPM grants legal rights to the land, through Land Rights Agreements (leases, wayleaves etc.) to be entered with the Project.

12. GoK leads relocation of PAPs from Project land in coordination with Counties, with the Project providing supplemental resettlement assistance to PAPs (see Section 4.5 below).

The statutory land acquisition process is ongoing (as at January 2021). A summary of data to be collected as part of the NLC land acquisition process and to be shared with the Project to support supplemental activities is shown in **Annex D**.

4.4 Project Land Rights

Once land title has been acquired by MoPM, the Project will enter into a number of Land Right Agreements with MoPM, as described below:

- **Land Lease Agreements**: Will apply to land that will apply to land for well pads, land fill area, CFA, waste management areasand Temporary camps. A long-term lease will be entered between MoPM and the KJV to grant the latter unfettered and where applicable exclusive land access rights to the relevant Upstream Project Land Footprint.

- **Easements/Wayleave Agreements** - Will apply to linear infrastructure. Easements and Wayleave Agreements will be entered between MoPM and the KJV granting the latter land rights for the right of way for interconnecting network and the water supply pipeline.

4.5 Supplementary Activities in the Land Access Process

To meet IFC Performance Standard requirements (notably PS5, PS1, PS7), where these go beyond the national statutory land acquisition process and compensation (see Annex X), the Project is in the process of agreeing with GoK the supplemental activities that the Project will undertake to support resettlement and livelihood restoration. The implementation of these supplemental activities will be coordinated with the Government-led process to ensure effective delivery and clarity for affected persons.

As stated in IFC PS5 (para 30) "*where land acquisition and resettlement are the responsibility of the government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with this Performance Standard*".

4.5.1 Boundaries on Project Supplemental Activities

The Project has received clear direction from GoK that it may not participate in, or interfere with, the statutory land acquisition process which is being undertaken under well-established legal procedures. The NLC will collect data and undertake engagement activities to support statutory land acquisition, and will share relevant data with the Project, where legally permitted, to provide a definitive, legally-recognised, basis for Project supplemental activities.

As summarised in Figure 1 above, the proposed supplemental activities are as follows:

Step 1: The Project plans supplemental measures and prepares the Resettlement and Livelihood Restoration Framework:

- The Project discusses and agrees with MoPM and GoK the supplemental measures (see Section 5.4 below), the approach for coordinated delivery and how to ensure that inappropriate precedents are not set for future national government land acquisition activities. The approach will also be discussed in engagements with County Governments who hold unregistered community land in trust on behalf of the community.

- In line with IFC PS5 requirements for situations involving Government-led land acquisition and resettlement (see Annex B), the Project will prepare a Supplemental Resettlement & Livelihood Restoration Plan. Initially this in the form of this Framework, which will be further developed into the Plan when detailed household-specific data on displacement impacts is provided by the NLC. The Plan will:
    - Identify and describe Government resettlement measures;
    - Identify affected people and impacts;
    - Describe NLC activities and statutory compensation and entitlements as defined in Kenyan law;

- Describe supplemental measures to meet PS5 requirements as permitted by the responsible agency;
- Provide an implementation plan, timetable and budget to implement the Plan.

- The Project will consult stakeholders (eg. National Government, County Governments) and affected communities during the development of the Plan.

The Framework (this document) will be developed in advance of NLC sharing appropriate data with the Project (which will be shown in the subsequent Plan). The Framework will set out the principles, approaches and assumptions that will be used to develop budgeted and implementable plans once household-specific data is shared by NLC.

Step 2: NLC provides the Project with Land & Asset Survey Data relating to Upstream Project land areas: GoK has agreed to provide the Project with all necessary information required to describe the land acquisition process and impacts and for planning non-statutory / supplemental activities. All data shared will be subject to appropriate confidentiality as requested by GoK. This information includes:

- The NLC's land & asset survey and valuation process to identify affected persons and assets; who did the survey work, when; how rightful owners of land and assets were established; what information and schedules were given to land and asset owners.
- Public participation, community and stakeholder engagement undertaken by the NLC including communication of the cut-off date for eligibility.
- Statutory compensation rates and allowances used by the NLC in valuing affected land and assets, including for land, trees, structures, graves, loss of business profit and disturbance allowances.
- Land and asset survey data showing affected land and assets for individual PAPs, photos and names of PAPs, PAP reference numbers, details of affected assets, including houses and structures, trees and crops, maps of surveyed land parcels and assets.
- Summary tables of PAP affected land and assets.

The Project will use the data to identify households and communities who are eligible for supplemental entitlements. These will be identified based on the qualification criteria defined in the Entitlements Matrix.

Step 3: The Project will then undertake the following activities:

- **ReviewNLC survey data:** he Project will check the completeness of details in the NLC database such as structure descriptions, photos of structures, owners and existence of other assets to support non-statutory supplemental activities.
- **Review of affected structures:** The Project will review the data on affected structures and assets, corroborate details in the NLC dataset and use the information in shaping the Project's planning for socio-economic survey work and supplemental entitlements.
- **Additional socio-economic survey of directly-affected PAPs:** In line with IFC PS5 requirements, the Project will undertake an additional socio-economic survey of persons / households affected by Upstream land requirements at the statutory cut-off date (date at which the intention to acquire the land was published in the Gazette) focusing on people affected by physical displacement and those affected by economic displacement. This socio-economic survey will draw on the NLC asset survey and establish the livelihoods baseline conditions of households prior to relocation and will be used to: gather more information on displacement impacts; to design and target supplemental measures and livelihood restoration; to identify any vulnerable persons requiring additional assistance; and for monitoring the effectiveness of subsequent restoration of livelihoods.
- **Engagement with stakeholders and PAP representatives on proposed supplemental measures:** Engagement with GoK, County Governments, other local stakeholders and PAP representatives will be undertaken by the Project in conjunction with MoPM to explain

why the Project is providing supplemental entitlements, the nature of these entitlements, eligibility for the entitlements and to get peoples' views on what supplemental measures would be most effective and appropriate to the circumstances of PAPs. Similarly, agreement will be reached on the nature of any additional transitional support that would benefit displaced households (eg. provision of food baskets for a set period), and what support will be provided to vulnerable persons. Further details on the nature of supplemental entitlements is provided in Section 5.4 and information on stakeholder engagement activities is provided in Section 7 below.

- **Planning to deliver supplemental measures including livelihood restoration:** The Project will develop the detailed plans for implementing the supplemental and livelihood restoration measures identified in Section 8 below.

Step 4: The Project prepares the Upstream Project Resettlement and Livelihood Restoration Plan: Using the detailed household-specific data from NLC on affected persons and from additional Project socio-economic surveys and plans for implementing supplemental measures drawn from the above steps, the Project will prepare the Resettlement and Livelihood Restoration Plan (building on the current Framework document). Affected persons and households will be identified from the NLC data which will provide the definitive and legally defensible list of those eligible. The Plan will include further details on the planned livelihood restoration support to be provided and plans for implementation of this support. The Plan will provide a detailed plan for implementation, including implementation budgets and timetables.

Step 5: The Project prepares PAP/Community supplemental entitlement schedules: The Project will prepare supplemental entitlement schedules for individual PAPs/affected communities which detail the supplemental entitlements. These will be based on the agreed Entitlements Framework (see Section 5). These will be separate to the compensation schedules prepared by the NLC (per Step 7 in the statutory process above) which detail the statutory awards for individual PAPs (using form LA.35 per the Land Act Regulations 2017). Liaison between the Project and GoK (via MoPM) will ensure consistency between the statutory and supplemental award schedules.

Step 6: Project briefings of PAPs/Communities on supplemental entitlements: Further to the NLC briefings of PAPs on their statutory entitlements (Step 8 in the statutory process above), the Project in coordination with MoPM and County Governments will also brief PAPs on their supplemental entitlements. These briefings will take place via meetings with affected households and communities, in the appropriate local language and with the presence of local community leaders if PAPs wish. Supplemental agreement forms signed by the PAPs and the Project will confirm agreement on the entitlements for each PAP. As part of this process, any additional household socio-economic data can be collected to provide a robust baseline for the household assets and incomes for livelihoods monitoring.

Step 7: Project delivery of supplemental entitlements: Subsequent to the NLC paying compensation to PAPs, the Project will deliver the agreed supplemental entitlements to the PAPs and affected communities (as set out in Section 5.4), including special assistance to households with vulnerable persons.

Step 8: Resettlement Assistance: At the point when GoK leads the relocation of PAPs from Project land (per step 12 in the statutory process) the Project will provide supplemental resettlement assistance to households in coordination with County Governments. Potential options for resettlement assistance to be provided by the Project to households will be discussed and agreed with MoPM and County Governments prior to discussions with households and prior to preparation of the RLRP. Any resettlement support provided by the Project will be in the form of support rather than monetary payment.

Step 9: The Project monitors delivery of supplemental entitlements including livelihood restoration, with on-going stakeholder engagement and grievance mechanism. The Project will undertake monitoring of the delivery of the supplemental entitlements, on-going stakeholder and community engagement and operation of the Project grievance mechanism.

Progress and resolution of any grievances will be regularly reviewed by the Project in consultation with MoPM. Progress updates will be provided to stakeholders such as County Governments. Completion reports will be prepared at the appropriate time to confirm that livelihood restoration measures and other supplemental entitlements have been delivered and are effective. The Project will also commission independent evaluation of the delivery of supplemental entitlements and will undertake a Completion Audit to confirm that entitlements have been provided and that the livelihoods of households have been adequately restored.

Monitoring will assess the progress of the land access, resettlement and livelihoods restoration process against the Resettlement and Livelihood Restoration Plan and will periodically assess progress and effectiveness of LAP/RAP implementation in restoring and improving living standards of project-affected people. The need for any changes or corrective action will be identified to improve delivery on a continuous basis.

A detailed monitoring and evaluation framework with key performance indicators will be developed as part of the Resettlement and Livelihood Restoration Plan. The progress and performance of land access, resettlement and livelihood restoration will also be subject to independent scrutiny by an Independent Monitoring Group (or similar, to be established in coordination with Project Lenders).

5 Eligibility and Entitlements Framework

This Section identifies the proposed entitlements for each type of displacement impact anticipated to arise from the Project and the eligibility criteria for affected persons to receive compensation and assistance. It covers statutory entitlements provided in line with Kenyan law and supplemental entitlements provided by the Project to meet the requirements of IFC PS5. The Section:

- Identifies those eligible to receive compensation and assistance (see Section 4.1);
- Defines how impacts on land and assets will be valued and sets levels of compensation to be offered to Project affected persons (Section 4.2);
- Identifies proposed supplemental entitlements to meet requirements of IFC Performance Standards where these go beyond Kenyan statutory entitlements (see Sections 4.3); and
- Summarises the above in the entitlements framework (see Section 4.4).

The entitlements outlined in this Section will be the subject of discussion and refinement during further resettlement planning engagements with Government, stakeholders and affected communities. The process through which this will be achieved is described in Section 6. The final, agreed entitlements will be presented in the Resettlement and Livelihood Restoration Plan (RLRP).

5.1 Eligibility Criteria

Persons eligible for compensation and assistance may be individuals, families, groups, businesses, organisations (for example churches) or communities which are subject to displacement resulting from Project land acquisition, loss of property or loss of access to land. Eligible affected persons are present at the time of the cut-off date and who were identified in the land and asset survey undertaken by the NLC.

Data (including GIS coordinates) on Project Affected People (PAPs) will be provided by the NLC, and include those affected by loss of land, dwellings (physical displacement), loss of other assets and persons whose livelihoods are impacted (economic displacement). See Annex D for information required from the NLC.

5.1.1 Eligibility Cut-Off

Assets established after the cut-off date (the date at which the intention to acquire the land was published in the Gazette) are not eligible for entitlements.

5.2 Categories of Eligible Persons

Categories of persons eligible for compensation, in line with IFC PS5, are as follows:

- Displaced persons who have **formal legal rights to land and/or the assets** they occupy, such as persons who are the registered owners of Project affected land.
- Those who **do not have formal legal rights to lands but do have a claim to land which is recognised under national law**, eg. communities which have customary ownership rights to community land per the Land Act 2012. As defined in law, County Governments hold unregistered community land in trust on behalf of the community. Compensation for loss of unregistered community land would therefore be paid to the County Government to hold in trust or to use on behalf of the community.
- Informal land users who have **no recognisable legal right or claim to land or assets they occupy or use**. This category includes persons who have constructed buildings or cultivate crops on land owned by others, without approval and/or knowledge of the land owner; and informal users on public land. Such persons may not be entitled to compensation for land, as they do not hold rights to it; however, they would be entitled to compensation for affected assets that they own – for example, the value of improved buildings, structures and crops. Eligibility for compensation does not create or confer a right where none previously existed and does not legitimise illegal occupation of land.

5.2.1 Eligibility Categories

The eligibility categories listed below refer to categories of persons who will experience various types of displacement-induced loss or increased vulnerability for as a result of physical and/or economic displacement and may include the following:

- Persons who hold rights to land under legal title or customary rights to land – though it is understood there are no such persons in the Upstream Project area since all land is understood to be unregistered community land;
- Persons who own affected buildings and structures, such as homesteads structures and animal enclosures;
- Communities with registered community land and assets, or unregistered community land held in trust by their County Government – all land in the Upstream Project area is understood to be unregistered community land;
- Institutions who own land and/or buildings, such as religious organisations and government authorities (eg. assets relating to schools, health facilities, roads, protected forest areas, etc.);
- Owners of seasonal crops, perennial agricultural crops or economic trees growing in the affected land areas, either on their own land or on the land of others;
- Owners or custodians of cultural heritage assets such as graves, graveyards, sacred trees, sacred stones etc.;
- Tenants of houses and/or land – i.e. occupier of rented property – this is unlikely to be the case in the Upstream Project area because all land is community owned and households tend to live in homesteads that they have built themselves;
- Businesses who have legal rights to land or buildings – these are expected to be limited to a few kiosk type businesses in the Upstream Project area;
- Persons who make use of natural resources on the land, such as Turkana pastoralist communities who graze livestock and collect firewood and medicinal plants;

- Vulnerable persons – i.e. persons for whom loss of assets or resources, and/or relocation may have a disproportionate impact on standards of living and livelihoods, due to their vulnerability and/or livelihood dependency on the land.

Specific criteria for eligibility for entitlements are set out below. Data from the NLC's land & asset survey and the Project's socio-economic surveys (to be undertaken as part of the Project's supplemental resettlement planning activities) will be used to finalise the eligibility categories.

5.3 Statutory Compensation

The NLC is undertaking survey and valuation of affected land and assets. In line with Kenyan law and regulations, such as the Land Act (2012) and the Land (Assessment of Just Compensation) Rules 2017, the basis of valuation and statutory compensation is as follows:

- **Land:** The value for land is the open market value of unimproved land at the date of publication in the Gazette of the notice of intention to acquire the land. Where active markets in land do not exist, the NLC uses comparative values from analogous settings elsewhere in Kenya. As noted below, PAPs also receive a statutory disturbance allowance of 15% added on top of the compensation value for land.
- **Orphaned Land:** The issue of orphaned land is not expected to arise in the Upstream Project area since all the land is understood to be unregistered community land which has not been divided into individual land parcels and it is expected that no privately owned land parcels will be affected.
- **Buildings & Structures:** The value of buildings and structures on the land is based on an evaluation of open market values. This applies to domestic structures (eg. houses, stores, traditional homesteads, plate racks, animal shelters, kraals), business structures and any affected community or institutional buildings. No market exists in the Upstream Project area for traditional homestead structures and animal shelters, since households construct their own – therefore, NLC valuation will take account of the time and materials required for construction. As noted below, PAPs also receive a statutory disturbance allowance of 15% added on top of the compensation value for affected assets.
- **Economic Trees & Crops:** The value of economic trees and crops (perennial and seasonal) on affected land is determined in accordance with published Government tree and crop rates. The compensation rates are specific for each type of tree and crop and vary by maturity of tree and density of crops. A 15% disturbance allowance is also added.
- **Seasonal Crops:** The arid conditions and limited water supplies mean that cultivation of seasonal crops is not expected to be observed in the Upstream Project area. If there are affected seasonal crops these will either be harvested prior to relocation or compensated for based on NLC market valuation if they cannot be harvested. A 15% disturbance allowance is also added.
- **Disturbance Allowance:** As stated in the Land (Assessment of Just Compensation) Rules 2017, a disturbance allowance of 15% based on the total compensation amount for affected land and assets is also provided to PAPs. This disturbance allowance will be taken into account when the Project assesses how GoK compensation rates relate to "full replacement cost" per IFC PS5.
- **Relocation expenses:** As stated in the Land (Assessment of Just Compensation) Rules 2017, reasonable relocation expenses are provided for persons who are required to change residence or place of business as a consequence of land acquisition.
- **Loss of Profit:** The Land (Assessment for Just Compensation) Rules state that compensation will be provided for "damage genuinely resulting from diminution of the profits of the land between the date of publication in the Gazette of the notice of intention to acquire the land and the date the Commission takes possession of the land".

- **Graves and cultural heritage sites:** In valuing and compensating for graves, standard practice in Kenya involves two components:
  - **Grave Removal and Reburial**: provision of budget to exhume graves in line with legal processes, which requires an application for a court order for exhumation; exhumation in the presence of a police officer, public health official and a relative of the deceased. No ceremonial requirements are specified. In terms of relocation after exhumation, a reburial permit is required. This permit can be issued by Chiefs and/or hospitals. Generally there is no cost associated with burial permits. Compensation payable is determined by registered valuer opinion and NLC guidance on rates set for grave types on other projects, which generally amounts to Kshs 50,000 for a grave located within compulsorily acquired land; however, this excludes payment of cash to cover customary ceremonies for family or communities below.
  - **Reburial ceremony**: A budget is provided to cover the reasonable expenses of family members in holding rituals associated with exhumation and reburial of a grave. It is noted that standard budgets for these customs are not documented and in most cases are agreed with affected communities, typically 50,000 to 100,000 Kshs.
  - **Cultural heritage site**: Other cultural heritage sites will be managed in accordance with Kenyan regulatory requirements, Project cultural heritage management procedures to recover and relocate (where appropriate) artefacts will be implemented in consultation with local communities and under the supervision of NMK where applicable.
- **Temporary Construction Sites:** Certain land areas may be required by the Project for temporary construction purposes (eg. construction camps for the buried water pipeline or inter-field connection routes). These temporary areas will where possible lie within land areas acquired for the Project, but if not, additional compensation will be provided for affected assets and temporary access to land based on temporary land lease rates established by the NLC.

NOTE: The NLC is to provide information on its methodology which will be reported in the final RLRP, therefore, the above is subject to change and confirmation.

5.4 Supplemental Entitlements

Further to GoK compensation outlined above in line with Kenyan legislation and regulations, the Project will also offer supplemental entitlements in certain defined circumstances to comply with IFC PS5 requirements. These will be recorded in a supplemental entitlements schedule to be provided to affected households separately to the statutory Compensation and Awards Schedule provided by the NLC.

The supplemental entitlements outlined below are initial proposals which will be subject to change in light of discussion with GoK, stakeholders and affected communities. The final entitlements will be presented in the Resettlement and Livelihood Restoration Plan document.

5.4.1 Physical Displacement of Households

IFC PS5 (para 20) states that physically displaced persons should be offered feasible options of "replacement housing or cash compensation where appropriate" and relocation assistance. In-kind replacement houses, however, are not provided under the statutory land acquisition processes implemented by the NLC as established by the Land Act (2012); instead fair and just monetary compensation is provided for affected house structures, as well as relocation expenses and disturbance allowances. As well as this statutory compensation and allowances, the Project will work with GoK and County Governments to provide physically displaced households with assistance in relocating from Project land areas. This assistance is planned to include transport assistance, provision of homestead construction materials (eg. timber and tarpaulins) and additional assistance to vulnerable households, if required, for homestead construction. The relocation process will be managed to ensure that affected households have

new homestead structures ready to move to before being required to relocate from Project land areas.

For the Upstream Project area, not offering an in-kind replacement housing option is not expected to cause hardship to affected households since homesteads are traditional structures built over a few days by the households which own and occupy them, using readily available local materials. Furthermore, reflecting the nomadic character of communities in the Project area, homestead structures are temporary in nature, with households periodically moving and constructing new homestead structures. As noted above, additional support will be available to vulnerable households who may require assistance in constructing new homestead structures, and the need for this assistance will be assessed on a case by case basis.

5.4.2 Assistance to Vulnerable Persons

Additional assistance will be offered to vulnerable persons or households who are physically or economically displaced by Project land access. The socio-economic survey to be undertaken by the Project will gather data to identify vulnerable households. A household will be categorised as potentially vulnerable on the basis of factors (to be confirmed in the RLRP) such as:

- The household is female-headed;
- The household is elderly-headed (60 years and older);
- The household has one or more physically and / or mentally disabled household members;
- The household has a high number of dependents relative to the number of household members about to generate livelihoods or income;
- The household has particularly low levels of income or limited sources of livelihood, eg. does not own livestock or only owns few livestock.

The factors which form part of these criteria may contribute to a household's ability to restore livelihoods and their resilience to displacement impacts. However, for some PAPs these factors may not affect their resilience to restore livelihoods and impacts on them from land acquisition will not necessarily be disproportionate.

To understand how these factors affect a household's resilience and vulnerability to the impacts of land acquisition requires case-by-case engagement with them and an understanding of the specific impacts on them. Households with the above characteristics will therefore be treated as 'potentially' vulnerable, which will trigger additional effort and engagement to get more information on their specific circumstances and to decide whether they should be treated as vulnerable and provided with additional support to assist relocation and ensure access to and effective delivery of livelihood restoration programs.

5.4.3 Communal Structures:

As described in Section XX, there are a number of community structures in Upstream Project land areas that may be affected by Project land requirements, such as the Lokosemikori Primary School located in the Amosing field and community water tanks provided by the Project in the Twiga, Ngamia and Amosing fields. Affected assets owned by the community or institutions will be compensated for under the statutory land acquisition process. The Project will also engage with GoK, MoPM, Turkana County Government, institutions and communities to discuss whether support can be provided in providing replacement buildings (in the case of school buildings) outside of Project affected areas nearby. The Project will also engage with stakeholders and communities to relocate community water tanks at suitable locations outside of affected land areas.

5.4.4 Communal Infrastructure:

Communally or institutionally owned infrastructure, such as roads, paths, drainage or power lines, which may potentially be affected by Project land requirements, are typically owned by GoK, County Governments or GoK agencies. The re-routing or replacement of this

infrastructure will be determined by GoK in consultation with County Governments, GoK agencies and the communities that are served by the infrastructure. No supplemental entitlements or role for the Project is anticipated in re-routing or replacement.

5.4.5 Supplemental Transitional Support:

In addition to the compensation and allowances provided by the NLC under Kenyan law, the Project will offer additional assistance to physically displaced households, particularly to vulnerable individuals or households.

In cooperation with the County Government, and in coordination with MoPM, households which are required to relocate may be provided with in-kind support including:

- Provision of vehicles to help in moving household assets;
- Provision of labour to help in moving and construction new homestead structures;
- Provision of materials to improve the quality of homestead structures;
- Provision of household equipment such as water carriers or solar lights.
- Transitional food baskets, based on a typical United Nations World Food Programme food basket. Although households will still be able to access grazing land in the vicinity of Project land areas and maintain their pastoral livelihood activities, transitional support will be provided to physically displaced households. The exact nature of this support and the length of the transitional period over which it will be provided is to be discussed and agreed with stakeholders, so will be confirmed in the Resettlement and Livelihood Restoration Plan.

5.4.6 Livelihood Restoration Support:

As noted in Section XX, the degree of economic displacement for the vast majority of affected persons is expected to be minor. The areas of communal grazing land directly affected by Upstream Project land requirements are small compared with the large areas of communal grazing land outside of Project areas that are already used on a daily and seasonal basis by local communities. Pastoralists typically graze their livestock across large areas of land and travel far away from Project areas to access seasonal grazing further afield.

Nevertheless, a degree of economic displacement will arise from Project land use, so the Project will provide culturally appropriate livelihood restoration support to ensure that livelihoods and standards of living are restored and preferably improved.

Due to the communal nature of land ownership and use in the Upstream Project area, the Project will provide livelihood restoration activities aimed at improving livestock grazing livelihoods amongst communities in Locations or Sub-Counties affected by Project land use, rather than being targeted at individual households.

Livelihood restoration measures will be developed in consultation with affected communities, stakeholders, County Government and GoK to ensure that they meet the needs of households and communities and fit with local priorities and other government support initiatives. Potential activities include:

- Project related employment per the Project's local employment plan;
- Livestock improvement, vaccination, disease control etc;
- Community water projects which provide benefits of drinking water for livestock and opportunities for small scale irrigation of vegetable gardens and tree nurseries;
- Enterprise development, eg. women's groups running poultry production and supplying food to the Project and local markets;
- Enterprise skills development, including skills for working for Project contractors, and accessing Project relating procurement opportunities;
- Micro credit for small businesses;
- Educational bursaries.

It is proposed that the Project will agree the programmes with County Governments, local stakeholders, GoK, MoPM and local communities. The nature of this support and scale of funding for different Locations and sub-Counties is also expected to reflect the area of community land affected by the Project, potentially using a standard budget amount per ha.

The focus will be on providing financial support or other contributions for a defined and fixed period of time to existing governmental or non-governmental programmes such as pastureland improvement, animal husbandry, drought resilience, skills development and training, and enterprise development etc.

The development of livelihood restoration support programmes will involve consultation with affected communities and stakeholders and build on the Project partners' extensive experience to date in areas such as provision of community water, local employment and enterprise development. Based on further research and stakeholder engagement, specific programmes will be identified and defined in the Resettlement and Livelihood Restoration Plan, together with defined budgets, timeframes and performance indicators.

The livelihood restoration measures will be contained within a Community Development Plan (CDP) to be developed by the Project, which will also include wider programmes to ensure that local communities receive development benefits and opportunities associated with the Project.

5.4.7 Money Management Training:

Individuals and households who receive large and sudden cash windfalls via monetary compensation will be provided with money management training so they can hold the money securely and make best use of it. The Project will support this training and engage with GoK to agree how money management training is provided to PAPs, potentially making use of local community bodies to provide the training.

5.5 Outline Entitlement Matrix

Error! Reference source not found. reflects the above and outlines the proposed Entitlements Matrix. It shows the various categories of potential loss envisaged, eligibility and entitlements. The entitlements include statutory entitlements set out in Kenyan legislation and supplemental entitlements to meet IFC PS5 requirements. It assumes eligibility in terms of presence of eligible PAPs and assets at the cut-off date.

As noted above, the entitlements are subject to discussion and refinement with GoK, MoPM, the NLC and County Governments, as well as stakeholders and affected communities, so that the final, agreed entitlements will be presented in the Resettlement and Livelihood Restoration Plan (RLRP).

Table 1: Outline Entitlements Matrix

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
1. PERMANENT LOSS OF LAND					
Permanent loss of <u>unregistered</u> community land. (Note: it is understood that all land in the Upstream Project area is unregistered community land).	The community that has customary rights to the land.	Cash compensation by NLC for loss of land based on statutory NLC land valuation.	Cash compensation is paid to the appropriate County Government who hold unregistered community land in trust for the community, based on market values established by the NLC. Plus: statutory 15% disturbance allowance.	Access to community-based livelihoods support initiatives.	Land is recognised as unregistered community land, ie. is not subject to any private or community legal allotments or registration – this is established by the NLC.
Permanent loss of community land <u>registered</u> to a local community. If the land is registered to the local community (in line with Community Land Act processes), compensation would be paid to the local community to which the land is registered. (Note: It is understood that there is no 'registered' community land in the Upstream Project areas, it is all unregistered).	The local community to which the community land is registered.	Cash compensation for loss of land – paid to the local community to which the land is legally registered, based on NLC land valuation.	Cash compensation is paid to registered community based on market land values established by the NLC. Plus: statutory 15% disturbance allowance.	Access to community-based livelihoods support initiatives.	Legal Certificate of Title issued by the Chief Land Registrar (as defined by Community Land Act) to the community proving that the land is legally registered to a defined local community. This would be confirmed by the NLC.
Orphaned Land: The issue of orphaned land is not expected to arise in the Upstream Project area since all the land is understood to be unregistered community land which has not been divided into individual land parcels.	n/a	n/a	n/a	n/a	n/a
Permanent loss of private land					
Loss of Land with dwelling – entire plot acquired (because it falls wholly in the Project footprint or because remaining land classified as orphaned land); or portion of plot is acquired. (Note: It is understood that there are no privately owned land plots in the Upstream Project area).	The legally titled owner of land or customary owner.	Cash compensation for loss of land based on NLC land valuation	Cash compensation paid to the private land owner based on market land values established by the NLC. Plus: • Statutory 15% disturbance allowance; • Reasonable relocation expenses established by the	Access to community-based livelihoods support initiatives. Relocation support including assistance with moving assets and building materials. Transitional support including food baskets for fixed period.	Hold legal title document issued by the relevant authorities prior to the cut-off date. Private ownership is confirmed by the NLC. Or customary ownership confirmed by the NLC.

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
			NLC.		
Permanent loss of privately owned agricultural (crop) land. (Note: It is understood that there are no privately owned land plots in the Upstream Project area, and no cultivation of crops has been observed).	The legally titled owner of land or customary owner.	Cash compensation for loss of land based NLC land valuation	Cash compensation paid to the private land owner based on market land values established by the NLC. Plus: • Statutory 15% disturbance allowance.	Access to community-based livelihoods support initiatives Transitional support including food baskets for fixed period.	Hold legal title document issued by the relevant authorities prior to the cut-off date. Private ownership is confirmed by the NLC. Or customary ownership confirmed by the NLC.
Permanent loss of privately owned grazing land. (Note: It is understood that there are no privately owned land plots in the Upstream Project area).	The legally titled owner of land or customary owner.	Cash compensation for loss of land based NLC land valuation.	Cash compensation paid to the private land owner based on market land values established by the NLC. Plus: Statutory 15% disturbance allowance	Access to community-based livelihoods support initiatives Transitional support including food baskets for fixed period.	Hold legal title document issued by the relevant authorities prior to the cut-off date. Private ownership is confirmed by the NLC. Or customary ownership confirmed by the NLC.
2. LOSS OF DWELLING STRUCTURE & ANCILLARY STRUCTURES					
Loss of occupied dwelling / house / homestead structure	Owner of affected occupied dwelling	Cash compensation for loss of structure(s) based on NLC valuation.	Cash compensation at full replacement cost based on NLC valuation. Plus: • Reasonable relocation expenses. • Statutory 15% disturbance allowance	Relocation support including assistance with moving assets and building materials. Transitional support including food baskets for fixed period. Access to community-based livelihoods support initiatives. Monitoring by the Project to ensure that household is not economically or socially disadvantaged by receiving cash compensation or subject to homelessness or hardship.	Dwelling complete and occupied at cut-off date as established by NLC survey. Owner, valuation and occupancy established by the NLC.
Loss of unoccupied dwelling / house / homestead structure. Unoccupied structures are defined as being fit for occupation, and are not abandoned of dilapidated.	Owners of affected structure.	Cash compensation with value is established by NLC.	Cash compensation at full replacement cost based on NLC valuation. Plus: • Statutory 15% disturbance allowance	Relocation support including assistance with moving assets and building materials.	NLC assessment of whether the structure is fit for occupation (ie. not abandoned or dilapidated). Owner, valuation and non-occupancy established by NLC survey.
Loss of other ancillary buildings or domestic structures, eg. storage buildings, animal shelters, plate racks, water wells.	Owners of ancillary buildings & structures.	Cash compensation with value is established by NLC.	Cash compensation at full replacement cost based on NLC valuation. Plus: • Statutory 15% disturbance	Relocation support including assistance with moving assets and building materials.	Owner and valuation established by NLC survey.

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
			allowance		
Loss of rented residential structure for building owner. (Note: No rented residential structures have been observed in the Upstream Project areas).	Owner of building rented out for residence.	Cash compensation with value is established by NLC.	Cash compensation established by NLC valuer to cover market value of building, plus statutory 15% disturbance allowance. Plus compensation for loss of rental income for a standard period – values and period to be established by the NLC. *(To be confirmed by NLC).*	Relocation support including assistance with moving assets.	Owner and valuation established by NLC survey.
Loss of rented residence for tenant – temporary loss of rented or loaned accommodation. (Note: No rented residential structures have been observed in the Upstream Project areas).	Tenant or other occupant permitted by the owner.	Cash compensation with value is established by NLC.	Cash compensation established by NLC valuer to cover rental accommodation payment for a standard period established by the NLC (eg. 3 months – to be confirmed by NLC). Plus reasonable relocation expenses.	Relocation support including assistance with moving assets to alternative accommodation. Transitional support including food baskets for fixed period.	Tenant identified by NLC survey.
3. LOSS OF BUSINESS & OTHER BUILDINGS OR STRUCTURES					
Loss of communally or institutionally owned buildings or structures, eg. educational, health or religious buildings.	Owners of affected structures – community or institution.	Cash compensation with value established by the NLC. Plus the Project will evaluate the need for any supplemental support on a case by case basis.	**C**ash compensation at full replacement cost based on NLC valuation. Plus: • Statutory 15% Disturbance Allowance	Relocation support including assistance with moving assets and building materials. Plus the Project will evaluate the need for any supplemental support on a case by case basis.	Building exists at cut-off date and identified through NLC asset survey, value and ownership established in NLC survey.
Loss of communally or institutionally owned infrastructure such as roads, paths, drainage, mains electricity	Owners of affected structures – community, institution, local authority, utility company.	In-kind re-routing of communally or institutionally owned infrastructure will be determined by GoK and County Governments.	• Diversion of roads or services and infrastructure in conformity with national standards; • Diversion / rerouting of pathways around project sites based on assessment of loss of access.	None	Facilities / infrastructure in place and working at cut-off date and identified in NLC asset survey. Owners of affected structures as identified in NLC survey.
Loss of Business Structures – eg.	Owner of business	Cash compensation at	Cash compensation at full	Relocation support including	Existence at cut-off, owner, valuation of

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
workshops, kiosks, offices etc	structure.	value established by NLC.	replacement cost based on NLC valuation. Plus: • Statutory Disturbance Allowance; • Reasonable relocation expenses; • Damages resulting from diminution of profits, as established by the NLC valuers.	assistance with moving assets and building materials. Access to relevant livelihood restoration support.	structures and diminution of profits established by NLC survey.
4. LOSS OF TREES & CROPS					
Loss of economic trees – fruit trees, timber trees, fodder trees, medicinal shrubs. (Note: Trees growing on community land in the Upstream Project area are owned by the community).	Owner of economic trees.	Cash compensation at value established by NLC.	**Cash:** cash compensation based on standard values established by NLC, taking into account Gazetted Kenya Forest Service rates[3] for trees (reflecting species, productivity and maturity) and any required updating by NLC.	No additional entitlements on top of statutory compensation established by the NLC. Where possible and appropriate, the Project will make felled timber available for community use. If the tree owner is not physically displaced, they will also get: • Access to community-based livelihoods support initiatives • Transitional support including food baskets for fixed period.	Existence of economic trees at cut-off date, ownership and valuation established by NLC surveys.
Loss of perennial or seasonal crops. (Note: reflecting the arid conditions in the Upstream area and very limited use of irrigation, no perennial or seasonal crops have been observed in the Upstream Project area).	Owner of perennial or seasonal crops.	Cash compensation at value established by NLC.	**Cash:** cash compensation based on standard values established by NLC. **Note:** If the construction schedule allows, seasonal crops can be harvested prior to land access. These crops will be recorded during the surveys and will be valued, they will be	No additional entitlements on top of statutory compensation established by the NLC. If the crop owner is not physically displaced, they will also get: • Access to community-based livelihoods support initiatives	Existence of crops at cut-off date, ownership and valuation established by NLC surveys.

[3] The Forests (Fees and Charges) Rules, 2012. Kenya Gazette Supplement no. 132, 28th Sept 2012.

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
			compensated for if affected, but not compensated for if they can be harvested.	• Transitional support including food baskets for fixed period.	
LOSS OF ACCESS TO NATURAL RESOURCES					
Loss of access to natural resources generating income in cash or in kind - eg. loss of community accessed resources such as livestock grazing and non-economic trees. **(**Note: No interruption to mineral licence exploration or extraction areas are anticipated from Project land use).	Resource users or any persons losing a cash or in-kind income stream associated with loss of natural resources or loss of access to natural resources	Project measures to maintain access and restore livelihoods.	None	Access to community-based livelihoods support initiatives.	Project led socio-economic survey work and engagement to identify affected local communities.
6. LOSS OF CULTURAL ASSETS					
Graves	Family and local community members linked to grave.	In kind assistance (exhumation, transportation and reburial) for grave relocation and reburial ceremony. Payment of compensation and exhumation / reburial budgets based on NLC valuer opinion or standard rates.	**In kind** – Relocation of grave (exhumation, transportation and reburial) in designated area agreed with the local community. AND **Cash compensation** - Provision of cash compensation based the NLC standard rates for exhumation and reburial. Monetary allowance to cover agreed customary ceremony to family or community at agreed rate.	The Project will commit to the same level of compensation and allowances if chance-finds are identified during construction.	Family or community linked to grave identified through NLC and Project consultation with community reps. Graves present at cut-off and identified during NLC asset surveys, and graves identified through chance-finds procedures. Graves identified through chance-finds will need to be verified by a local GoK official.
Any substantial loss of cultural assets or activities resulting from land acquisition or loss of access. These can be educational, religious or recreational assets.	Community or cultural group impacted by the loss.	In kind assistance	None	No such sites identified during baseline surveys. In the event this situation occurs, the Project will work with the affected community to identify whether access can be maintained.	Shrine or sacred asset identified during asset surveys and engagements with affected local communities and stakeholders. Note that no such sites identified during ESIA baseline surveys. Sites will need to be verified by a local GoK official.
7. VULNERABLE INDIVIDUALS OR GROUPS					
Vulnerable persons requiring special	Vulnerable	Supplemental Project	TBC	Focused Project assistance	Identified through NLC survey and/or

Type of Loss / displacement impact	Qualifying Category	Mitigation Type	Statutory Entitlement	Project Supplemental Entitlement	Eligibility conditions
support	individuals or groups who may be disproportionately impacted by displacement, such as the elderly, disabled or those suffering extreme forms of deprivation.	measures of social support for vulnerable people entitled to any of the above entitlements.		as assessed on a case by case basis to ensure that vulnerable people have access to intended compensation and protection provided in the entitlements. Practical assistance such as additional moving assistance, other specific support related to moving process (e.g. medical assistance) identified by support workers; and participation in livelihood improvement programmes.	Project socio-economic survey, including through use of agreed vulnerability indicators relevant to the Project area.
Persons receiving cash windfalls by way of monetary compensation.	Individuals and families who receive sudden cash windfalls via monetary compensation.	The Project will support the provision of money management training.	None	Access to money management training. The Project will engage with GoK to agree how money management training is provided to PAPs.	All persons receiving cash compensation identified in final compensation schedules.

6 Development of Resettlement and Livelihood Restoration Plan

The final Resettlement and Livelihood Restoration Plan will take the principles, assumptions and approaches set out in this Framework and combine these with factual NLC survey data and information gathering from supplemental socio-economic data gathering to provide the final details of Upstream land requirements, impacts arising, entitlements and implementation plans for delivering these entitlements to affected persons and communities. It will also provide further details of the engagement undertaken, budget, timeframes, implementation roles and responsibilities, grievance mechanisms and plans for monitoring and evaluation.

6.1 Contents of Resettlement & Livelihood Restoration Plans

The Resettlement and Livelihood Restoration Plan will set out:

- Approach and methodology;
- Livelihood restoration programmes identified for the Project to support;
- Findings from the supplemental socio-economic survey;
- Information on displacement impacts and affected persons;
- The agreed entitlements framework, including national statutory and supplemental entitlements to meet IFC requirements;
- Indigenous peoples plan and vulnerable persons plan;
- Communications protocols and grievance system;
- Records of engagements with stakeholders and affected persons;
- Plans for delivering statutory and supplemental entitlements, including relocation assistance;
- Plan and schedule for livelihoods restoration activities;
- Budgets;
- Roles and responsibilities;
- Reporting and communications;
- Plans for implemental monitoring and evaluation.

6.2 Next Steps

The RLRP will be developed by the Project in coordination with MoPM, NLC/GoK and the County Governments. This will help ensure that supplemental activities are coordinated and closely aligned with NLC timelines and activities.

The Framework is intended to provide an outline of the approach to be developed and finalised in the Plan. This will provide sufficient detail to support coordination with key stakeholders including MoPM, NLC, GoK, County Governments, prospective Lenders etc.

The Plan will be developed prior to FID and prior to mobilisation of the EPC Contractor. It is planned that the Plan will be developed such that NLC data can be obtained and the Project's PAP/household socio-economic surveys of completed, prior to any resettlement activities taking place.

It is planned that resettlement would occur only after FID and construction activities on land acquired by GoK via the statutory compulsory land acquisition process would not commence until resettlement activities have been undertaken.

The next steps in the development of the RLRP will include the following:

Preparation and Confirmation of Framework:

- Review and finalise draft Framework with MoPM, NLC and GoK input.
- Engagement with MoPM, NLC, GoK, County Governments to ensure they are familiar with the concepts, approaches and timings.
- Coordination with NLC on data to be provided (including data validation).

Development of Plan:

- Engage with County Governments, representatives of affected communities and Non-Governmental Organisations to identify appropriate livelihoods restoration programmes for support.
- Engage with NLC on data hand-over.
- Review of data with MoPM.
- Identify affected persons/households/communities.
- Develop list of households, proposed entitlements, additional livelihoods data required.
- Develop community/stakeholder messaging on topics such as supplemental entitlements and socio-economic survey.
- Dissemination of the Project grievance mechanism.
- Plan household surveys and engage with MoPM and County Governments.
- Develop and implement public messaging related to influx management.
- Undertake household socio-economic surveys, engage with PAP/households/communities on supplemental entitlements, confirm entitlements with households and explains grievance system.
- Identify vulnerable persons and households and identify what additional support they require.
- Coordinate with MoPM, NLC and County Governments over plans for physical resettlement
- The Project will coordinate plans with EPC Contractor related to land clearance and associated engagement.

Implementation of Plan:

- Planning and coordination meetings with NLC, MoPM and County Governments.
- NLC progresses steps in the statutory land acquisition process (per Section X).
- MoPM, NLC, County Governments and the Project implement entitlements, assistance, resettlement and livelihood restoration support, with on the ground engagement of affected households.
- The Project undertakes follow-up engagement with affected households.
- Then, ongoing and periodic monitoring, evaluation and reporting until the Resettlement and Livelihood Restoration Plan Completion Audit undertaken.

7 Stakeholder Engagement

7.1 Stakeholder Engagement Activities

Stakeholder engagement related to the land acquisition process and development of the RLRP is critical to ensuring successful preparation and implementation of the RLRP and in meeting IFC requirements and expectations of stakeholders.

Stakeholder Engagement will include the following steps which will be coordinated with the overall Project stakeholder engagement plan.

Table 2 Stakeholder Engagement Plan

What	Who	When	How	Outcomes
Preparation and Confirmation of Resettlement & Livelihoods Restoration Framework				
Review and finalise draft Framework	The Project, MoPM, NLC and GoK	Once internal review draft prepared and reviewed by Project Director	Face to face meetings Teams Meeting	Comments documented and incorporated into Framework document
Engagement to ensure they are familiar with the concepts, approaches and timings	MoPM, NLC, GoK, County Governments	Once MoPM, NLC, GoK, County Government review completed	Process supported by MoPM Face to face meetings Teams Meeting	County Governments briefed about plans
Coordination with NLC on data to be provided (inc data validation)	NLC	Once MoPM, NLC, GOK review completed	Face to face meetings Teams Meeting	NLC to provide list of data fields to be shared with the Project
Development of Resettlement & Livelihoods Restoration Plan				
Engage to identify appropriate supplemental entitlements, assistance and livelihoods restoration programmes for support	County Governments, representatives of affected communities and Non-Governmental Organisations	As soon as possible, can commence prior to finalisation of Framework	Face to face meetings Teams Meeting Internet research	Summary of all relevant livelihoods related programmes by county, together with suggestions for Project engagement, potential costs and how this could support PAP livelihood improvement
Engage with NLC on data hand-over	NLC	Prior to, during, and after completion of NLC surveys and gazettement of awards	Face to face meetings Teams Meeting	NLC database (redacted as necessary) handed over to the Project
Review of data with MoPM	MoPM	After NLC database shared with the Project	Face to face meetings Teams Meeting	Evaluation of database and identification of issues and/or implications
Develop community /stakeholder messaging and engagement plans for the implementation phase. To include public messaging to mitigate influx risks	Project (internal preparation) MoPM NLC/GoK	As soon as possible, can commence prior to finalisation of Framework	Face to face meetings Teams Meeting	Implementation Stakeholder Engagement Plan prepared
Plan household surveys and engage with MoPM and County Governments.	MoPM and County Governments	After NLC database shared with the Project	Face to face meetings Teams Meeting	Survey implementation plan agreed

What	Who	When	How	Outcomes
Undertake household socio-economic surveys, engage with affected persons, households and communities on supplemental entitlements, confirm entitlements and explains grievance system	Affected persons, households and communities	Once survey implementation plan agreed and prior to resettlement activities	Field surveys	Households surveys completed and agreement to supplemental entitlements confirmed with each household / community, grievance system “live”
Coordinate with MoPM and County Governments over plans for physical resettlement	MoPM and County Governments	Prior to physical resettlement activities	Face to face meetings Teams Meeting Field-based activities	Documented plan for delivery of Project resettlement support measures
Implementation of Resettlement & Livelihoods Restoration Plan				
MoPM and County Governments implement resettlement with Project support	MoPM and County Governments, affected communities	During physical resettlement activities	Face to face meetings Field-based activities	Documented delivery of Project resettlement support measures
Project undertakes follow-up engagement and visits to affected persons/households/communities	Affected persons, households and communities	3 months after resettlement activities completed	Face to face meetings Field-based activities	Resettlement monitoring report
Then, ongoing periodic monitoring, including use of grievance system	Affected persons, households and communities	6, 12, 18 months after resettlement activities completed 24 months	Face to face meetings Field-based activities	Resettlement monitoring report Resettlement completion audit report

7.2 Monitoring & Evaluation

The RLRP monitoring and evaluation (M&E) system will include internal, external and participatory monitoring and reporting processes to ensure complete and objective information is provided.

Indicators will be selected to measure inputs, outputs, and outcomes for resettlement activities and will aim to provide feedback to the Project as well as to relevant stakeholders on the RAP implementation process. The M&E process will be linked to the household level socio-economic data, including assessments of household vulnerability.

Four main types of M&E will be undertaken:

- **Internal Monitoring and Evaluation** of ongoing RLRP implementation to track progress in delivering planned actions and against key performance indicators (KPIs) and to identify corrective actions where necessary to incorporate into delivery. This will involve:
  - **Process Monitoring and Evaluation** to track progress in implementing the planned activities contained in the RLRP, such as: PAP entitlement briefings, payment of compensation, delivery of livelihood restoration activities and transitional assistance.
  - **Performance and Compliance Monitoring and Evaluation** to establish whether resettlement implementation and the outcomes being generated are meeting the key objectives defined in the RLRP, and in compliance with national and international requirements and restoration of livelihoods and assistance to vulnerable persons.
  - **Construction Monitoring** covers construction activities and identifies and addresses any additional land acquisition and impacts on land and assets that may arise during construction.
- **Periodic External Monitoring and Evaluation** of RLRP implementation will aim to verify the project's monitoring information, assess compliance with RAP commitments and provide any advice on how improvements can be made to ensure future compliance. This will be provided by external independent experts.
- **Completion Audit.** Upon completion of the resettlement activities, a completion audit will be conducted to verify that the Project has complied with commitments and addressed impacts in a manner consistent with the RLRP. It will conclude whether the monitoring process can be ended and, if necessary, a Corrective Action Plan listing outstanding actions necessary to meet the objectives will be prepared and implemented.
- **Post RLRP Implementation Evaluation** to be undertaken between 3 and 5 years after the completion audit, to assess and report on the lasting effectiveness and outcomes of the resettlement and entitlements programmes and the socio-economic status of the physically and economically displaced households.

8 Implementation Plan

8.1 Roles & Responsibilities

The roles and responsibilities of the key Government agencies, the Project and others involved in delivering land for use by the Project, under both the statutory and supplemental processes, are shown in Table 3 below.

Table 3: Resettlement and Livelihood Restoration Roles and Responsibilities

Organisation	Responsibilities
MoPM – as the Acquiring Body	• Acquire Land through the NLC and avail secure land rights to the Project (KJV) • GoK / MoPM Grievance Mechanism for the benefit of the Project Affected Persons. • Conduct comprehensive public participation in conjunction with relevant agencies regarding land acquisition. • Share relevant acquisition process data i.e. public participation reports, survey reports and compensation reports with the Project to facilitate preparation of RAP/LRP or input into the RAP/LRP[4]. • Plan use of land that is not taken up by the Upstream Project (within polygon) and that will be available for community or public use. • Integrate land access approach between the Upstream Project and the Midstream Project.
NLC – as the Acquiring Authority	• Conducts the statutory land acquisition process. • Shares Land acquisition process data with MoPM i.e. methodologies, public participation reports, communication of messages to communities including on cut-off, survey reports and valuation and compensation reports. • Negotiate with Project Affected Persons and the relevant County Government for compensation of land and assets. • Resolve land acquisition related disputes via statutory processes and on behalf of MoPM. • Undertake sensitization in conjunction with MoPM regarding land acquisition.
MoL -as the registrar of land rights	• Conducts final surveys and issues requisite Maps. • Registers Land rights. • In collaboration with NLC, assist in survey and valuation of land and assets. • Advice on the appropriate land rights between MoPM and KJV
County Government Which hold unregistered community land in trust on behalf of communities	• In collaboration with MoPM and NLC, coordinate public participation for land acquisition and access. • Implement mechanism to manage reasonable restrictions on land use within the Gazetted Area and communication of cut-off dates. • Support the Project and MoPM in carrying out supplemental work to land acquisition and resettlement. • Facilitate assessment of compensation in collaboration with MoL and NLC. • Negotiate with NLC on compensation for unregistered community land.
The Project – as the ultimate land user and the Contractor under the PSCs	• Develop and implement an appropriate Resettlement and Livelihoods Restoration Framework and Plan, and other supplemental documentation required to meet IFC Performance Standards. • Disclosure of documentation to meet IFC Performance Standards. • Identify land requirements and inform MoPM. • Obtain from MoPM relevant information on resettlement support required for Project Affected Persons.

[4]Annex 3: Key Land Acquisition Data Requested to be Shared by MoPM with KJV

Organisation	Responsibilities
	• Undertake socio-economic data collection and analysis. • Plan livelihood restoration and other aspects of supplemental support and entitlements for affected persons and communities. • Engage with communities, in collaboration with County Government, to achieve informed consultation and participation. • Conduct any additional stakeholder engagement required to achieve and demonstrate free prior and informed consent (FPIC). • Supervise implementation of applicable resettlement, site restoration and other procedures • Coordinate implementation of grievance management and community liaison procedures. • Undertake ongoing monitoring and evaluation of resettlement and livelihood restoration plan process, prepare corrective action plans where necessary and report on progress to stakeholders.

8.2 Implementation Schedule

To support the overall Project schedule, the GoK and the Project will develop and agree a schedule for both the statutory and non-statutory land access processes.

The agreed schedule will address the following key milestones:

- Land Access Strategy to support Lender engagement;
- Access to land by GoK, and compliance with International Standards by the KJV is required at FID;
- Grant of secure land rights to the Project ahead of FID as construction of the project facilities is expected to begin immediately after FID.

The schedule is based on two key assumptions:

1. The Resettlement and Livelihood Restoration Framework and Plan are required for FID.
2. To meet the first assumption above, data from GoK statutory process will be made available to the Project on or before (date for provision of outline data) and (date for provision of complete data).

Table 4: Indicative Schedule for Project Activities

[To be included once finalized]

8.3 Land Access Process Inter-Dependencies

There are a range of interdependencies between the GoK-led land acquisition process and the Project's supplemental activities to meet the Project Schedule and International Standards. Unless effectively managed, these will impact the Project, in relation to the following key areas:

- **Schedule** – The Project cannot meet the Project Schedule without timely delivery of land access (formal land rights and physical land access);
- **Cost** – An efficient process will minimize costs for all parties;
- **Complexity** – Effective coordination will minimize confusion, duplication and delay and threaten the social license to operate.

These issues may be encountered in relation to a range of areas, including:

- **Engagement and Public Participation** – Coordination, alignment and participation related to stakeholder engagement will be critical enable the Project to meet Kenyan legal requirements and International Standards.
- **Disputes** – Disputes or resistance from affected persons, communities and their representatives over compensation, entitlements, ownership etc could cause delays. Effective planning, communication and community engagement is essential for timely delivery of the RLRP process.
- **Data Sharing** – The development of the Supplemental Resettlement and Livelihood Restoration Plan in line with the Project Schedule will require the timely sharing of data from the GoK-led land acquisition process;
- **Process and Methodology** – A clear understanding of the details of the GoK-led land valuation and acquisition process will be needed for the Project to demonstrate how the GoK process is aligned with International Standards;
- **Schedule** – Both the GoK-led land acquisition and certain key elements of the Project's supplemental activities are required as prerequisites for FID and for financing. The Project's supplemental activities cannot be completed without data from the GoK-led process.
- **Budgets and Resources** – GoK and government bodies such as the NLC, the Project and County Governments will need to be able commit sufficient resources to enable effective and timely implementation of RLRP activities. Any duplications or delays due to inadequate resources or poor coordination will lead to increased costs.

Annex A – Upstream Project Land Requirements

Table 5: Land to be Acquired via Statutory Land Acquisition

Land component	Specific land	Estimated Land Requirement (ha)
CFA	CFA	250
Wellpads	Wellpads	540
Landfill	Landfill Ngamia	40
Interconnecting Network (Oil gathering network, infield-OHTL and Road network)	Oil gathering network, infield-OHTL and Road network	620
	Total	**1,450**

Table 6: Land to be Leased on Temporary Basis (Not Acquired by NLC)

Land Requirement	Land Area (Ha)	Type of Land Rights Needed
Temporary Fly-Camp within fenced Turkwel Dam area, during construction of the Water Pipeline	**TBD**	Lease/Licence

Annex B – Legal & Policy Framework

The Project's approach to land access is based on meeting:

- Kenyan statutory legal requirements for land acquisition, compensation and resettlement;
- International financing standards, notably IFC Performance Standard 5 on Land Acquisition and Involuntary Resettlement;
- Obligations set out in the Host Government Agreements with the Government of Kenya; and
- Project Environmental and Social policies.

This section describes the above requirements and the legal framework for the Upstream Project. It includes gap analysis between national and international requirements and identifies how any gaps will be addressed.

B-1. National Legislation

Table 7 shows key national laws and policies that are relevant to land acquisition, compensation and resettlement activities for the Project.

Table 7: Key Kenyans Laws Related to Land Acquisition

Legislation	Guidance and provisions
Constitution of Kenya, 2010	Article 40 of the Constitution recognizes citizens' right to acquire and own property. It also states that Government can acquire land for a public purpose or interest, providing prompt payment in full, of just compensation to the affected person. It allows any person who has an interest in or right over that property, a right of access to a court of law. It requires compensation to be paid to occupants in good faith of land acquired who may not hold title to the land. Articles 61 and 62 define three types of land, namely public, community and private land. Article 63 (1) states that any unregistered community land shall be held in trust by County Governments on behalf of the communities. Article 63(4) requires that community land shall not be disposed of or otherwise used except in terms of legislation specifying the nature and extent of the rights of members of each community, individually and collectively. The legislation to implement this requirement is contained in the Community Land Act. Article 66 provides for the State to regulate land rights for the benefit of the general public, including for the promotion of public safety, public order, public morality, public health and for land use planning. The same article mandates Parliament to enact legislation to ensure communities benefit from proceeds of investments in property or land. Article 67 establishes the National Land Commission and sets out its functions.
National Land Policy, 2009	The Policy addresses constitutional issues such as compulsory acquisition and development control. Section 45 of the Policy defines compulsory acquisition as "the power of the State to extinguish or acquire any title or other interest in land for a public purpose, subject to prompt payment of compensation".
Land Act No.6, 2012	The Act provides procedures for transactions in private land including sale, transfer, leases, easements and Public rights of way. It establishes GoK's powers to acquire land for projects in the public interest and sets out detailed procedures for acquisition of land for public interest. It gives the NLC the mandate to undertake compulsory acquisition of land on behalf of the national or County Governments. Although the Act requires that compensation for land is required to be just and paid promptly in full, Section 120(2) also gives powers to the NLC to acquire land before compensation has been paid where there is an urgent necessity for land acquisition and where it would

Legislation	Guidance and provisions
	be contrary to the public interest to delay acquisition.
Land Registration Act No.3, 2012	The Act provides for the registration of absolute proprietorship interests over private, public and community land (exclusive rights) that has been adjudicated or any other leasehold ownership interest on the land. Such land can be acquired by the state under the Land Act 2012.
National Land Commission Act No. 5, 2012	The Act establishes the NLC which is mandated to provide land management and administration, in accordance with the principles set out in the 2010 Constitution. The Act also establishes the NLC as the linkage between the Commission, County Governments and other institutions dealing with land and land related resources. The Act mandates the NLC to carry out compulsory acquisition of land for specified public purposes. It requires the NLC to (a.) monitor and provide oversight over land use planning of all County land and (b.) manage and administer unregistered trust land and/or community land on behalf of the County Government, and (c.) ensure that all unregistered public land is registered within ten years from inception of the Act.
Environment & Land Court Act No. 19, 2011	The Act establishes the Environment and Land a Court to hear and determine disputes relating to environment and land administration and management, including cases relating to public, private and community land. It is the only Court with jurisdiction on land matters. The Act mandates the Court to facilitate just, expeditious, proportionate and accessible resolution of disputes on land, including disputes related to compulsory acquisition undertaken by the NLC.
Survey Act	The Act governs and requires the survey of any land for the purposes of registration of transactions in land or title to land. The Act requires the survey of all land acquired through compulsory acquisition.
Prevention, Protection & Assistance to Internally Displaced Persons & Affected Communities Act, 2012	The Prevention, Protection and Assistance to Internally Displaced Persons & Affected Communities Act (2012), sets out procedures to protect and assist internally displaced persons, including those required to leave areas of residence due to large scale development projects. Government shall ensure that the displacement is carried out in manner respectful of human rights and consistent with law, taking in particular into account the protection of community land and the special needs of women, children and persons with special needs. The Act requires Government to provide durable solutions for livelihoods, restoring housing, land and property, consultation, participation and free prior informed consent of the displaced people.
Community Land Act, 2016	Provides for the recognition, protection and registration of community land rights, management and administration of community land. The Act mandates County Governments to hold unregistered community land in trust for the community. County Governments shall not dispose of community land, unless it is acquired for a public purpose through compulsory acquisition and prompt payment of compensation to the persons entitled to the land.
Land Law Amendment Act 2016	The Act provides amendments to land laws enacted in 2012 to give effect to the Constitution to clarify the Mandate of the Ministry of Lands and eliminate overlaps with the role of the National Land Commission. The Act limits the mandate of the NLC to management of public land on behalf of National and County Government, limit the policy making powers of the NLC, limit the powers of NLC regarding allocation of public land, and vests them with the Ministry of Land, Housing and Urban Development.
Community Land Regulations, 2017	These regulations provide detailed procedures for implementation of the Community Land Act 2016, including conversion of community land via compulsory acquisition.
The Land (Assessment of Just Compensation) Rules, 2017	The Rules set out the basis for the valuation of land and assets and setting of compensation and assistance for land acquired compulsorily in line with the Land Act. They state that: "market value" means the value of the land at the date of publication in the Gazette of the notice of intention to acquire the land. The rules state that the NLC

Legislation	Guidance and provisions
	shall consider the following factors when assessing compensation: the market value of the land; damage sustained or likely to be sustained due to severing the land from a person's other land; damage due to acquisition injuriously affecting a person's other property, whether moveable or immovable; reasonable expenses incidental to the relocation; damage resulting from diminution of the profits of the land between date of Gazettement of the intention to acquire the land and the date the NLC takes possession of the land. The Rules also state that the NLC shall add a disturbance allowance of 15% of the total amount of compensation due affected land and assets.
Petroleum (Exploration, Development and Production) Act (2017)	"Petroleum operations" mean all or any of the operations related to the exploration for, development, extraction, production, separation and treatment, storage, transportation and sale or disposal of petroleum up to the point of export. The Government shall grant or cause to be granted to the contractor, its contractors and sub-contractors such way-leaves, easements, temporary occupation or other permissions within and without the contract area as are necessary to conduct the petroleum operations and in particular for the purpose of laying, operating and maintaining pipelines and cables, and passage between the contract area and the point of delivery of petroleum.

Key Aspects of Kenya's Legal Framework

Key aspects of the existing national legal framework of relevance to land access for the Project include the following:

- Government can acquire land (including community land) through compulsory land acquisition for public interest purposes and can convert any class of land into public land. Procedures for compulsory acquisition are set out in the Land Act, 2012 and require that fair compensation is provided in line with the Constitution and Land Act.
- Unregistered community land is held in trust by County Governments on behalf of the people of the County.
- The National Land Commission (NLC) is the body mandated with implementing compulsory land acquisition and administering community land.
- Public and community participation is a key requirement in any compulsory acquisition processes. Gender equity and consideration for vulnerable groups is also required.
- Under the Community Land Act, community land can be registered and managed at community level.
- The Prevention, Protection and Assistance to Internally Displaced People & Affected Communities Act (2012), sets legal requirements to protect and assist internally displaced persons, including those required to leave areas of residence due to large scale development projects. Government must ensure that the displacement is carried out in manner respectful of human rights and consistent with law, taking in particular into account the protection of community land and the special needs of women, children and persons with special needs. The Act requires Government to provide durable solutions for livelihoods, restoring housing, land and property, consultation and participation of the displaced people.
- The Land (Assessment of Just Compensation) Rules, 2017 set the basis for valuation of land and assets, compensation and assistance for land acquired compulsorily in line with the Land Act, including factors to consider in establishing market values and the requirement for a 15% disturbance allowance.

B-2. Applicable International Standards

The Upstream Project will undertake a range of additional activities to comply with International Standards.

International Standards comprise those required by Equator Principles Financial Institutions who may participate in the project financing and other corporate requirements of the Project. Specifically, this will entail compliance with IFC Performance Standards of relevance to land access.

Relevant IFC Performance Standards

The key IFC Performance Standards of relevance to land access by the Project are:

- **PS1: Assessment and Management of Environmental and Social Risks and Impacts** – specifically related to stakeholder engagement;
- **PS5: Land Acquisition and Involuntary Resettlement** – particularly related to requirements for private sector responsibilities under Government-managed resettlement;
- **PS7: Indigenous Peoples** – particularly related to the requirement for free, prior and informed consent related to the use of land traditionally used by indigenous peoples.

The relevant requirements of each Performance Standard are set out below.

IFC PS1 – Risk Assessment & Management

IFC PS1 requires that potential project impacts are identified and assessed and that an effective stakeholder engagement process is implemented to ensure that Affected Communities are engaged through a process of Informed Consultation and Participation (ICP)[5].

IFC PS 1 also requires that if a project is anticipated to have adverse impacts on Indigenous Peoples, that a process of ICP will be implemented and in certain circumstances (described in IFC PS7) that the free, prior and informed consent of such Indigenous Peoples is obtained[6].

IFC PS5 – Land Acquisition and Involuntary Resettlement

IFC PS5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use the land, including physical displacement (relocation or loss of shelter) and economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood).

The objectives of PS5 are:

- To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
- To avoid forced eviction;
- To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost, and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
- To improve, or restore, the livelihoods and standards of living of displaced persons; and
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

When physical and/or economic displacement results from compulsory acquisition in accordance with host country law, PS5 applies. Requirements of PS5 are summarised in Table 8 below.

It should be noted that where land acquisition and resettlement is the responsibility of the government, PS5 para 30-32 require the Project collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with PS5. And where government capacity is limited, the client will play an active role during resettlement planning, implementation, and monitoring. If government measures do not meet requirements of PS5, the Project should prepare a Supplemental Resettlement Plan (for

[5] IFC PS 1, para 32
[6] IFC PS1, para 32.

physical displacement) or an E&S Action Plan (for economic displacement only) to complement government action.

IFC PS5 Project Responsibilities Under Government-Led Resettlement

The approach adopted by the Project is guided by IFC Performance Standard 5, para 30-32 which define private sector responsibilities under government-managed land acquisition and resettlement as follows:

PS5 recognises that there are situations where the Government will lead resettlement activities. This is the case for Upstream Project and the Project will collaborate, to the extent permitted by the responsible agency (the National Land Commission and relevant GoK ministries), to achieve outcomes that are consistent with IFC PS5 (IFC PS5, Para 30).

Requirements Where Physical Displacement Occurs
Key steps to be undertaken where compulsory acquisition results in physical displacement comprise:

- Identifying and describing Government resettlement measures;
- Where these do not meet the requirements of PS5, the Project will prepare a Supplemental Resettlement Plan (to bridge the gaps). This will include:
    - Identification of affected people and impacts;
    - Description of activities and entitlements under applicable national law;
    - Supplemental measures to meet PS5 requirements as permitted by the responsible agency, and an implementation timetable;
    - Implementation plan and budget to implement the Plan.

Requirements Where No Physical Displacement but Economic Displacement May Occur
Where there is economic displacement only, the requirement in PS5 is to identify and describe the measures that the responsible government agency will use to compensate affected communities and persons (IFC PS 5, Para 32). If these measures do not meet the requirements of PS5, the Project will prepare an Environmental & Social Action Plan to complement government action. This may include additional compensation for lost assets, and additional efforts to restore lost livelihoods where applicable.

Table 8: Summary of Key Requirements of IFC PS5

- Feasible alternative Project designs should be considered to avoid or minimise physical or economic displacement, while balancing environmental, social, and financial costs and benefits, paying particular attention to impacts on the poor and vulnerable.
- When displacement cannot be avoided, the client will offer displaced communities and persons compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living or livelihoods.
- Full replacement cost is defined in PS5 as the market value of the assets plus transaction costs (such as land registration costs) and depreciation of structures and assets should not be taken into account.
- Projects should recognise that displaced persons include persons with: formal legal rights to land and assets; no formal legal rights to land or assets, but a claim to land recognised or recognisable under national law; and those with no recognisable legal right or claim to the land or assets they occupy or use.
- The Project should engage with Affected Communities, including host communities, through the process of stakeholder engagement described in PS1 and where appropriate PS7.
- The Project should establish a grievance mechanism consistent with PS1 as early as possible in the project development phase.

- A census should be carried out to collect appropriate socio-economic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance.
- The Project should identify those persons who will be displaced and establish a cut-off date to establish eligibility for compensation.
- The Project should offer land-based compensation, where feasible, where livelihoods of displaced persons are land-based, or where land is collectively owned.
- Where physical displacement occurs, the Project should offer the choice of in-kind replacement housing of equal or higher value, security of tenure, equivalent or better characteristics, and advantages of location or cash compensation where appropriate.
- Where physical displacement occurs, Projects should prepare a Resettlement Action Plan (RAP); and where only economic displacement occurs, should prepare a Livelihood Restoration Plan (LRP).
- Standards for compensation should be transparent and consistent within a project, and established with the participation of the Project Affected Persons.
- Projects must offer displaced persons and communities' compensation for loss of assets at full replacement cost, and other assistance to help them improve or at least restore their standards of living or livelihoods.
- In the case of physically displaced persons, the project proponents should offer the choice of replacement property of equal or higher value, equivalent or better characteristics, and advantages of location and security of tenure, or cash compensation at full replacement value where appropriate.
- If land acquisition for the project causes loss of income or livelihood, regardless of whether or not the affected people are physically displaced, projects are required to: promptly compensate economically displaced persons for loss of assets or access to assets at full replacement cost.
- Affected business owners should compensated for the cost of re-establishing commercial activities elsewhere; for lost net income during the period of transition, and for the costs of the transfer and reinstallation of the plant, machinery or other equipment; provide replacement property (e.g. agricultural or commercial sites) of equal or greater value, or cash compensation at full replacement cost where appropriate.
- Compensate economically displaced persons who are without legally recognizable claims to land for lost assets (such as crops, irrigation infrastructure and other improvements made to the land) other than land, at full replacement cost.
- Provide additional targeted assistance (e.g. credit facilities, training, or job opportunities), and opportunities to improve or at least restore their income-earning capacity, production levels, and standards of living to economically displaced persons whose livelihoods or income levels are adversely affected.
- The need to pay particular attention to impacts on vulnerable persons and to ensure that they are not disadvantaged and can access the compensation and assistance available.
- Provide transitional support to economically displaced persons, as necessary, based on a reasonable estimate of the time required to restore their income-earning capacity, production levels, and standards of living.
- Identify, review, and abide by all laws of the host country that are applicable to land acquisition and involuntary resettlement.
- In cases of Government led land acquisition, the Project should collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes consistent with PS5. If government measures do not meet requirements of PS5, the Project should prepare a Supplemental Resettlement Plan (for physical displacement) or an E&S Action Plan (for economic displacement only).

IFC PS7 – Indigenous Peoples

Under IFC PS7, requirements for a Free, Prior and Informed Consent (FPIC) level of consultation and engagement are triggered if there are likely to be impacts on lands and natural resources subject to traditional ownership or under customary use by Indigenous Peoples (IFC PS7, para 14).

The basic required level of consultation and engagement for Indigenous Peoples is Informed Consultation & Participation (IFC PS1, para 32).

Indigenous Peoples may be particularly vulnerable to the loss of, alienation from or exploitation of their land and access to natural and cultural resources. In recognition of this, in addition to the general requirements of PS7, the Free Prior and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples is required under the following conditions:

- Impacts on lands and natural resources subject to traditional ownership or under customary use; and/or
- Relocation of Indigenous Peoples from Lands and Natural Resources Subject to Traditional Ownership or Under Customary Use; and/or
- Impacts on critical heritage and/or the use of cultural heritage for commercial purposes.

Although officially there are no indigenous groups in Kenya, and communities such as the Turkana are identified in the Kenyan Constitution (2010) as "marginalized groups", the Turkana demonstrate characteristics that meet applicable criteria in PS7 for defining indigenous groups:

- Self-identification as a distinct cultural group and recognition of this identity by others;
- Collective attachment to distinct territories and to associated land and natural resources;
- Customary cultural and social institutions and a distinct language.

The FPIC process and documented agreement will reflect the outcome of the negotiation with the community and will involve repeated consultations involving project description, project impacts and project impact avoidance, minimization, mitigation and compensation. The delivery of commitments articulated in the agreement will be monitored and reported.

A detailed description of the engagement strategy to secure IFC Performance Standard stakeholder engagement requirements is described in the Project's Stakeholder Engagement Framework, outlined in Section 9 below.

B-3. Comparative Analysis between National Law and IFC Requirements

A comparative analysis between Kenyan national legislation and IFC PS5 and PS7 requirements is summarised below, and measures to address any gaps are outlined. There are several areas where IFC requirements are more stringent than national legislation, for example, in requirements for:

- **Project design:** alternative project designs to be considered to avoid or at least minimise physical or economic displacement.
- **Socio-Economic Surveys**: Conducting socio-economic surveys to assess impacts on livelihoods is required by PS5, but not required by Kenyan law. The Project is implementing socio-economic surveys in line with PS5.
- **Consultation, Stakeholder Engagement and FPIC:** PS5 sets greater requirements than Kenyan law for giving affected parties the opportunity to participate in, for example, the negotiation of livelihood restoration and resettlement assistance. The Project will adopt approaches to meet both PS5 and PS7 requirements. IFC requires that the Project prepare and implement a stakeholder engagement plan. In addition, Free prior and informed consent (FPIC) is required in specific circumstances defined under IFC PS7.

- **Livelihood Impacts and Restoration**: Unlike Kenyan law, PS5 includes requirements for livelihood restoration to restore incomes and standards of living of displaced persons to pre-project levels (both for people with formal and informal land title).
- **Transitional Support:** PS5 requires transitional support, which is not specifically provided under national legislation.
- **Development benefits:** PS5 requires projects to provide opportunities to displaced communities and persons to derive appropriate development benefits from the project.
- **Valuation of land & assets:** PS5 requires compensation to be based on full replacement costs, whereas Kenyan legislation only refers to market value. Discussion is required with the NLC to understand whether national valuation methods represent full replacement cost as defined by PS5.
- **In-Kind Compensation:** PS5 considers in-kind compensation (such as replacement housing and replacement land) preferable to cash compensation and requires that displaced persons should be offered options, whereas Kenyan law only requires compensation.
- **Preparation of RAP/LRP documents**: Kenyan law does not contain a strict requirement for the preparation of resettlement action or livelihood restoration plans. In practice, these are typically prepared but not specifically to meet IFC requirements.
- **Vulnerable Persons:** PS5 requires that project pay particular attention to the poor and vulnerable during any RAP / LRP processes.
- **Grievance Mechanism** – Unlike PS5, Kenyan law does not require establishment of a grievance mechanism to resolve land related grievances.
- **Monitoring and evaluation:** PS5 requires monitoring and evaluation of implementation and successful completion of RAP or LRP.

The Project will be developed and implemented to meet the higher of national legislative and IFC standards. This RLR Framework therefore identifies how to bridge the gaps identified between national legislation and PS 5 and PS7 FPIC requirements.

The Table below summaries the analysis of the Kenyan Land Acquisition process when compared to IFC PS 5 and 7. The table describes the anticipated variance and establishes the way forward to ensure that the Project implements most stringent of the two approaches.

Table 9 Comparative Analysis of Kenya Legislation and IFC Requirements

Aspect	Analysis of Gap between Kenyan Legislation and IFC requirements:	Measures to Address the Gaps:
Avoiding/ minimizing displacement through Project design	GoK protocols provide limited requirements for avoiding and/or minimising displacement related impacts.	Design the Project to avoid or minimise the extent of displacement.
Socio-economic census	EIA regulations of 2003 require social economic analysis of the project but not a socio-economic survey / census. Kenyan laws do not require a socio-economic census of displaced persons to be undertaken.	Based on NLC data, the Project will identify all qualifying households who will be displaced as a result of the development activities. The Project will undertake a separate supplemental socio-economic survey of qualifying households related to livelihoods and incomes prior to any physical resettlement to determine the socio-economic characteristics of affected persons and design assistance for livelihood restoration and engagement with vulnerable persons.
Consultation,	Consultation processes associated with	Consultation will be undertaken by the NLC

Aspect	Analysis of Gap between Kenyan Legislation and IFC requirements:	Measures to Address the Gaps:
Engagement and FPIC	Kenyan compulsory land acquisition processes are usually aimed at sensitising affected parties on the project and the activities that will be undertaken as part of the land acquisition process. In Kenyan law, consultation during compulsory acquisition does not require: giving all affected parties the opportunity to participate in planning resettlement programmes (e.g. livelihood restoration planning). Whilst the Prevention, Protection & Assistance to Internally Displaced Persons & Affected Communities Act, 2012 requires free prior and informed consent of displaced persons, it is unclear how this is applied in practice.	in accordance with Kenyan legal requirements. Outside of the statutory land acquisition process, the Project will implement a stakeholder engagement and disclosure plan for the land access programme that defines additional consultative activities to be undertaken following the statutory land acquisition process. Where necessary the Project will implement community and stakeholder engagement, related to supplemental activities, that fulfils PS7 FPIC – including: providing sufficient information, sufficiently prior, involving engagement with recognised community reps and all parts of community (including women, youth, vulnerable etc.), and signing agreements with affected households, as well as rigorous recording of community engagements.
Livelihood restoration	Despite provisions in national legislation, the Kenyan compulsory land acquisition process does not require Projects to ensure that displaced individuals/ communities are assisted in improving or at least restoring livelihood to pre-project levels as required by IFC PS5.	The Project will provide supplemental entitlements to assist economically displaced persons to restore their livelihoods in line with PS5. These will be proportionate to the nature and degree of economic displacement. The Project will develop and implement a Resettlement & Livelihood Restoration Plan once impacts of statutory land acquisition and resettlement activities have been identified. This document will be consistent with PS5 requirements.
Transitional Support	Kenyan law does not require transitional support to be provided, but does provide for disturbance allowances and relocation expenses.	The Project will provide supplemental transitional support to assist displaced persons.
Development Benefits	Kenyan law does not require the sharing of development benefits with persons affected by major projects.	The Project will develop and implement a Resettlement & Livelihood Restoration Plan, as well as local employment procedures during project construction to provide development benefits to affected communities.
Valuation of Assets and compensation	Kenyan laws provide for "just compensation to be paid promptly in full" based on market value and provides an additional 15% disturbance allowance, relocation expenses and for loss of profit. Compensation of land and assets at full replacement cost is not a specific requirement of national legislation.	The Project will document and describe the valuation process and methodology used by the NLC, and describe how NLC valuations, relocation expenses and the statutory 15% disturbance allowance relate to full replacement cost.
In-kind compensation options	Under Kenyan law, compensation is provided in the form of cash, and does not include the option of in-kind replacements land or assets.	Where appropriate, the Project will meet PS5 requirements. The Project will engage with NLC to determine whether it is feasible to provide physically displaced persons the option to choose either cash compensation

Aspect	Analysis of Gap between Kenyan Legislation and IFC requirements:	Measures to Address the Gaps:
		or in-kind replacement houses, and similarly in-kind replacement land where PAPs lose significant areas of land used for livelihoods. If not, the Project will undertake monitoring of PAP circumstances and develop appropriate measures to ensure that standards of living and livelihoods of those getting cash compensation are not affected by risks relating to this issue.
Preparation of RAP/LRP documents	Kenyan law does not contain a requirement for the preparation of resettlement action or livelihood restoration plans.	The Project will prepare and implement a Resettlement & Livelihood Restoration Plan in line with PS5 requirements for government led land acquisition programmes.
Vulnerable Persons	Kenyan compulsory acquisition processes do not make provision for identifying and engaging vulnerable groups/ individuals, or require that vulnerable persons are provided with additional support during implementation.	The Project will work with the GoK to the extent possible ensure that vulnerable persons are effectively engaged in the land acquisition process, are able to benefit from compensation and support and will be assisted in the relocation process.
Grievance management	GoK legal provisions include an appeals process in line with legislation relating to compulsory acquisition of land. Grievance redress associated with compulsory practices does meet lender requirements for a grievance mechanism.	In conjunction with County Government, develop a grievance mechanism accessible to project affected persons, including free access to judicial and administrative remedies.
Monitoring and evaluation	Kenyan regulations do not require Projects to monitor and evaluate land acquisition and resettlement.	The Project will develop an independent monitoring and evaluation procedure to assess the effectiveness of the supplemental measures and restoration of livelihoods. Affected persons will be consulted during the monitoring and evaluation.

B-4. Corporate Policies

Project partners' Environment and Social policies state that it will comply with the requirements of applicable host country laws and regulations and apply corporate standards where their requirements are more stringent than host country laws.

The Project will ensure that its activities are in line with the requirements of its shareholders and comply with national regulatory requirements and applicable international standards and other requirements.

As land for the Upstream Project is being provided by GoK in line with the PSCs, the Project is not involved directly in land acquisition which is the sole responsibility of the Government of Kenya. As stated above, the Project will work, to the extent permitted by GoK, to ensure that GoK land acquisition activities related to the project are aligned to the requirements of applicable international standards, notably IFC PS 5.

B-5. Institutional Roles

The respective roles of Government bodies involved in land acquisition, compensation and resettlement have been in a period of transition in recent years in light of legislative developments such as the Amendments to the Land Laws 2015. Institutional roles are outlined below.

Table 10 Roles and Responsibilities

Organisation	Responsibilities

Organisation	Responsibilities
MoPM – as the Acquiring Body	• Acquire Land through the NLC and avail secure land rights to the Upstream Project • Develop Grievance Mechanism for the benefit of the Project Affected Persons related to the Upstream project. • Conduct comprehensive public participation in conjunction with relevant agencies regarding land acquisition. • Share relevant acquisition process data i.e. public participation reports, survey reports and compensation reports with the Project to facilitate preparation of RLRP. • Plan use of land that is not taken up by the Project and that will be available for community or public use. • Integrate land access approach (with LCDA) between the Upstream Project and the Midstream Project.
NLC – as the Acquiring Authority	• Conduct the statutory land acquisition process, including land and asset surveys and valuation. • Conduct comprehensive public participation in conjunction with MoPM and other relevant agencies regarding land acquisition. • Share land acquisition process data with MoPM and the Project, i.e. public participation reports, survey reports and valuation and compensation reports. • Establish the rates of compensation for affected private land, public land, community land and assets thereon. Negotiate and inform Project Affected Persons and the relevant County Government on compensation rates. • Resolve any land acquisition related disputes on behalf of MoPM. • Undertake sensitization in conjunction with MoPM regarding land acquisition.
MoL -as the registrar of land rights	• Conducts final surveys of land and issues requisite Maps. • Registers Land rights. • In collaboration with NLC, assist in survey and valuation of land and assets. • Advice on the appropriate land rights between MoPM and the Project.
County Governments As the custodian of unregistered community land	• In collaboration with MoPM and NLC, coordinate public participation for land acquisition and access. • Implement mechanism to manage reasonable restrictions on land use within the Gazetted Areas. • Support the NLC in assessment of compensation (eg. in relation to Land Value Index). • Negotiate with NLC on compensation for community land and manage compensation received on behalf of affected communities. • Support the Project in carrying out supplemental work to restore livelihoods.
The Project – as the ultimate land user	• Develop and implement an appropriate Resettlement and Livelihoods Restoration Framework and Plan, and other supplemental documentation required to meet IFC Performance Standards. • Identify land requirements and inform MoPM. • Obtain from NLC and MoPM relevant information on statutory entitlements for Project Affected Persons and NLC PAP survey data sets. • Undertake supplemental socio-economic survey of PAPs and data for analysis of

Organisation	Responsibilities
	impacts, to feed into livelihood restoration planning, implementation and disclosure. • Engage with communities, in collaboration with County Governments, to achieve informed consultation and participation and PAP/stakeholder involvement in the design of livelihood restoration measures. • Conduct any additional stakeholder engagement required to achieve free prior and informed consent if applicable. • Implement supplementary entitlements, livelihood restoration measures, site restoration and other procedures • Implement grievance management and on-going community liaison procedures.

B-6. Summary

The Kenyan legal framework establishes legal powers for acquisition of land in the public interest, provided that fair compensation is paid to persons with interests in the land. It also sets out processes for how land will be acquired and the lead roles of Government bodies (such as the National Land Commission) in implementing the land acquisition process.

As well as complying with Kenyan legislation, the Project is required to ensure that land acquisition meets applicable international standards. There are a number of areas where these standards exceed national legislative requirements (eg. the requirement for livelihood restoration where economic displacement occurs and the level of engagement with affected communities).

Therefore, the approach to securing land access will follow the Government led land acquisition approach, supplemented with additional steps and measures required to meet international funder requirements.

IFC Performance Standards recognise that there are situations where the Government will lead resettlement activities. In these cases, the Project will collaborate, to the extent permitted by the responsible agency, to achieve outcomes that are consistent with the IFC Performance Standards.

This approach will require effective and coordinated joint working between national Government (including MoPM, MoL and NLC), County Governments and Project partners. Agreement needs to be reached over the supplemental measures the Project will provide and clear roles and responsibilities for the Project and government bodies such as the NLC.

Annex C: Land Use and Socio-Economic Context

The following describes land tenure, land use and the socio-economic context of the Upstream Project area.

Land Tenure in the Project Area

The Constitution of Kenya (2010) and the Sessional Paper No.3 (2009) on the National Land Policy, classify land in Kenya as either Public land, Private land; or Community land[7]. Land in the Project area is classified as Community Land and remains unregistered, both in Turkana and West Pokot. It is understood that there is no privately or publicly owned land in the Project area.

Article 63 of the Constitution states that "Community land shall vest in and be held by communities identified on the basis of ethnicity, culture or similar community of interest". Community land includes land which is lawfully registered to a specific community, and community land which has not been formally registered to a community ('unregistered community land'). Article 63 states that "Any unregistered community land shall be held in trust by county governments on behalf of the communities for which it is held".

Beyond Kenya's recognized forms of land tenure, Turkana people recognise that land is a shared resource and common property across all of people of Turkana. In this sense, land in the Project area in Turkana is unregistered community land that belongs to all people of Turkana. Similarly, the land through which the 8 km stretch of water pipeline passes in West Pokot from the Turkwel reservoir before entering Turkana County, is understood to be unregistered community land belonging to the people of West Pokot County.

Elsewhere in Turkana, in addition to unregistered Community Land, land may be classified (or held) as either private or public land. The majority of private or public land is located in urban settings such as Lodwar (the County capital) and towns such as Lokichar.

Communal Land Use and Livelihoods

The predominant land use and source of livelihoods in the Project area is livestock pastoralism, particularly goats, camels, sheep, donkeys and some cattle. Livestock contributes to livelihoods in many ways including sustenance (milk, blood and meat), accumulation of wealth, cash through sale of livestock, and various socio-cultural aspects of Turkana lives including status, dowry payments, support to linked social groupings (clans, sections) etc.

Livestock based livelihoods are typically supplemented by small-scale income-generating activities such as the sale of firewood and charcoal, weaving of mats and baskets, brewing and other small-scale business activities. Emergency relief in the form of food aid or the provision of cash supplements to households continues to supplement traditional livelihoods and is reported to represent an important element supporting the continued existence of traditional pastoralism.

Uses of land in the Upstream Project area include for:

- Homesteads – long term, short term (seasonal) and very short term (migratory).
- Grazing of livestock, mainly goats, sheep and camels which feed on shrubs (eg. Emekwi *(Indigiferaspinosa)*, seed pods of Ewoi trees *(Acacia tortilis)* (especially in the dry season) and foliage of trees such as Eregae *(Acacia reficiens).*

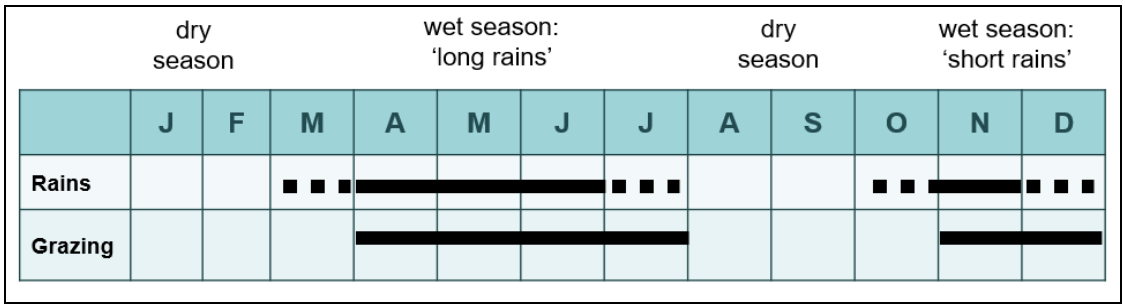
[7] Community Land: (a) Land lawfully registered in the name of group representatives under the provisions of any law; (*b*) land lawfully transferred to a specific community by any process of law; (*c*) any other land declared to be community land by an Act of Parliament; and (*d*) land that is: (i) lawfully held, managed or used by specific communities as community forests, grazing areas or shrines; (ii) ancestral lands and lands traditionally occupied by hunter-gatherer communities; or (iii) lawfully held as trust land by the County Governments.

- Other uses of trees such as: Elim, used for shade and tea is brewed from the bark; Ebei (fruit trees) the berries of which are boiled and eaten, as well as having medicinal qualities.
- Medicinal plants such as Egong (for treating diarrhea), Erodo (for treating elephantitus) and Aloe vera (for treating vomiting, chest, back and skin complaints).
- Trees used for construction of homesteads and animal shelters, including Eregae *(Acacia reficiens)* branches and bark of Ewoi trees *(Acacia tortilis)* as well as charcoal production and carving of implements such as sticks and bowls.
- Lugga (seasonal water courses) where water holes are dug, as well as providing shade especially during dry season months.

In terms of water use, most of the people living in or near the Upstream Project area in South Lokichar rely on community water tanks installed and filled by the Project.

Seasonal patterns of rainfall, quality of grazing and availability of water, mean that the Turkana are nomadic. Although rainfall varies from year to year, the South Lokichar Project area, as illustrated in Figure 6, typically experiences 'long rains' from April to June and 'short rains' around November and December. The wet seasons are interspersed with dry seasons, during which livestock move to areas of dry season grazing, usually to the hills between 10km – 25 km to the south west of South Lokichar towards Kainuk.

Figure 5: Typical Seasonal Rains and Grazing in the Project Area



Source: EOPS ESIA Lands Baseline, Golder Associates for TKBV, 2017.

Figure 6: Livestock Grazing in the Project Area – camels and goats

Community Social Structures and Linkage to Land:

Key terminology related to the Turkana traditional social units include:

- ***Awi (pl: ng'awi) or household:*** The most fundamental unit of social aggregation is the family unit, which is headed by a male head of household with one or multiple wives, children and often other dependent women. Households may cluster and travel with two to five other households to form a large *Awi* or *Awi Apolon* (McCabe, 2004);

- ***Ere (pl: ng'ereria):*** describes the ancestral domain of a family. An *ere* may be described by the current household (including grand-parents, siblings and children) as the location from where the family derives and, to a variable extent, may live (seasonally or more permanently for the old, women and children) and graze their livestock. The *ere* is not necessarily a place of permanent abode or settlement in so far that seasonal migration may take the *ere* family away from their *ere*. The *ere* family may claim authority over, and preferential access to, natural resources (e.g. trees and seasonal grazing) located within the *ere*, but this claim does not convey (land) ownership rights – unregistered community land is owned by the people of Turkana. As such, Turkana can access land within a family's *ere* for temporary grazing purposes but it is understood that permission must be sought. The person with the right to speak on behalf of people in the *ere* is the man who heads the *ere* family. Borders of the *ere* are usually delineated by features such as a *luggas,* ridgelines, livestock tracks (for moving stock long distances), roads and occasionally certain species of trees. These borders are generally known by everyone living in the vicinity, however opinions can vary within an administrative unit over where *ere* boundaries lie and the geographic scale of an *ere*, with *ere* boundaries identified by one person sometimes differing or being superimposed upon an *ere* identified by others.

- ***Ekitela (pl: ngitela)* or territorial Section:** All herd owners are members of a territorial Section, geographic areas, often with overlapping boundaries[8]. Sections differ in various ways, such as environmental conditions or characteristics. Though once a territorial unit in a socio-political system, their role is diminished by government administration (Müller-Dempf, 1994);

- ***Emacar (pl ngimacarin)* or Clans*:*** Non-territorial social organisation related to kinship and stock associations. All Turkana are born into the clan of one's father and women join the clan of their husband upon marriage. Clans are exogamous (i.e., a man may not marry a woman from his clan) and membership is symbolised by brands that appear on animals in a herd (McCabe, 2004);

[8] Müller-Dempf, 2014

- ***Adakar (pl. ngadakarin):*** A temporary clustering of *awi* or homesteads usually formed during the wet season when families congregate into temporary associations particularly for the purpose of security from livestock raiding. People within the *adakar* remain together, for companionship and protection, for as long as the forage and water resources permit; this is often 2-4 months following the onset of rains. (McCabe, 2004). Sometimes referred to as "cattle camps" even if the herd does not specifically contain cattle; and

- ***Arumrum: (pl. ng'arumrumio)***: New form of social organisation starting from the mid-1990s consisting of a large encampment of multiple heard owners under the leadership of a single man. Concentrically built thorn fences and heavy armament was designed to fend off attacks. (McCabe, 2004). This clustering could include up to 100 households (Eriksen, S, and J Lind. 2009).

In recent years, a number of *Adakar* or *Arumrum* have been observed in the Upstream Project area, for example: in the Ngamia field area, the Lotiman adakar and Kode Kode adakar have developed since around mid-2017; and in the Amosing field area, the Lokosimekori adakar was established in 2018. Each of these contained an estimated 30-40 households in November 2018, and were apparently established in response to safety concerns in the face of livestock raiding and for access to the main road and community water tanks provided by the Project.

Homestead Structures and Shelters:

Traditional Turkana and most people in the Upstream Project area, reside in non-permanent circular homestead dwellings known as *akai* (see Figure 3). An *awi* may live in a homestead comprising multiple *akai* to accommodate the head of the household, his multiple wives and children and any extended family members such as elderly relatives. There may also be daytime structures which provide shade (*ekol*). In addition, a homestead usually has temporary animal enclosures nearby for protecting livestock at night known as *anok,* made from thorned branches (such as Eregae), with separate enclosures built for goats and camels.

Figure 7: Traditional Nomadic Homestead Structures in the Project Area

Different categories of homestead structures are present in the Project area:

- **Long term homesteads** – 'Long term' homesteads are occupied in an area over an extended period covering both wet and dry seasons and typically for a period of a year or more. The elderly and young members of the household often remain at this homestead all year round. These types of structure typically take around 5 days to build. The location of long-term homesteads is often within an *ere* linked to the family, and the precise location

within an area inhabited by a household may periodically change (every 6 months or so) to avoid issues such as livestock dung build, ticks and animal disease. In addition, a small number of mud and stick walled, corrugated metal sheet dwelling structures have recently been observed in the Upstream Project area.

- **Short-term homesteads** (seasonal) - typically used for 2-3 months, whilst accessing wet season livestock grazing in an area, and only take one or two days to construct.
- **Very short-term homesteads** (migratory) – occupied for a few nights en route to other areas, and only take a few hours to construct.

Each of these types of homestead typically have animal shelters next to them (see Figure 4).

Figure 8: Nomadic Animal Shelters in the Project Area

Displacement Impacts:

Potential displacement impacts expected to arise from Project land use for the Upstream Project are outlined below. More detailed analysis of impacts will be included in the subsequent RLR Plan once Project land areas are confirmed and will be informed by future Project baseline field work and the GoK's land and asset surveys as part of the government led statutory land acquisition process.

Physical Displacement

Physical displacement will occur if a household is occupying a homestead structure and is required to move away from the site of a new Project facility. This is expected to only apply to *occupied* long-term and seasonal homesteads, since people do not re-use shelters that they have vacated unless they have been very recently built and in good repair. Physical displacement would not apply to "very short term" / "migratory" homestead structures, since these are only used for 2 or 3 days and would be vacated in a few days in any case.

Even if a household is affected by physical displacement, the extent of the impact will be relatively limited since nomadic pastoralists in the area frequently move the location of their homesteads, either to access better grazing elsewhere, or to avoid pests or disease associated with dung build-up in animal shelters next to the homestead.

In recent years, the number of homesteads in the Project area at any particular time has varied according to factors such as seasonal rains which affects quality of grazing, and the security situation vis a vis the risk of livestock raiding. The South Lokichar Project area is an area of 'wet

season' grazing, used most by nomadic pastoralists (who construct seasonal homesteads) during the months of April to June and November to December when their livestock access wet season grazing in the area. In addition, there are usually some homesteads present throughout the year, including homesteads where children and elderly members of a household live whilst the men, some women and youth tend their livestock in dry season grazing areas generally located towards hills 10km - 25km away to the south west of the Project area.

Even when a household stays in an area for a longer period spanning wet and dry seasons, the household typically moves the homestead and animal shelters every few months to avoid risk of pest and disease associated with build-up of dung in animal shelters next to the homesteads.
Since mid-2017, a number of larger *adakar* or *arumum* clusters of homesteads have been established in the Ngamia and Amosing areas – with two present in the Ngamia field in November 2018, and one present in the Amosing field. Factors behind the establishment and location of these are understood to include enhancement of security in the face of livestock raiding threats, proximity to the main road to enable access to GoK support (especially in times of drought) and proximity to community water tanks provided by the Project.

The following summarises findings from the Upstream ESIA (2019) on the number of households living in the Project areas.

- **Twiga field:** The November 2018 baseline survey identified six occupied long-term homesteads in the Twiga field. Five of these were located near the large lugga to the NW of the Twiga field and one just east of Twiga-01. The homestead families reported that they had been living in the area over a number of years and since before Tullow commenced activities in the area in 2012.
- **Ngamia field:** The November 2018 baseline survey identified some 75-95 occupied homesteads in the Ngamia field, a significant increase on the numbers recorded from 2015 to 2017. Of these, an estimated 30-40 households were living in the Lotiman adakar, located 600 m inside the northern boundary of the Ngamia field – this adakar was established around mid-2017. A further 30-40 households were living at the Kode Kode adakar located around 200m south east of Ngamia-1 on the eastern side of the road. Away from these two adakar, there were another 16 occupied homesteads in the Ngamia field area, all of them were located east of the main road.
- **Amosing Field:** The November 2018 baseline identified approximately 40 to 50 occupied homesteads in the Amosing field area. These comprised an estimated 30 to 40 households living in the Lokosimekori adakar, located just east of the main road some 750 m west of the existing Amosing-5 well pad. A further 12 households were identified elsewhere in the Amosing field area, mainly in the north eastern portion of the Amosing field towards Nakukulas settlement which lies approximately 1 km north east of the field – 10 of these homesteads were classified as long-term and 2 were classified as short-term seasonal homesteads.
- **Ekales / Agete field:** not covered in the Nov 2018 lands baseline data survey.
- **Etom field:** not covered in the Nov 2018 lands baseline data survey.
- **Interconnection lines:** The routes of interconnecting buried flowlines and overhead transmission line (OHTL) run for 18.3 km between the Twiga field and the Ngamia field and a shorter 800 m section between the Ngamia and Amosing fields. These interconnection routes fall outside the Gazetted field areas. A right of way (RoW) of 30 m will be established for temporary land access during installation of the flow lines and an additional 10 m RoW established for the OHTL. Baseline land survey undertaken in July 2019, identified only one occupied homestead area within the interconnection RoW between Twiga to Ngamia (1 km south east of the Kapese airstrip facility) and no occupied homesteads within the RoW for the 800 m section of interconnection route between the Ngamia and Amosing fields.

Displacement of Structures Other than Dwellings

Other structures that could be affected are animal shelters / enclosures which Turkana and West Pokot people construct next to their homesteads – made of circles of branches and twigs cut from nearby trees and shrubs, in which goats and camels are kept overnight. These are temporary structures which are quick to assemble. When the people leave a homestead, the animal shelters fall into disrepair and tends not be re-used due to build-up of dung and risk of disease, animal ticks and other pests. As noted above, even when a household stays in an area for a longer period spanning wet and dry seasons, the household typically moves the homestead and animal shelters every few months to avoid pests and disease associated with build-up of dung in the animal shelters next to the homesteads.

Other private physical assets, which could potentially be affected by Project land access, include dug water holes, though these have not been observed in the three fields in recent years due to the provision of water tanks by the Project.

Displacement of Community Structures

Community facilities or structures which lie within the Project land areas and which may be affected by Project land use include: the new Lokosemikori Primary School located in the Amosing field 775 m west of Amosing-3 well pad, constructed in 2018 but not in use in Nov 2019; and community water tanks provided by the Project in the Twiga, Ngamia and Amosing field areas, including the raised metal water tank linked to the piped community water system constructed 2018-19, just north of Ngamia-1.

The following community structures are not expected to be affected by Project land use, though this needs to be confirmed. The Ngamia Secondary School, which is use and comprises classrooms and dormitories (constructed in 2016-2017) is located on the edge of the Ngamia field area, 2.4 km south east of Ngamia-1, but this is not expected to be affected by Project land use. Similarly, the Lomokamar Primary School classroom, constructed in 2018 and which came into use in 2019, located 120 m north outside the Twiga field area, is also not expected to be affected by Project land use.

Economic Displacement due to Loss of Communal Grazing Land

The majority of the Project area is used for nomadic livestock grazing at certain times of year depending on seasonal rains. Wet season grazing in the area typically takes place from April to June and November to December, and at other times of the year pastoralists take their livestock to dry season grazing areas generally located towards hills 10km - 25km south west of the Project area.

The impact of Project land use on grazing livelihoods, however, is expected to be low in view of the large areas of available grazing land in and around the Project area and the relatively limited area of land directly affected by the Project footprint. Furthermore, for much of the year (especially during dry seasons) livestock is moved to dry season grazing areas outside of the Project area, generally towards the hills 10km to 25km to the south west.

Because of the arid conditions and sparse vegetation, animals require large areas over which to graze, and models such as the Tropical Livestock Unit (TLU) model (see Box 1) estimate that in Turkana, 1 head of cattle or 6 goats require 1 acre of land per annum to graze, and 1 camel requires 1.5 acres per annum. This means that the Project affected land areas would only support a relatively few number of livestock.

Box 1: Land Areas required for livestock grazing

The Tropical Livestock Unit (TLU) model is used in Kenya and elsewhere in sub-Saharan Africa by Governments and bodies such as the UN Food and Agriculture Organisation (UNFAO), Government of Kenya and County Governments, for managing and monitoring livestock production and grazing.

Different livestock types (eg. cattle, camels, goats) can be converted into common units for comparing the grazing land requirements of livestock types in different climatic zones and for identifying stocking densities for optimal management of pastoral grazing land.

Within the TLU model, sub-Saharan Africa is categorised into five agro-ecological zones (AEZs): highlands, humid, sub-humid, semi-arid and arid. There are standard metrics for the areas of land needed to sustain one TLU in these different agro-ecological zones. Pastoral land in Turkana County is classified as falling within ecological zones 4 and 5 (i.e. arid and semi-arid) which can support 1 Tropical Livestock Unit (TLU) per acre per annum. 1 TLU is equal to one head of cattle or 6 goats or sheep. 1 camel is equal to 1.5 TLU implying that 1.5 acres of land are needed to support one camel for one year.

Temporary disruption of livestock movement could potentially occur, eg. due to construction of linear infrastructure such as buried flow lines, but in reality this impact is expected to be minimal since only limited stretches of land would be affected at any one time and animals could easily find alternative routes and mitigation could include livestock movement paths through the linear construction areas.

Loss of Access to Natural Resources

As well as using land for livestock grazing, communities in the vicinity of the Project area use a variety of natural resources: wood for fires and construction of homestead shelters, medicinal plants, food (wild fruits and roots) etc. Land clearance for construction purposes will involve the loss of these resources in areas of the Project footprint. However, the actual level of impact on communities is expected to be low due to availability of similar natural resources nearby and the large extent of community land in the vicinity. The areas to be occupied by the Project represent only a small portion of the total land area from which these natural resources can be obtained. In addition, it's possible that felled trees and timber would be made available for use by the community.

As noted above, there are certain areas described as *ere* to which families have ancestral linkages. Whilst an *ere* does not confer ownership of land or natural resources on the land, it does bring preferential authority over use of the *ere* land and natural resources on it. For instance, if someone arrives in an area and wants to graze animals in someone else's *ere* or stay there, they would need to get agreement from the *ere* leaders and usually provide a gift such as a goat. Project land access may affect *ere* and therefore reduce the area of land and natural resources over which people affiliated to an *ere* have preferential authority over. However, the effect on people's livelihoods of this is not considered significant.

Impacts on Graves and Cultural Heritage

Graves are very important to Turkana communities and are located across the landscape, often where people passed away, and not in specific communal burial areas. There is very little experience of grave relocation in the Turkana and during the E&A phase the Project always sought to avoid any identified graves. Although wherever possible graves will be avoided, it is likely that some graves will be affected by the Upstream Project's land requirements, in which case culturally appropriate steps will need to be agreed and taken to relocate graves, including support for reburial ceremonies. Experience from the E&A Phase showed that apart from graves, there are few other cultural heritage sites in the Project area.

Impacts on Host Communities

IFC PS5 defines 'host community' as any community receiving displaced persons. Although Upstream Project land access is expected to result in some physical displacement, there are not expected to be host community impacts because: there are large areas of communal land and similar suitable areas nearby for establishing new homesteads; the nomadic nature of the community means that people already frequently move homesteads from location to location; and the distribution of homesteads across the area is sparse, so affected households will be able to construct new homestead structures nearby outside of Project affected land areas.

Summary of Displacement Impacts

As indicated above, the magnitude of displacement impacts on individuals or households is expected to be relatively low. Details of the actual numbers of affected households will be drawn from GoK's forthcoming land and asset surveys. The range of impacts (from permanent loss of grazing land and displacement of homesteads, to temporary disruption of access to grazing or natural resources) will be taken into account during resettlement planning and is reflected in the entitlements framework shown in Section 5.5.

Annex D: Key Land Acquisition Data from GoK

Table 11: Key Land Acquisition Data Requested to be shared by MoPM with the Project

	Key IFC PS Data Requirements for Land Acquisition	Rationale	Specific Information Requested
1	**Public Consultation and Participation**	To document the processes of engagement undertaken by GoK / NLC with stakeholders and affected persons.	Copies of invitations and announcements to Public consultations/Meetings
			Records of public announcements, eg. Gazettement notices
			Minutes of meeting detailing discussions/deliberations and resolutions
			Copy of attendance register (gender disaggregated if possible) signed by attendants, indicating their positions, identification details e.g. Id no & contacts
			Issues Register capturing stakeholder concerns and responses
			Copies of consensus and agreements reached with PAPs, stakeholders, community or other officials
			Public sensitization and stakeholder engagement reports
			Publication/correspondence /minute declaration of Cut Off Date
			Reports of engagements, minutes and points agreed with County Governments regarding land acquisition process and entitlements for affected community land assets.
2	**Project Affected Persons**	Document the affected persons	**GoK data on the affected persons and communities, including:**
			Listings of affected land and asset owners, including names, ID number, age, gender, photo, NLC PAP reference number, location, contact details / telephone number if available.
			If communities own affected land and assets, details of the affected communities.
			Any socio-economic data on affected persons gathered by GoK / NLC, *though it is expected that the Project will need to undertake supplemental socio-economic data gathering.*
3	**Details of the GoK survey process**	To document the land & asset survey and valuation processes	Details from GoK / NLC on how the statutory survey processes were carried out to identify and valuation affected land and assets, how the rightful owners were identified, how NLC went about valuing affected land and assets in line with statutory requirements per Kenyan law.
4	**Asset Inventory/ Register and Valuation/ Compensation Schedules**	Informs and records eligibility and entitlements for individual affected persons	Personal details of individuals within project affected households including Names, ID Nos., Tel. No., photos, PAP reference numbers etc
			Description of Loss of land including coordinates, area affected, land tenure/ownership.
			Description of Loss of structure including Construction details, accommodation, use of structure, owner of structure, extent of damage and Photo
			Description of any impacted cultural heritage sites / graves, including family grave is linked to if known, nature of grave, location, photo of grave.
			Description of trees and crops including Type, size/age, Number/area occupied
			Compensation and Entitlements - broken down as: - Land value, Crops and Trees values, Value of structures owned by different PAPs - Basis of valuations - Disturbance allowance - Allowance for disturbance of business profits - Any provision made related to vulnerability - Any statutory relocation assistance (cash or in kind).
			NLC awards notices, detailing statutory compensation and entitlements to PAPs.
5	**Grievance Redress Mechanism**	Mechanism to receive	Grievance register (registration forms, acknowledgement forms, resolution forms) and details of appeals.

	Key IFC PS Data Requirements for Land Acquisition	Rationale	Specific Information Requested
		process and resolve grievances associated with the statutory land acquisition process	Documented Grievance Redress Mechanisms

ANNEX II

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Consultation Meeting Attendance Records

1 Consultation Meeting Attendance Records

Redacted due to inclusion of personal information

ANNEX II

Signature Page

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10 September 2021

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