



Preliminary  
Threat  
Analysis of  
the South  
Lokichar Oil  
Field Basin



# Preliminary Threat Analysis:

Foundation Stage Development of the South Lokichar Oil Field Basin

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Front-page photo: ©Judy Kosgei / WWF-Kenya

The publication of this report has been through the support from the Norwegian Agency for Development Cooperation (Norad) and WWF-Norway. Views in the document do not necessarily reflect those of WWF-Norway or Norad.

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# Acknowledgments

We would like to thank all those who contributed to this preliminary threat Analysis of the South Lokichar Foundation Stage Development. In particular, we acknowledge all those who have actively participated in the focus group discussions and provided information on the implications of the south Lokichar foundation stage development and their recommendations for mitigation measures.

We would like to acknowledge the following community groups and institutions: Lokichar Ward Administration, Turkana Council of Elders, Residents of Lokichar, Lomokomar, Lokicheda, Nakukulas and Turkwel villages, Turkana Empowerment Advocacy Group (TEA-G, Nakulalas Economic Development Organization (NEDO), Asegis Group, Turkana Natural Resources Governance HUB, Inter-religious, SAPCONE, TUPAPAI, Friends of Lake Turkana (FOLT), TUPADO, NKI and Kenya Oil and Gas Working Group.

We would like to thank Marte Ness - Senior Advisor Energy and Development WWF Norway, for her review and input.

# Acronyms

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BPD	Barrels Per Day
CBOs	Community Based Organisations
CPF	Central Processing Facility
CFA	Central Facility Area
ESIA	Environmental and Social Impact Assessment
EWT	Extended Well Test
FGD	Focus Groups Discussion
FID	Final Investment Decision
FEED	Front End Engineering Design
GIS	Geographic Information Systems
IFC	International Finance Corporation
IWMF	Integrated Waste Management Facility
IWRM	Integrated Water Resource Management
JVP	Joint Venture Partners
KOGWG	Kenya Oil and Gas Working Group
LAPSSET	Lamu Port South Sudan Ethiopia Transport Corridor
LLCOP	Lamu Lokichar Crude Oil Pipeline
MoPM	Ministry of Petroleum and Mining
MMBO	Million Barrels of Oil
NEMA	National Environment Management Authority
NGOs	Non Governmental Organisations
STOIP	Stock Tank Oil Initially in Place
WIT	Water Injection Tests
WWF	World Wide Fund for Nature

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# Executive Summary

It is estimated that the South Lokichar Basin contains at least 560 million barrels of oil with the potential to produce more. The country has witnessed increased efforts in oil exploration particularly in the South Lokichar Basin (blocks 10BB and 13T) with a total of 40 exploration and appraisal wells having been drilled in the basin to date. So far extended well tests, water injection tests, well interference tests and water-flood trials have been conducted by the Joint Venture Partnership - Tullow Oil, Africa Oil, Total and the Government of Kenya in order to obtain data on reservoir capacity. This has proven critical in informing planning for the development and commercialisation of the oil fields for example, the successful encounter of over 200 meters of net oil pay in the Ngamia-1 well resulted into further exploration at the Amosing, Twiga, Etuko, Ekales, Agete, Ewoi, Ekunyuk, Etom, Erut and Emekuya areas. As a result, Kenya is now steadily shifting from oil exploration to development and production.

The planned Foundation Stage Project envisages to develop 321 wells consisting of producer and injector wells in Ngamia, Amosing and Twiga. Once the crude oil has been processed and stabilised it will be transported via a buried export pipeline to Lamu for onward sale to the international market. The Front-End Engineering and Design (FEED) was completed in 2018 and submitted to the Ministry of Petroleum and Mining while Final Investment Decision (FID) and Environmental and Social Impact Assessments (ESIA) for the Foundation Stage Project (FSD) is targeted in 2020 with the First Oil production approximately 36 months after FID. The total gross capex associated with the Foundation Stage upstream infrastructure and oil export pipeline is expected to be around \$3 billion.

The key components of the South Lokichar Foundation Stage Project include the following infrastructure:

- New well pads in different fields within the South Lokichar Basin and well drilling activities;
- Buried interconnecting flowlines to transport oil;
- A water pipeline from Turkwel dam;
- Construction of a Central Processing Facility (CPF);
- Construction and use of new access roads; and
- Support facilities and infrastructure, including construction camps, laydown areas and waste management infrastructure.

The FSD is expected to catalyze multimodal developments (sociol, economic, structural) both at local and regional scale however, if not properly managed FSD might have detrimental impacts on existing natural environment and communities. In order to flag such risks associated with FSD, WWF and partners undertook a preliminary threat analysis in South Lokichar oil fields and identified the following high level issues:

## Environmental implications

- Contamination of soil, ground and surface water. FSD is envisaged to directly contribute to increased production of hazardous waste like chemical lubricants, waste water, solid waste etc. If not properly managed, waste water seepage and oil lubricants mixing during construction and operation phases are particularly of great concern. This might result in contamination of both underground and surface water ways such as sand dams along laggas which provide water for livestock and human consumption, this might directly impact on health.
- Hazardous Greenhouse gasses Emission. During the exploration and production phase ,gas flaring is likely to occur at South Lokichar Oil fields releasing high volumes of harmful gases into the atmosphere such as carbon dioxide, methane,sulphur and other forms of gases. These have direct implications on air quality and health of the communities living in the vicinity of the flares and negates commitments made by countries under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol.
- Impacts on Water resource management and governance: While FSD has plans to secure the projects water demands from Turkwel dam, it was identified that the project will have minimal impact on water

volumes. However, due to multiple uses of the Turkwel river (such as electricity generation, small scale irrigation, wildlife (Nasolot National Park and West pokot), livestock consumption, fishing, gold mining activities), there is need for appropriate adherence to water regulations and legislation in ensuring effective water resource management and governance measures to ensure balance in water quality, quantity and equity in resource use.

- Land acquisition, displacement, Land use and ownership changes: FSD lies in predominantly rangeland areas with the main land use being pastoralism. Community land ownership is the major form of land entitlement. This study ascertained a number of issues including :
  - i) The introduction of oil and gas activities is anticipated to bring in urban growth and subsequent population influx in the FSD area;
  - ii) Ongoing infrastructure constructions around Twiga and Amosing oil fields has not only blocked traditional grazing corridors leading to Angorangora pasturelands but also denied local pastoralists access to prime Nagumet - Nasulu - Kakori - Kamar Stream and adjacent pastures which are critical for dry season grazing (regions between Lopii and Lokwamosing) the oasis around Nagumet hills provides all season water point for livestock;
  - iii) Relocation of communities as a result of land acquisition for the FSD supporting infrastructure ( Land adjacent to Ngamia and Amosing fields will be required for the development of infrastructure such as the CPF, camps, access roads and waste management infrastructure). There is need to adhere to existing land governance mechanisms including laws and regulations that ensures that community land rights are protected. This can be through compensation and resettlement for displaced communities as well as their livelihoods. Previous examples of land acquisition related to oil activities within Kenya, have historically been characterized by disputes and confusion arising due to land ownerships and illegal transfers observed when land has been identified and earmarked for project development. In the past many local communities have felt displaced from their traditional lands of heritage without Free Prior and Informed consultation and through unscrupulous means that often include denial to full access to information on the land acquisition process.
- Biodiversity Threat: The Nasolot and South Turkana reserves and their rich biodiversity heavily rely on the Turkwel, Kerio Rivers and their tributaries for all season water supply. Specifically the large herds of elephants in both reserves implies large volumes of water supply is required for their survival. This study assumes minimal pressure on Turkwel dam water volumes even with the tapping of the resource to support Oil field water demands. However, laxity in observing water regulations might impact negatively on both water quantity and quality and this might pose devastating effects to the flora and fauna in the two critical habitats (Nasolot and South Turkana) national reserves.

### **Socio-economic implications**

- Shrinkage of pastoral lands and the potential lack of access of pastoral migratory routes leading to resource conflicts. Exploration and appraisal of the Turkana fields was initially undertaken in the absence of the Community Land Act, 2016 which would regulate negotiations with the Turkana pastoralist communities for compensation mechanisms. Pastoralist communities view the shrinkage of pastoral land as systematic displacement and loss of livelihood means that can only be supported by such a fragile ecosystem which they have depended upon for centuries.



- Population influx as a result of immigration and in-migration due to increased access to opportunities in the South Lokichar Oil basin.

WWF and KOGWG have elaborated recommendations below to help guide the FSD process in an attempt to ensure that the potential direct and indirect impacts on people and nature are addressed.

1. Need to establish a detailed baseline data repository for biodiversity, social and ecosystem services of the South Lokichar oil basin which could assist in a follow-up to the Environmental Management Plan.
2. Need to reinforce inter- agency monitoring and reporting on the implementation of the Environmental Management Plans by NEMA and other lead agencies and provide feedback mechanism to CSO's and communities in order to build understanding and partnership with all the stakeholders during the project lifecycle .
3. Adherence to National Laws and International standards in regard to waste water, hazardous waste, health and safety, air, noise, restoration and decommission of oil and gas projects. Noting the high carbon production wells at Ngamia, There is need to implement cleaner technologies to mitigate climate change impacts such as carbon capture and storage technologies
4. Develop and implement an Oil spill contingency and response plan for the foundation stage development.
5. There is a need for a separate Environmental Impact Assessment (EIA) for waste handling and management facility to advise on the hazardous waste management considering the anticipated voluminous production of waste at the south Lokichar basin and the acquisition of five (5) hectares of landfill close to the Central Processing Facility (CPF).
6. Operationalise Community Land Act by fast tracking the registration of community land to ensure compensation models that benefit project affected persons/community. By promoting social responsibility agreement between investor company and local community, loss of livelihoods by the community will be minimised.
7. Develop and implement a customized/ hybrid grievance mechanism that adopts both formal and traditional dispute resolution within the South Lokichar oil fields. In doing so, ensure collaboration between relevant agencies to review and set favourable and fair rates payable for compensation to the project affected persons.
8. Develop and implement a national Resettlement Action Plan Framework to mitigate against involuntary displacement and maintain human dignity and uphold human rights in the land acquisition process.

### **Recommendations specific to indigenous pastoralist communities**

1. Undertake environmental and social impacts assessments of all components of the Foundation Stage Development project and designing strategies to mitigate negative impacts on Indigenous pastoralists cultures and traditions and the environments that make the cultures possible.
2. Enable constructive, focused engagement with Indigenous Peoples of Turkana to recognize, respect and protect their rights while ensuring and enabling structures that will ensure their full and effective participation in all processes related to oil and gas development, recognizing and respecting Indigenous Peoples rights to free, prior and informed consent over their lands, territories and resources.

3. Clarify and resolve land tenure issues concerning Indigenous Peoples along the LAPSSET corridor and the South Lokichar Basin, recognizing and respecting Indigenous Peoples ancestral claims to territories on the basis of the continued impact of the doctrine of discovery and their right to redress under Article 28 of the UN Declaration on the Rights of Indigenous Peoples.
4. Institute reliable, lasting conflict prevention and management systems that build on ongoing peace initiatives in the South Lokichar Basin between Indigenous Peoples and with neighboring communities.
5. Recognize, promote and support Indigenous pastoralist livelihood systems while enabling opportunities to engage in modern economic practice, for those who wish, but ensuring development with culture and identity.

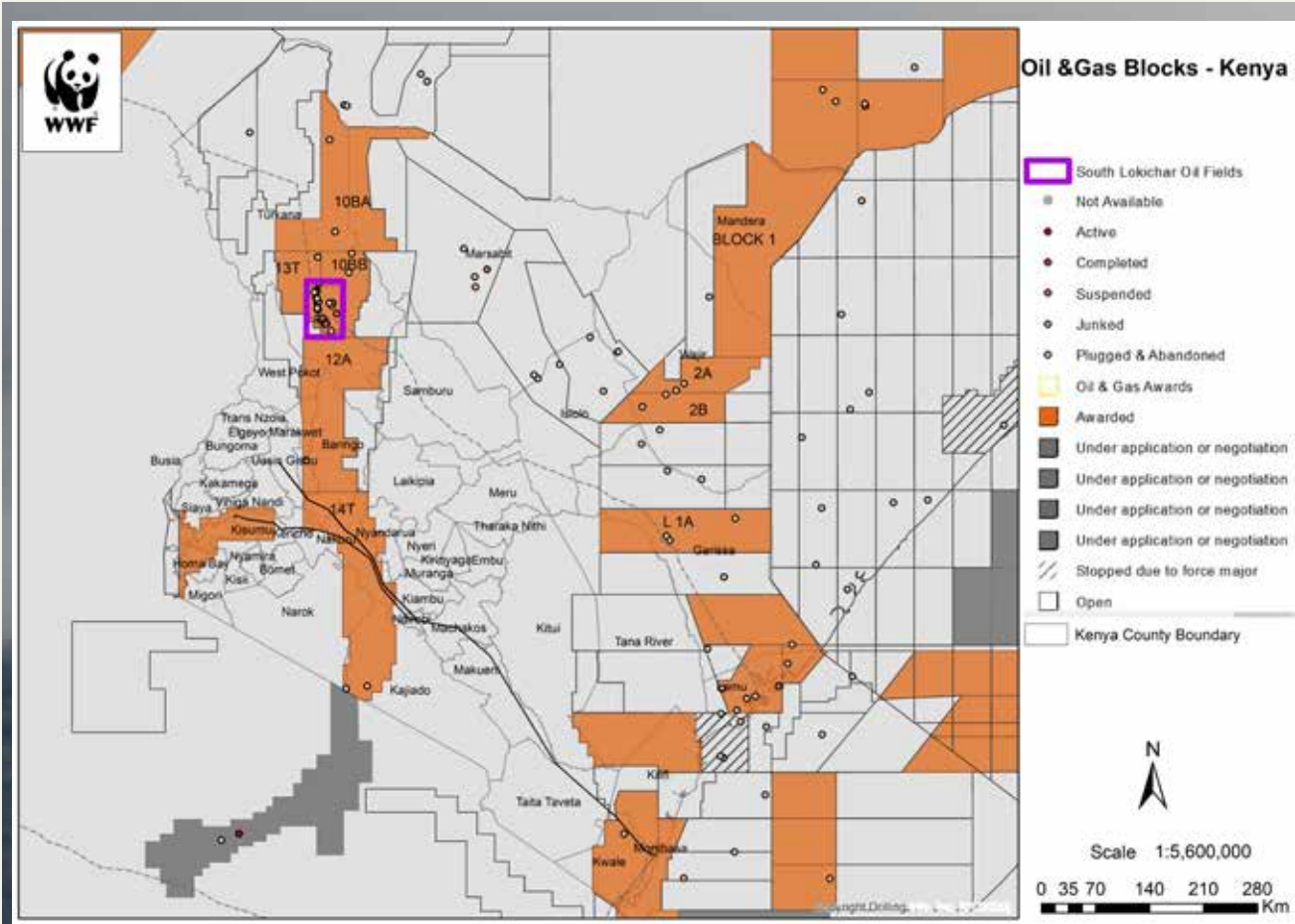
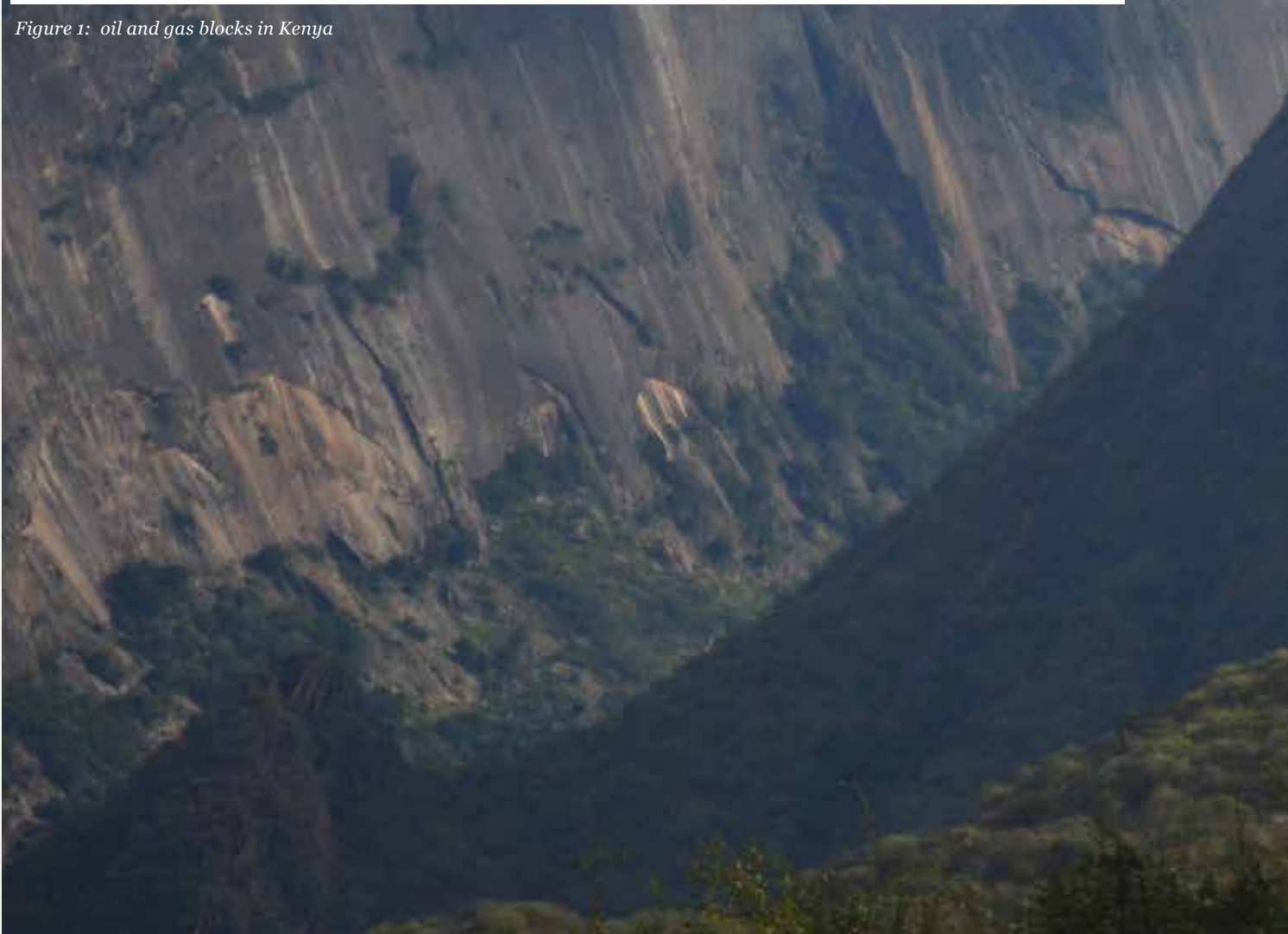


Figure 1: oil and gas blocks in Kenya





# 1. INTRODUCTION

The South Lokichar Basin is covered by two separate Production Sharing Contracts for Block 13T and Block 10BB which includes Twiga, Etuko, Ekales, Agete, Amosing, Ewoi, Ekunyuk and Etom in Turkana County. Tullow Kenya B.V which is the Operator holds 50% interest in 10BB and 50% in block 13T while Africa Oil Kenya B.V 25% in 10BB and 25% 13T and Total 25% in 10BB and 25% in 13T.

In 2012, the Ngamia-1 exploration well has successfully encountered over 200 meters of net oil pay resulting to a significant drilling programme at the Amosing, Twiga, Etuko, Ekales, Agete, Ewoi, Ekunyuk, Etom, Erut and Emekuya oil accumulations. A total of 40 exploration and appraisal wells have since been drilled in the basin by the Joint Venture Partnership (Tullow Oil, Africa Oil, Total and the Government of Kenya) who have conducted extended well tests, water injection tests, well interference tests and water-flood trials.

Following a full analysis of all the exploration and appraisal data, it is estimated that the South Lokichar Basin contains at least 560 million barrels of oil (mmb) that can be recovered with the potential to produce more. Recently, Project Oil Kenya's Joint Venture Partners have proposed to the Government of Kenya that the Amosing, Twiga and Ngamia fields be developed as the Foundation Stage for the South Lokichar development.

The installed infrastructure from this initial phase can then be utilised for the optimisation of the remaining South Lokichar oil fields, allowing the incremental development of these fields to be completed at a lower cost post-First Oil. The incremental development of the remaining recoverable oil and the upside potential is expected to increase from 8000 barrels of oil per day and plateau production to 100,000 barrels of oil per day (bopd) or greater.

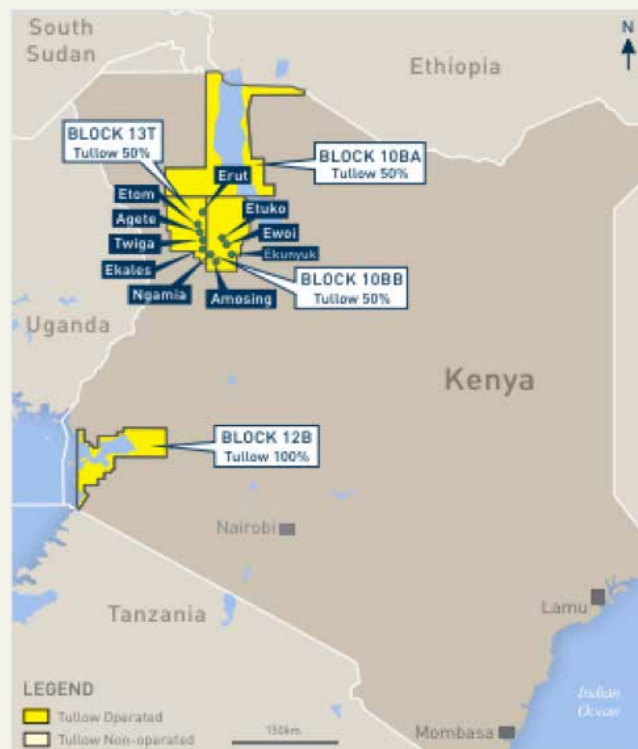


Figure 2: Location of the South Lokichar Oil Fields

## 2. Foundation Stage Development

### 2.1 About Foundation State Project

The Foundation Stage Project is currently planned to develop an initial 321 wells through 22 well pads at Ngamia, 81 wells through 9 well pads at Amosing, and 10 wells through 2 pads at Twiga. This stage will target production of approximately 226 mmbo, and a plateau rate of 60,000 to 80,000 bopd. Once the crude oil has been processed and stabilised it will be transported via a buried export pipeline to Lamu for onward sale to the international market.

The Front-End Engineering and Design (FEED) work and Environmental and Social Impact Assessments (ESIA) for the Foundation Stage Project are ongoing. FID is targeted in 2020 and First Oil production approximately 36 months after FID. Total gross capex associated with the Foundation Stage upstream infrastructure and oil export pipeline is expected to be around \$3 billion. The key components of the South Lokichar Foundation Stage Project include the construction of the following infrastructure:

1. New well pads in different fields within the South Lokichar Basin and well drilling activities;
2. Buried interconnecting flowlines to transport oil;
3. A water pipeline from Turkwel dam;
4. Construction of a Central Processing Facility (CPF);
5. Construction and use of new access roads; and
6. Support facilities and infrastructure, including construction camps, laydown areas and waste management infrastructure.

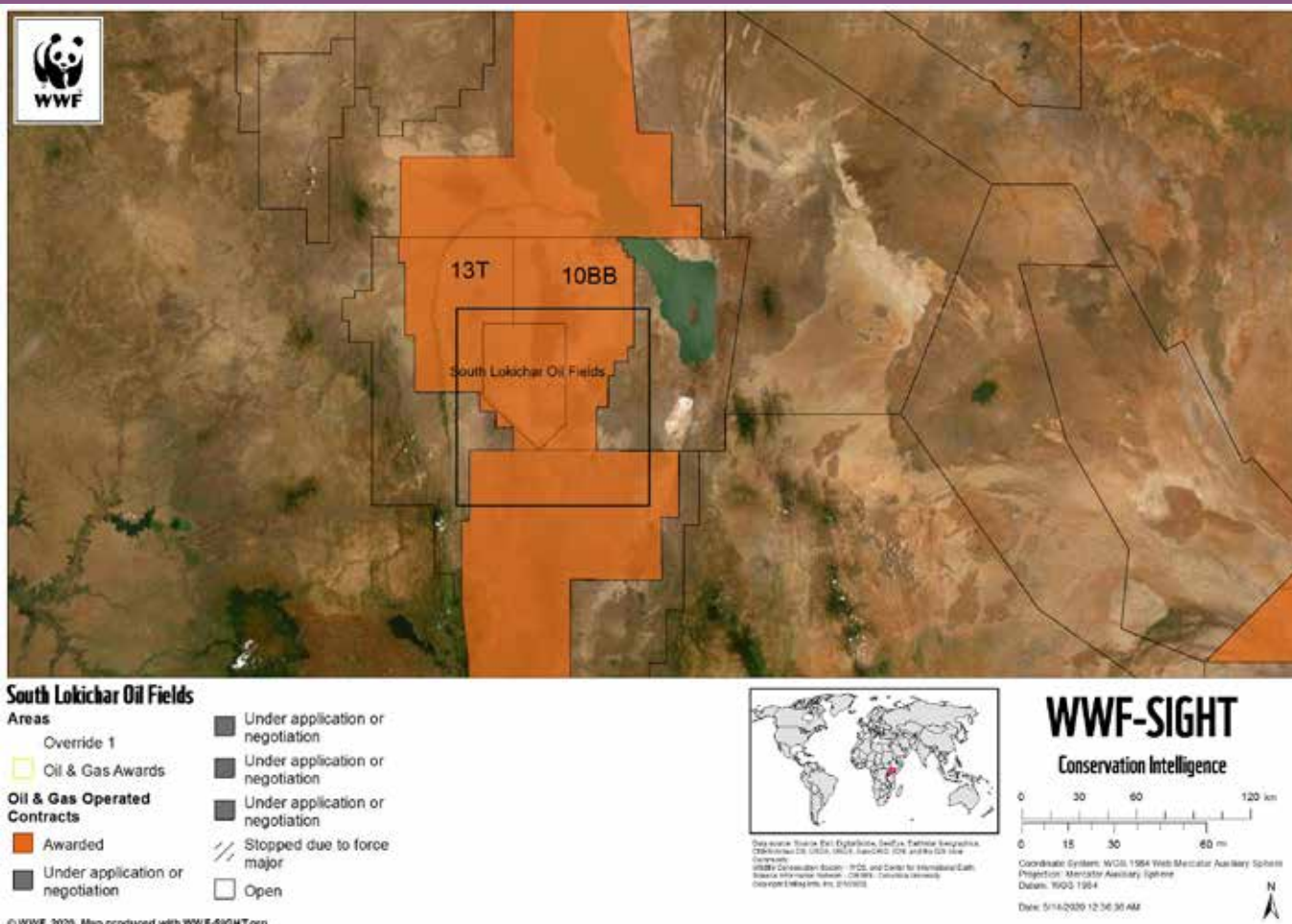


Figure 3: A map showing block 10BB and 13 T



Figure 4: A layout of the Central Processing Facility

It is anticipated that 1085 ha of land will be required for the foundation stage development which includes the central processing area that comprises accommodation, laydown areas, offices, waste management facility and facilities to support during construction and production stages. In addition, a 5 hectares outside the central processing area will be required as a landfill. Water for the project will be extracted from Turkwel dam where 104,000 bpd will be required for the project while 112,000 bpd for the community. Water from the dam will be transported through buried pipe to the CPF and the community area.

## Upstream commercial frameworks

This consists of a suite of agreements which ensure the economic viability of the Upstream Petroleum Development and Production. The agreements include those that are already in effect between the government of Kenya and the JVP as well as those that will need to be negotiated as part of the process prior to FID.

<b>Existing Agreements</b>	
Block 10BB and 13T Production Sharing Agreements (PSC)	Covers the rights and obligations for the investor in the execution of Upstream petroleum operations Capital provisions Operational expenses Risks of the operation Allocation of petroleum production PSC remain the core commercial agreement for the life of the project
Potential supplements and clarifications to the PSC which would require approval from MoPM include;	Joint Development Plan Common Development Plan Continued exploration Handling of new commercial discoveries Delineation of Development Area Valuation of the crude oil Local content processes Procurement processes Participation rights Contractor rights Financing rights Tax clarifications
<b>Future Agreements</b>	
State Support Agreements	Support required from GoK to allow for a stable legal, fiscal and regulatory regime and addresses parameters including requests for GoK to procure and co-ordinate support from other government entities
Upstream Development Agreement	Establishes mechanisms for coordinating joint development activities in the development area
Participation Agreement	Provides the framework for the government to exercise back in rights for blocks 10BB and 13T and are based on the proforma agreements contained in the PSC
Transportation Agreement	Provides the commercial framework for the transportation of the crude oil from point of production to the delivery point through the LLCOP in consideration for the payment of a tariff
Infrastructure Support Agreement	Commitment by GoK to provide and facilitate access to key infrastructure on an exclusive or priority basis
Water Agreement	Water is a critical natural resource for the project during construction and operational phases. The agreement will be between the GoK and the contractor and will specify the agreed water source and regulate water usage
Power Agreement	Agreement between GoK and contractor which outlines the arrangements for delivery of power to the project
Lifting Agreement	Agreement between the contractor and GoK which provides for administrative procedures for nominations and lifting of crude oil
Construction and Tie-in Agreement	Agreement between the contractor and pipeline company for the tie-in and interaction between feeder pipelines to the export pipeline
Pipeline Proximity Agreement	Agreement between the contractor and the pipeline company regulating upstream facilities and the export pipeline
Commingled Agreement	Agreement between two block operators which regulates the interaction between streams of oil between each of the blocks commingling

### 3. Legal and Regulatory Framework for Oil and Gas in Kenya

Petroleum Operations are anchored on existing state policies, legislation and regulations. In the development of the south lokichar oil fields under the Foundation Stage Development phase, the JVPs will need to adhere to applicable legislative and regulatory frameworks including;

- The Constitution of Kenya, 2010 (the ‘Constitution’);
- Petroleum (Exploration Development and Production) Act, 2019
- The Ninth Schedule to the Income Tax Act (Chapter 470, Laws of Kenya) (the ‘Ninth Schedule’).
- There are numerous other laws which have an impact on the oil and gas sector, including:
  - The Land Act, 2012;` z
  - The Access to information Act, 2016;
  - The Community Land Act, 2016;
  - The Occupational Safety and Health Act, 2007;
  - The Competition Act, 2010;
  - The National Construction Authority Act, 2011; and
  - The Environmental Management and Coordination Act, 1999 (‘EMCA’) CAP 389.

There are also proposed laws which will affect the oil and gas sector if passed into law including:

- The Natural Resources (Benefit Sharing) Bill, 2014 which is intended to provide a legislative framework for the establishment and enforcement of a system of benefit sharing in resource exploitation between resource exploiters, the Government, county governments and local communities; and
- The Local Content Bill, 2016 which provides a framework to facilitate local ownership, control and financing of activities connected with the exploitation of petroleum and mineral resources while at the same time expected to increase local revenue along the value chain in the exploration of petroleum and mineral resources.
- The Public Participation Bill, 2016 which provides for a general framework for effective Public Participation in order to give effect to the constitutional principles of democracy and participation of the people under the Constitution.
- The Sovereign Wealth fund Bill and Policy 2019 which provides for channeling of the petroleum and minerals revenues to 3 components; one for savings, one for budget stabilization and one for domestic spending and investment







Muturi Kamau presenting on overlap analysis for the south lokichar basin

## 4. Methodology

To better understand the environmental and socio-economic implications of the Foundation Stage Development, WWF and civil society partners conducted:

1. Focused Group Discussions (FDGs) in communities living around the South Lokichar Oil fields to gather socio and economic perceptions from them regarding implications of ongoing oil and gas related activities in the area.
2. Desktop review of existing literature coupled with GIS analysis involving overlay of foundation stage development associated infrastructures with key environmental and social layers to derive level of risk related to exposure.
3. Risk ranking: We further qualitatively ranked the severity of risk in five categories (Severe or very high threat, Significant or high threat, Moderate or medium threat, Marginal or low threat, Negligible threat) using threat ranking matrix.



### i) Focus Group Discussions (FDGs)

WWF - Kenya conducted Focus Group Discussions (FDGs) with key stakeholders to create an understanding of the issues and implications perceived by the affected communities and compile their recommendations for mitigation measures. These FDGs were conducted in Lodwar, Lokichar, Nakukulas, Lomokomar, Lokicheda, Turkwel. A total of 104 participants were consulted representing local communities, council of elders, ward representatives, NGOs and CBO's in Turkana East, Turkana South and Turkwel areas.

### ii) GIS Data used

Foundation stage Infrastructure:

- LAPSET Infrastructure Corridor - LCDA , 2019.
- Crude Oil Pipeline - LCDA , 2019.
- Oil Wells - Satellite imagery digitisation
- Central Processing Facility - Tullow.

Important Biodiversity and Natural Habitats:

- Protected areas and conservancies in Kenya: KWS, 2018.

Water Resources:

- Major rivers: NEMA, 2014
- Lakes and Reservoirs: HydroSHEDS, 2018

Local Socio economy:

- Land cover: ESA Climate Change Initiative, Land Cover project 2017

### iii) Determining the environmental risk

Table 1: delineations used to scale threat of the issues identified within the GIS analysis.

Threat level	Description
Severe or very high threat	Within the Southern Lokichar Oil Fields (Extent), the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within ten years or three generations.
Significant or high threat	Within the Southern Lokichar Oil Fields (Extent), the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within ten years or three generations.
Moderate or medium threat	Within the Southern Lokichar Oil Fields (Extent), the threat is likely to moderately degrade/reduce the target or reduce its population by 11-30% within ten years or three generations
Marginal or low threat	Within the Southern Lokichar Oil Fields (Extent), the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within ten years or three generations.
Negligible threat	Within the Southern Lokichar Oil Fields (Extent), the threat is likely to be negligible slightly degrade/reduce the target or reduce its population less than 1% within ten years or three generations.

### Limitations of this analysis

It is important to acknowledge that the GIS analysis and derived risk analysis are based on an overlap analysis that is indicative of a potential threat of adverse effect and does not certify actual impact. As such, the results of this study need to be taken as a high-level overview, useful in illustrating the threats and implications that the proposed foundation stage development may have.

## 5. Results

### 5.1 Water Demand and Supply

The two permanent river systems in the south Lokichar basin are Kerio and Turkwel with highest dependency by locals on Lokichar River which is predominantly seasonal. Water within the Turkwel river basin is relied upon by both wildlife in the 2 protected areas for drinking as well as domestic and commercial use through irrigation and small scale gold mining. The largest quantities of water from Turkwel Gorge Dam are utilized for Hydro-electric power generation of 106MW of electricity and serves for irrigation, fishing and as one of the tourist attractions in this region. The dammed waters of Turkwel dam have formed a large artificial lake that stretches westwards between the hills, home to a large variety of birdlife.



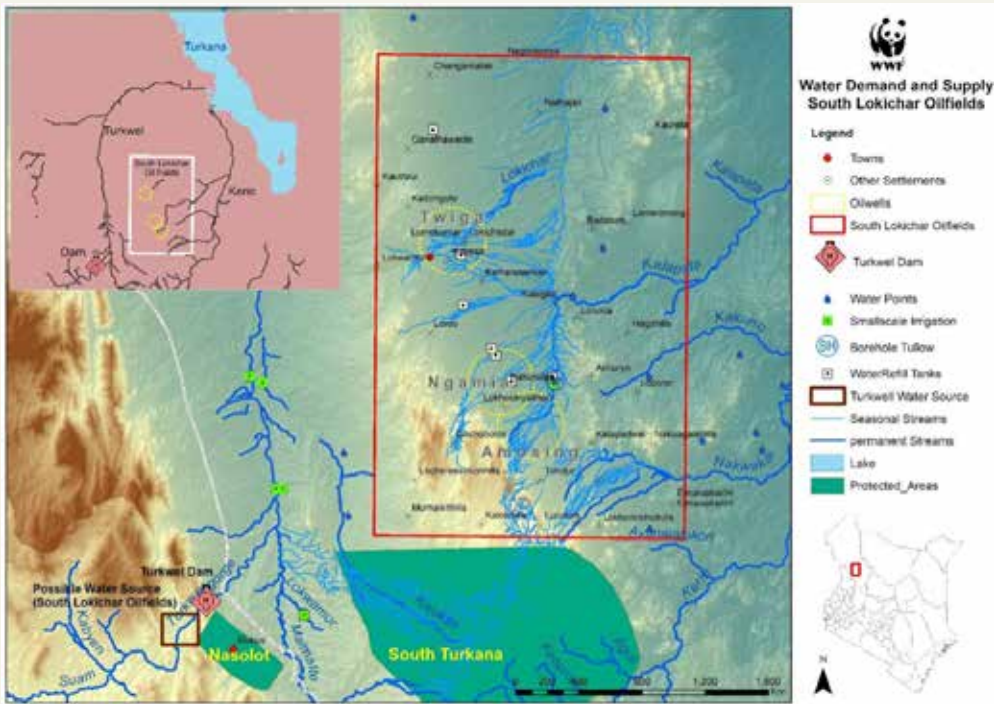


Figure 5: Showing the hydrological setup and water demand within the South Lokichar Oilfields region



Figure 6: The Turkwel Dam, a hydroelectric dam at the head of a gorge harnessing the waters of the Turkwel River.

## 5.2 Land Use and Human Footprint

### 5.2.1 Land use and tenure

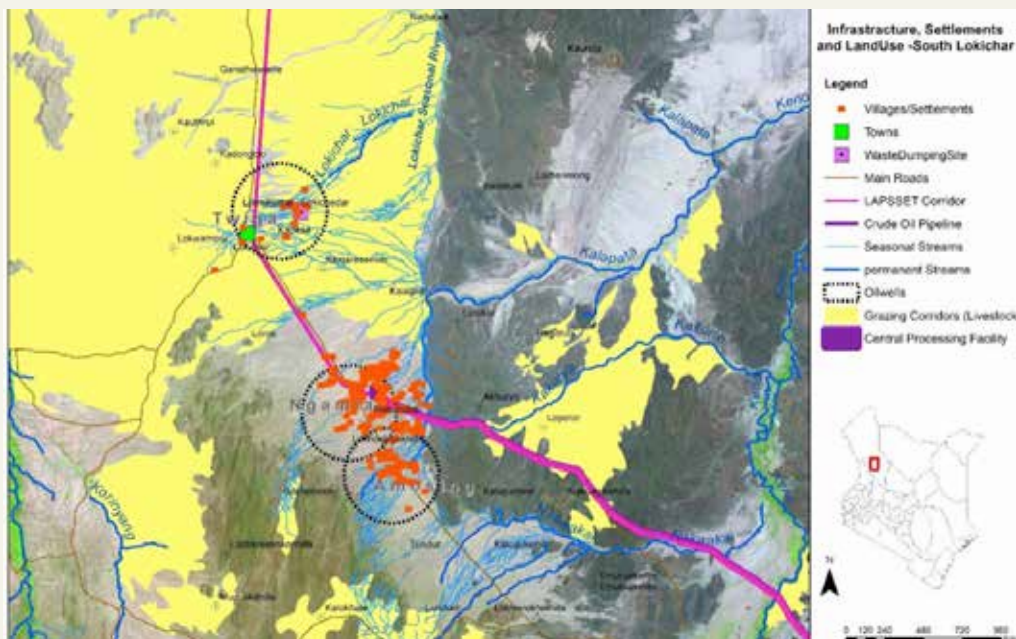


Figure 7: The Turkwel Dam, a hydroelectric dam at the head of a gorge harnessing the waters of the Turkwel River

The form of land use for Turkana community is largely livestock keeping in pastoral regime hence highly depended on land for pasture. Key wet season and dry season grazing zones in the south Lokichar oil fields are located within the Open to closed herbaceous vegetation land use subcategory/zone.

Majority of the settlements are located around the area of Foundation Stage Development (Ngamia and Amosing). The settlements are also located along major lagas including the Lokichar and Kalapata rivers due to water access.

Land tenure system is mainly community land ownership

### 5.3 Biodiversity

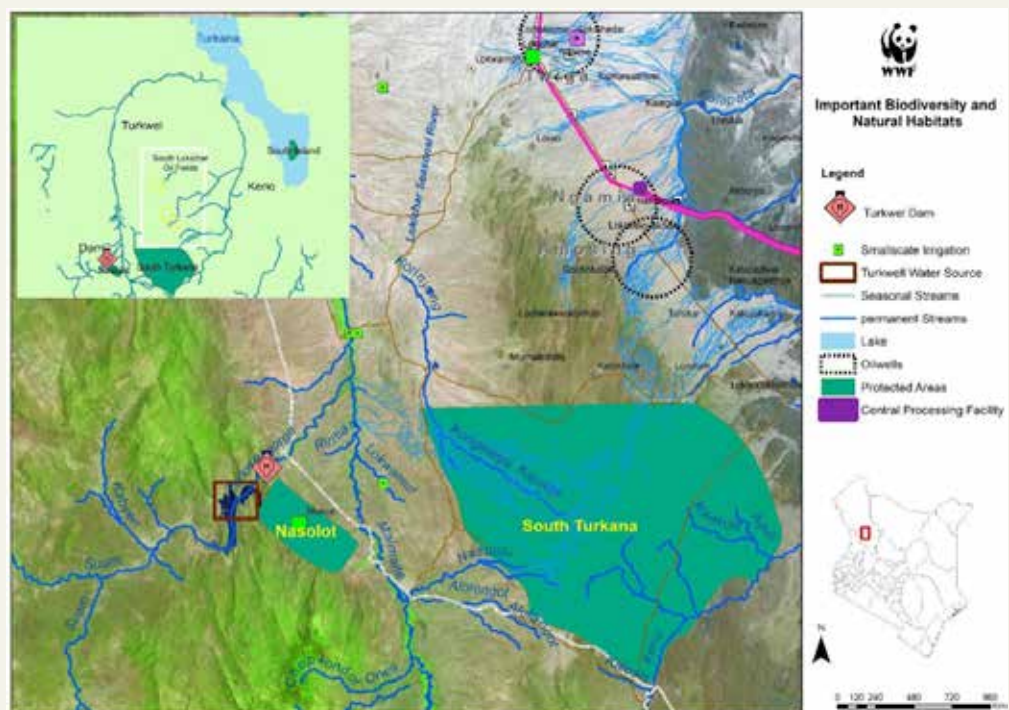


Figure 8: Infrastructure, critical grazing corridors and spread of Human Settlement along Lokichar River and Tributaries and in Close Proximity to South Lokichar Oilfields

Nasolot and South Turkana National Reserves are the key biodiversity hotspots and natural habitats located south west of the South Lokichar oil fields and in close proximity to the Turkwel dam. The two reserves heavily rely on both Turkwel and Kerio rivers for the ecosystem service they provide. During foundation stage development of the south Lokichar oil fields, it is anticipated that water volumes will be piped from the dam to the Central Processing Facility.

### Case Study: Nasolot and South Turkana National Reserves:

**Nasolot National Reserve** was gazetted in 1979 and consists 9,200 hectares (92km<sup>2</sup>) of beautifully rugged land. It is located to the north of Mount Melo at over 3,000 metres. It is designated as IUCN Management Category: II. Major Attractions

Nasolot include Rocky out crop at the periphery of the reserve called NasolotHill; game viewing. Key Wildlife species include: Elephant, the Lesser kudu (currently classified as 'Near Threatened' IUCN), bushbuck, duiker, Lion, Leopard, Kirk's dik-dik, spotted hyena, jackal, impala, Sykes'monkey, beisa and fringe-eared oryx, waterbuck, olive baboon, buffalo, gazelle and hippo.

**South Turkana National Reserve** Is located in South Western sides of Lake Turkana in Turkana County, it is designated as Category II by IUCN classification and it was established in 1979 and consists of 10, 91.0 km<sup>2</sup> of very rocky and very stunning expanse. The reserve consists of dense thorn bushes, riverine forests as well as open grasslands where it is easy to spot the plain game. The region is attractive because of its hot springs and bird sanctuaries. Key wildlife species includes giraffe, elephant, buffalo, oryx, eland, impala, greater kudu, bushbuck, Grant's and Thompson's gazelle, leopard, lion, cheetah, spotted hyena and jackal. The crocodiles can be spotted in the rivers as well as abundant birdlife



Case study 1: Elephants at Nasolot National Reserve.

## 5.4 Waste handling and Management

### Construction Phase:

In the construction phase, materials are stored that can potentially contaminate the soil, surface and ground water if not correctly stored and managed. This include plastic bottles, sewage discharges from the camps as well as PVC materials.

### Production Phase:

- Waste water and gas from CPF: At the CPF is where separation of crude oil occurs into Oil, gas and water. Usually the water byproduct which is generally managed as a waste product composed of a mixture of several contaminants is brought to the surface. If untreated the waste water may result in soil and water contamination. On the flip side, gaseous byproducts are usually combusted through gas flaring releasing greenhouse gases like methane into the atmosphere.
- Hazardous waste: The production of petroleum involves generation of drilling waste (drilling fluids and cuttings) which commonly forms a major source of pollution in the oil producing industry



Figure 9: Showing some waste PVC used as roof cover for manyatta



Figure 10: An exposed waste disposal area

## 5.4 Waste handling and Management

### Construction Phase

Emissions of Carbon dioxide(CO<sub>2</sub>), Carbon monoxide(CO), Sulphur dioxide(SO<sub>2</sub>), and Nitrogen oxides(NO<sub>2</sub>) will result from the operation of the proposed project and road vehicles during construction of the pipeline and associated facilities.

Dust generated during construction will result from clearing and earthworks, including trenching, levelling, bund construction and reinstatement operations. The major dust sources will be from the movement of vehicles over the cleared work area within the CPF and water pipeline from Turkwell gorge and from vehicles transporting pipes and equipment to the work areas.

### Production Phase

Some of the natural gas associated with oil production will be flared. Natural gas is a gaseous mixture of hydrocarbons, the primary component being methane and non hydrocarbon gases i.e water vapour, carbon dioxide. Gas flaring contributes to climate change by emission of carbon dioxide, the main greenhouse gas. The flares associated with gas flaring give rise to atmospheric contaminants. These may include oxides of Nitrogen, Carbon and Sulphur and hydrogen sulphide. Gas flaring on human health is related to the exposure of those hazardous air pollutants emitted during incomplete combustion of gas flare.



## 4.5 Atmospheric emissions

### Construction Phase

Emissions of CO<sub>2</sub>, CO, SO<sub>2</sub>, and NO<sub>2</sub> will result from the operation of the proposed project and road vehicles during construction of the pipeline and associated facilities. Dust generated during construction will result from clearing and earthworks, including trenching, levelling, bund construction and reinstatement operations. The major dust sources will be from the movement of vehicles over the cleared work area within the CPF and water pipeline from Turkwel gorge and from vehicles transporting pipes and equipment to the work areas.

### Production Phase

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Gas flaring on human health is related to the exposure of those hazardous air pollutants emitted during incomplete combustion of gas flare.

## 6. Discussions

### 6.1 Water Supply and Demand

It is anticipated that the waters for the oilfields will be tapped from the Turkwel dam since it is the only viable water in close proximity to the southern oil fields and has capacity to supply the demanded volumes. The project requires approximately 104,000 barrels per day for project related activities like drilling, construction, field camps, other project operational need and 112,000 barrels per days for the community. The current volume of Turkwel dam stands at 1.6 billion cubic meters (WorldBank, 2011) yet the daily Water usage for development of the oil fields is projected at 30,000 m<sup>3</sup> per day which translates to 10.9 million cubic meters (m<sup>3</sup>). While this implies less pressure to the water resource, it is important to note that the dam is also used for electricity generation, small scale irrigation, wildlife and livestock consumption, fishing, gold mining activities among other uses downstream hence appropriate adherence to water regulations and legislation in ensuring effective water resource management and governance measures to ensure balance in water quality, quantity and equity in resource use.

The Lokichar River which is predominantly composed of seasonal Lagas plays a critical role in supplying water (through sand dams) to the communities around the south Lokichar oil fields. The river system is bound to be interfered with during the construction phase by the interconnecting pipelines servicing the Central Processing Facility (CPF) for instance construction of the river crossing points on Kalapata and Lokichar streams might result in obstruction leading to change of river course. At operation phase of the pipelines if the integrity of the pipelines is compromised resulting in leakage of crude oil to the streams and general pollution of the environment.

THEMATIC AREA	LEVEL OF RISK	
	Construction	Operation
Water demand and Supply	<p>■ Moderate / Medium Threat: During construction, materials that will be used if poorly handled can result in surface and groundwater contamination i.e diesel spillage</p> <p>■ Marginal or low : it is anticipated that the construction of the pipeline will be carried out during the dry season posing minimal pollution related risks.</p>	<p>■ Significant /high threat: Poor waste handling of hazardous waste especially during flooding seasons leading contamination of water sources for human and livestock.</p> <p>■ Significant /high threat: Oil leakage/ spills of the interconnecting pipeline across river crossing points especially during rainy seasons / flooding events might result in ground water contamination considering Lagas have shallow water levels. This may lead to irreversible damage to sand dams.</p> <p>■ Marginal/Low threat: The demanded Water volumes for production phase is considered sufficient posing minimal pressure to the current use and demand of Turkwel dam.</p>
Biodiversity	<p>■ Moderate / Medium Threat: excavation and movement of sediments for installing both the water and crude oil pipelines could lead to con</p>	

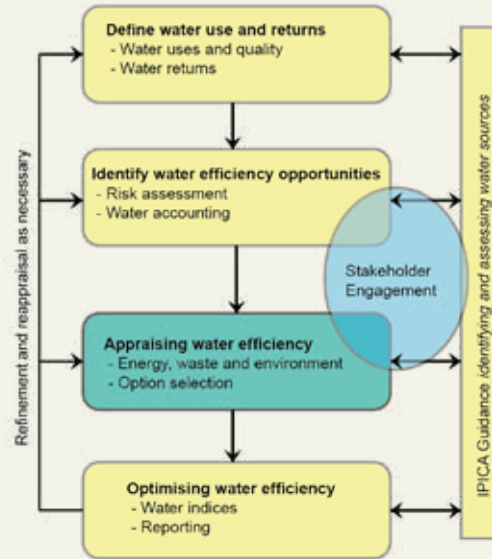
A systematic process for identifying and assessing potential measures to improve water efficiency should be considered in the South Lokichar oil project. Improving the efficiency of water use in the Foundation Stage Development involves identifying and measuring water uses, understanding the risks associated with various source of make-up and produced water and disposal pathways, and managing water effectively to maximize the economic, social and environmental well-being associated with the resource. The project should consider improving water use efficiency by incorporating the principles outlined below;

### Water stewardship

Water stewardship is one of the key principles that underpin good practice in water management. It is defined by the Alliance of Water Stewardship (AWS, 2014) as ‘the use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process ...’ Four aspects capture the intent of water stewardship:

- Water governance: addresses how water is governed and managed both internally within an operation and externally within the wider drainage basin. It covers the issues of rights, regulations, permits, licenses, plans and policies to ensure that water is managed equitably as a resource for all users within the catchment, with a strong emphasis on stakeholder engagement.
- Sustainable water balance: addresses the amount and timing of water use, including abstractions, consumption and discharges, and whether the volumes involved are sustainable relative to renewable water supplies.
- Water quality: addresses the physical, chemical and biological properties of water, to determine whether the water quality within the site and drainage basin meets local water quality regulation, and is fit for the requirements of the ecosystem services present and for any human need or purpose.

- Important water-related areas: addresses the spatial aspects of water at the site and within the wider drainage basin, and concerns the health of environmental, social, cultural or economic benefits derived from the catchment.



### **Integrated Water Resource Management**

Similar to water stewardship, IWRM promotes the coordinated development and management of water, land and related resources (e.g. energy consumption, greenhouse gas emissions) with a view to maximizing economic and social welfare while protecting the environment (GWP, 2013). The underlying principle of IWRM is that water is a shared resource and that many of its uses are interdependent. In the assessment of any given water resource for use in an operation, consideration should therefore be given to the impacts of its use on other users, the impact of other users on the operation, and its importance in terms of biodiversity and ecosystem services.

#### **Measurement**

Efficient water management requires an understanding of an operation’s water use and the collection of reliable, good quality data across its water infrastructure. These data facilitate the evaluation of water use efficiency which enables continuous improvements to be made. It is also important to record the quality of the different water streams to provide an understanding of the options for sustainable management.

#### **Risk assessment**

The risks associated with water use in oil and gas operations may be financial, environmental, social or political. These risks should be identified in the early stages of a project, and assessed on an ongoing basis given that, as the project evolves, its associated risks may change.

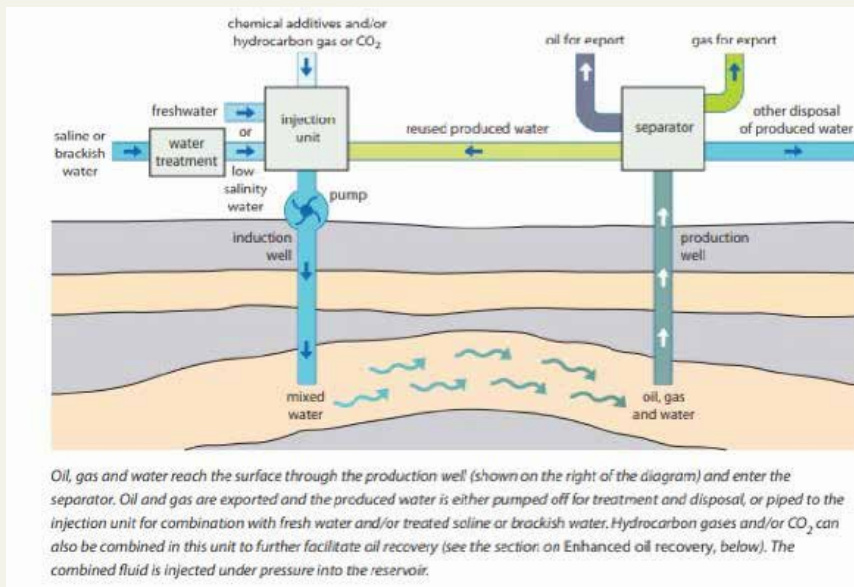


Figure 11: Water use during the secondary oil production phase (not to scale)

### Prescriptive regulations against International Best Practices

The local, national and international regulations that apply to an existing operation, or to new operations, are an important risk to consider when designing or upgrading a water management system. Some jurisdictions may be prescriptive down to the level of specific water efficiency measures and processes employed on an operation. Regulatory regimes can cap the quantity of water abstracted, and may specify recycle and discharge requirements. These regulations will present associated risks and constraints that will need to be considered when planning the water management system. Early engagement and understanding of the regulatory environment is therefore important for defining the constraints on the water management system and likely water efficiency requirements for the South Lokichar oil project.

### Social, cultural and environmental considerations

The Turkana community may consider some water-related aspects to be important for the ecosystem services that they provide, or for cultural, spiritual, recreational, economic or biodiversity values. Their views and any issues and concerns they might have about potential impacts of the proposed operation may impose constraints on the water management system. Consultation should be undertaken early and often. Wastewater streams being reused or recycled for other consumptive tasks can raise cultural sensitivities in certain areas. The sources of water used within certain tasks, and the potential options for reuse, may need to be considered in light of these cultural issues as part of the overall water management system.

### 6.2 Land Use and Land Tenure System

Open to closed herbaceous vegetation which act as key pasture zones are less impacted by Amosing and Ngamia oil fields, however it is the Twiga oil fields that sits on key dry season pasture zones while also blocking traditional grazing corridors connecting Ngamia based pastoralists to Angorangora pasturelands. Around the Amosing fields the Nagumet - Nasulu - Kakori - Kamar Stream and adjacent pastures are Critical for dry season grazing (regions between Lopii and Lokwamosing) the oasis around Nagumet hills provides all season water point for livestock.



Land adjacent to Ngamia and Amosing fields will be required for development to allow for setting up of infrastructure such as the CPF, camps, access roads and waste management infrastructure. Thus communities living adjacent to or in close proximity to the fields will need to be relocated to allow for the development. There will be need to adhere to existing land governance mechanisms including laws and regulations that ensures that community land rights are protected. This can be through compensation and resettlement for displaced communities as well as their livelihoods.

Previous examples of land acquisition related to oil activities within Kenya, have historically been characterized by disputes and confusion arising due to land ownerships and illegal transfers observed when land has been identified and earmarked for project development. In the past many local communities have felt displaced from their traditional lands of heritage without Free Prior and Informed consultation and through unscrupulous means that often include denial to full access to information on the land acquisition process.

The two widely applied modes of land compensation in Kenya are “land for land” and “cash for land”. Despite their general acceptability, sustainability concerns continue to arise especially among the directly affected communities.

The locals, in this case the land losers are expected to receive cash instead of alternative land and the money is used to buy viable land elsewhere. Some of the landowners, by the time they receive compensation they have relocated hence tracking them is problematic. Some locals prefer to choose viable land elsewhere and select locations of their preference. Others prefer cash compensation which could provide opportunities for opening family businesses.

However, cash compensation is least helpful particularly for rural and other marginal populations because rural economies are in large part non-monetized, based on reciprocal exchange of goods and services; therefore, people are not well accustomed to managing cash. Some rural people have very little transaction experience with the outside world; finding relocation land is increasingly difficult. In addition, the costs for relocating, transporting, salvaging building materials, and so on can put financial strain on the displaced persons if not well accounted for in the cash compensation package. Furthermore, compensation for land acquisition should not be limited to monetary payments for individuals; there should be appropriate compensation to the community for people to re-establish their new communities. Since unemployment is rife in these six counties those at greater risk of displacement are landless laborers.

Development of oil fields is envisaged to attract economic developments in existing trade centres and oil adjacent areas. This will spiral demand for land due to population influx and as a result, potential land related conflicts might arise due to the sensitive communal land ownership regime currently in place.

THEMATIC AREA	LEVEL OF RISK	
	Construction	Operation
Water demand and Supply	<ul style="list-style-type: none"> <li>■ Moderate / Medium Threat: During construction, materials that will be used if poorly handled can result in surface and groundwater contamination i.e diesel spillage</li> <li>■ Marginal or low : it is anticipated that the construction of the pipeline will be carried out during the dry season posing minimal pollution related risks.</li> </ul>	<ul style="list-style-type: none"> <li>■ Significant /high threat: Poor waste handling of hazardous waste especially during flooding seasons leading contamination of water sources for human and livestock.</li> <li>■ Significant /high threat: Oil leakage/spills of the interconnecting pipeline across river crossing points especially during rainy seasons / flooding events might result in ground water contamination considering Lagas have shallow water levels. This may lead to irreversible damage to sand dams.</li> <li>■ Marginal/Low threat: The demanded Water volumes for production phase is considered sufficient posing minimal pressure to the current use and demand of Turkwel dam.</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>■ Moderate / Medium Threat: excavation and movement of sediments for installing both the water and crude oil pipelines could lead to con</li> </ul>	

### 6.3 Biodiversity

The Nasolot and South Turkana reserves and their rich biodiversity heavily rely on the Turkwel, Kerio Rivers and their tributaries for all season water supply. Specifically the large herds of elephants in both reserves implies large volumes of water supply is required for their survival. Earlier discussions have pointed to minimal pressure on Turkwel dam water volumes even with the tapping of the resource to support oil field water demands. However, laxity in observing water regulations might impact negatively on both water quantity and quality and this might pose devastating effects to the flora and fauna in the two national reserves (Nasolot and South Turkana).

THEMATIC AREA	LEVEL OF RISK	
	Construction	Operation
Biodiversity	<ul style="list-style-type: none"> <li>■ Moderate / Medium Threat: excavation and movement of sediments for installing both the water and crude oil pipelines could lead to stress and disturbance of biodiversity and natural habitats.</li> </ul>	<ul style="list-style-type: none"> <li>■ Significant /high threat: Unregulated water abstraction / use at the dam might result to water shortage and poor quality affecting wildlife and biodiversity especially in Nasolot National Reserve. This might result to cases of human wildlife conflict due to water resource competition.</li> </ul>

### 6.4 Waste Handling and Management

Almost every process in exploration and production of petroleum generates many types of waste which impacts on the environment negatively such as the generation of cuttings and drilling fluids, waste gases and water etc. These materials have direct negative consequences to the environment in any state of matter, hence if not carefully treated and managed before release to the environment might result in irreversible damages to people, flora and fauna.

THEMATIC AREA	LEVEL OF RISK	
	Construction	Operation
Waste handling and management	<p>■ Moderate / Medium Threat: Disposal of plastic waste (bottles) and sewage from construction basecamps might alter the pristine state of the environment. Especially when sewage runoff finds its way into the Lagas and consequently ground water</p>	<p>■ Significant /high threat: Unmanaged release of waste matter to the environment, in cases where oil field waste products are released to the environment without careful release protocol, irreversible damage might occur to people, flora and fauna. The inexistence of waste handling facility in the exploration phase has resulted into substandard waste disposal likely to impact the people and biodiversity</p>

### 6.5 Atmospheric Emissions



#### Construction Phase

Carbon dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>) contributes directly to climate change by enhancing low level ozone production. These gases are poisonous at high concentrations and can potentially enhance photochemical smog formation. Carbon Monoxide (CO) is also highly toxic to human health at concentrations of several percent. Oxides of nitrogen (NO<sub>x</sub>) are toxic gases, even at relatively low concentrations. NO<sub>x</sub> also contributes to the formation of acidic species which can be deposited by wet and dry processes. Acidic species may impact both freshwater and terrestrial ecosystems.



The significance of the dust generation will depend upon meteorological and ground conditions at the time and location of the construction. However, under normal meteorological conditions, dust impacts will be limited to within several hundred meters of the construction area. Dust generation can affect the ability of nearby vegetation to survive and maintain effective evapotranspiration resulting in death of the vegetation. Air quality impacts associated with dust generation will be of “low” significance.

Gas flaring contributes to climate change by emission of carbon dioxide, the main greenhouse gas. The flares associated with gas flaring give rise to atmospheric contaminants. These may include oxides of Nitrogen, Carbon and Sulphur (NO<sub>2</sub>, CO<sub>2</sub>, CO, SO<sub>2</sub>) and hydrogen sulphide (H<sub>2</sub>S). These contaminants acidify the soil, hence depleting soil nutrients. The resulting effect of depletion is loss of nutritional value of crops within such vicinities (Ajugwo, 2013).

### **Health implication**

The emitted gases can be associated with adverse health effects such as cancer, neurological, reproductive and developmental diseases. Deformities in children, lung damage and skin problems have also been reported (Ovuakporaye et al, 2012). Hydrocarbon compounds contained in flared gas can also contribute to diseases such as anaemia, pancytopenia and leukemia, (Kindzierski, W.D, 2000).



## 7. Conclusions and Recommendations

The Foundation Stage Development of the South Lokichar fields is likely to induce environmental, economic, social and cultural changes. The extent of these changes is especially important to the local groups particularly the indigenous Turkana people who may have their traditional lifestyle affected. The key impacts may include changes in land-use patterns such as pastoralism as a direct consequence (land acquisition and exclusion) or as a secondary consequence by providing new pastoral migratory routes leading to unplanned settlements and exploitation of natural resources beyond the Twiga, Ngamia and Amosing sites. Population influx as a result of immigration and in-migration due to increased access to opportunities; sociocultural systems such as social structure, organization and cultural heritage, practices and beliefs, and secondary impacts such as effects on natural resource, rights of access, and change in value systems influenced by foreigners; aesthetics, because of unsightly or noisy facilities; transportation systems due to increased road and air infrastructure and associated effects e.g. noise, accident risks, increased maintenance requirements or change in existing services. The assessment identified the following risks;



Community members attending public awareness meeting

## Environmental implications

- Contamination of soil, ground and surface water. FSD is envisaged to directly contribute to increased production of hazardous waste like chemical lubricants, waste water, solid waste etc. If not properly managed, waste water seepage and oil lubricants mixing during construction and operation phases are particularly of great concern. This might result in contamination of both underground and surface water ways such as sand dams along laggas which provide water for livestock and human consumption, this might directly impact on health.
- Hazardous Greenhouse gasses Emission. During the exploration and production phase ,gas flaring is likely to occur at South Lokichar Oil fields releasing high volumes of harmful gases into the atmosphere such as carbon dioxide, methane,sulphur and other forms of gases. These have direct implications on air quality and health of the communities living in the vicinity of the flares and negates commitments made by countries under the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol.
- Impacts on Water resource management and governance: While FSD has plans to secure the projects water demands from Turkwel dam, it was identified that the project will have minimal impact on water volumes. However, due to multiple uses of the Turkwel river (such as electricity generation, small scale irrigation, wildlife(Nasolot National Park and West pokot), livestock consumption, fishing, gold mining activities), there is need for appropriate adherence to water regulations and legislation in ensuring effective water resource management and governance measures to ensure balance in water quality, quantity and equity in resource use.
- Land acquisition, displacement, Land use and ownership changes: FSD lies in predominantly rangeland areas with the main land use being pastoralism. Community land ownership is the major form of land entitlement. This study ascertained a number of issues including :
  - i) The introduction of oil and gas activities is anticipated to bring in urban growth and subsequent population influx in the FSD area;
  - ii) Ongoing infrastructure constructions around Twiga and Amosing oil fields has not only blocked traditional grazing corridors leading to Angorangora pasturelands but also denied local pastoralists access to prime Nagumet - Nasulu - Kakori - Kamar Stream and adjacent pastures which are critical for dry season grazing (regions between Lopii and Lokwamosing) the oasis around Nagumet hills provides all season water point for livestock;
  - iii) Relocation of communities as a result of land acquisition for the FSD supporting infrastructure ( Land adjacent to Ngamia and Amosing fields will be required for the development of infrastructure such as the CPF, camps, access roads and waste management infrastructure). There is need to adhere to existing land governance mechanisms including laws and regulations that ensures that community land rights are protected. This can be through compensation and resettlement for displaced communities as well as their livelihoods. Previous examples of land acquisition related to oil activities within Kenya, have historically been characterized by disputes and confusion arising due to land ownerships and illegal transfers observed when land has been identified and earmarked for project development. In the past many local communities have felt displaced from their traditional lands of heritage without Free Prior and Informed consultation and through unscrupulous means that often include denial to full access to information on the land acquisition process.
- Biodiversity Threat: The Nasolot and South Turkana reserves and their rich biodiversity heavily rely on the Turkwel, Kerio Rivers and their tributaries for

all season water supply. Specifically the large herds of elephants in both reserves implies large volumes of water supply is required for their survival. This study assumes minimal pressure on Turkwel dam water volumes even with the tapping of the resource to support Oil field water demands. However, laxity in observing water regulations might impact negatively on both water quantity and quality and this might pose devastating effects to the flora and fauna in the two critical habitats (Nasolot and South Turkana) national reserves.

### **Socio-economic implications**

- Shrinkage of pastoral lands and the potential lack of access of pastoral migratory routes leading to resource conflicts. Exploration and appraisal of the Turkana fields was initially undertaken in the absence of the Community Land Act, 2016 which would regulate negotiations with the Turkana pastoralist communities for compensation mechanisms. Pastoralist communities view the shrinkage of pastoral land as systematic displacement and loss of livelihood means that can only be supported by such a fragile ecosystem which they have depended upon for centuries.
- Population influx as a result of immigration and in-migration due to increased access to opportunities in the South Lokichar Oil basin.

WWF and KOGWG have elaborated recommendations below to help guide the FSD process in an attempt to ensure that the potential direct and indirect impacts on people and nature are addressed.

1. Need to establish a detailed baseline data repository for biodiversity, social and ecosystem services of the South Lokichar oil basin which could assist in a follow-up to the Environmental Management Plan.
2. Need to reinforce inter- agency monitoring and reporting on the implementation of the Environmental Management Plans by NEMA and other lead agencies and provide feedback mechanism to CSO's and communities in order to build understanding and partnership with all the stakeholders during the project lifecycle .
3. Adherence to National Laws and International standards in regard to waste water, hazardous waste, health and safety, air, noise, restoration and decommissioning of oil and gas projects. Noting the high carbon production wells at Ngamia, There is need to implement cleaner technologies to mitigate climate change impacts such as carbon capture and storage technologies
4. Develop and implement an Oil spill contingency and response plan for the foundation stage development.
5. There is a need for a separate Environmental Impact Assessment (EIA) for waste handling and management facility to advise on the hazardous waste management considering the anticipated voluminous production of waste at the south Lokichar basin and the acquisition of five (5) hectares of landfill close to the Central Processing Facility (CPF).
6. Operationalise Community Land Act by fast tracking the registration of community land to ensure compensation models that benefit project affected persons/community. By promoting social responsibility agreement between investor company and local community, loss of livelihoods by the community will be minimised.
7. Develop and implement a customized/ hybrid grievance mechanism that adopts both formal and traditional dispute resolution within the South Lokichar oil fields. In doing so, ensure collaboration between relevant agencies to review and set

favourable and fair rates payable for compensation to the project affected persons.

8. Develop and implement a national Resettlement Action Plan Framework to mitigate against involuntary displacement and maintain human dignity and uphold human rights in the land acquisition process.

### **Recommendations specific to indigenous pastoralist communities**

1. Undertake environmental and social impacts assessments of all components of the Foundation Stage Development project and designing strategies to mitigate negative impacts on Indigenous pastoralists cultures and traditions and the environments that make the cultures possible.
2. Enable constructive, focused engagement with Indigenous Peoples of Turkana to recognize, respect and protect their rights while ensuring and enabling structures that will ensure their full and effective participation in all processes related to oil and gas development, recognizing and respecting Indigenous Peoples rights to free, prior and informed consent over their lands, territories and resources.
3. Clarify and resolve land tenure issues concerning Indigenous Peoples along the LAPSET corridor and the South Lokichar Basin, recognizing and respecting Indigenous Peoples ancestral claims to territories on the basis of the continued impact of the doctrine of discovery and their right to redress under Article 28 of the UN Declaration on the Rights of Indigenous Peoples.
4. Institute reliable, lasting conflict prevention and management systems that build on ongoing peace initiatives in the South Lokichar Basin between Indigenous Peoples and with neighboring communities.
5. Recognize, promote and support Indigenous pastoralist livelihood systems while enabling opportunities to engage in modern economic practice, for those who wish, but ensuring development with culture and identity.

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