



KENYA ELECTRICITY GENERATING COMPANY PLC

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE
PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR
105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK IN
NAIVASHA SUB-COUNTY, NAKURU COUNTY.**



PROJECT PROPONENT:

KENYA ELECTRICITY GENERATING COMPANY PLC

TEAM LEADER:










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Proponent: Kenya Electricity Generating Company PLC

Activity: Environmental & Social Impact Assessment Study for the Proposed Drilling of 42 Geothermal Wells.

Report Title: Environmental & Social Impact Assessment Study Report for the Proposed Drilling of 42 Wells on IR 105419/1 (L.R No. 12881/5) within Hell's Gate National Park in Naivasha Sub-County, Nakuru County.

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11/11/2024

For: KenGen PLC

Date

EXECUTIVE SUMMARY

The Project Proponent

The project proponent is Kenya Electricity Generating Company PLC (KenGen). KenGen is the leading electric power generating company in East Africa with 70% Government of Kenya and 30% public shareholding. The company is licensed to generate energy in bulk with Kenya Power Company being the sole off taker of electricity under competitive Power Purchase Agreements (PPAs). The company's current total installed capacity is 1,904 MW comprising of Geothermal (799 MWe – 42%), Hydro (826 MW – 43%), Thermal (253.5MW – 13%) and Wind (25.5MW – 2%). The company commands a market share of 61% of electricity consumed in the country. The Ministry of Energy granted KenGen geothermal resource license No. 1/2008 dated 19th September 2008 and valid for thirty (30) years. The license is for the Olkaria Geothermal Field which covers a total area of 204 km² (20,400 Ha). While undertaking power generation activities, KenGen conforms to ISO 9001:2015 (Quality Management System), ISO 14001:2015 (Environmental Management System) and ISO 45001:2018 (Occupational Health and Safety Management System) for which the company has certifications. KenGen is a member of the United Nations Global Compact Kenya (UNGCK) which serves as the local network of the United Nations Global Compact. UNGCK aims at accelerating and scaling up the collective impact of businesses in Kenya by upholding the 10 principles of the United Nations Global Compact (UNGC) and delivering the Sustainable Development Goals (SDGs) through accountable companies and ecosystems that enable change. KenGen has developed an ambitious strategy to increase its geothermal power generation capacity. In support of this strategy, the company has entered into a sublease agreement with Kenya Wildlife Service (KWS) in order to develop geothermal resource at Olkaria.

Nature of the Proposed Project

KenGen proposes to drill forty-two (42) geothermal wells at Olkaria Geothermal Field in Hell's Gate National Park. The project will comprise of production, monitoring and reinjection wells. The wells will be drilled using three (3) rigs owned by KenGen i.e. KGN1, KGN2 and N370 for an approximate period of five (5) years. The scope of the project covers construction of well pads and cellars where drilling will take place, new roads that will interconnect the well pads, laying of water supply lines from the existing water storage tanks to the respective well pads, rig move using vehicles owned by KenGen, rigging-up of the rig and installation of associated

auxiliaries, drilling of the geothermal wells to the desired total depth depending with the type of well, well testing and capping using a permanent wellhead assembly.

Project Inputs and Cost

The materials required to drill a well up to a total depth of 3,000 metres include: 47.50 tonnes of bentonite, 0.60 tonnes of starch, 0.90 tonnes of caustic soda, 42,000 litres of drilling detergent, 0.85 tonnes of mica flakes, 21,000 litres of drilling polymer, 130.50 tonnes of blended cement, 161.80 tonnes of neat cement, 3.50 tonnes of mica flakes (3% BWOC), 2.61 tonnes of Wyoming (2% BWOC), 0.09 tonnes of fluid loss (0.3% BWOC), 0.09 tonnes of friction reducer (0.3% BWOC), 0.09 tonnes of retarder (0.3% BWOC), 0.42 tonnes of mica flakes (2% BWOC), 466,480 litres of diesel, 140,000 cubic metres of fresh water, 210 litres of corrosion inhibitor and 840 litres of pipelax. Water will be sourced from Lake Naivasha for which KenGen has a valid water abstraction permit.

Drilling of the proposed wells using each of the three rigs will be undertaken in four shifts. Each shift will have a total of thirty four (34) employees thus making a total of 136 employees per rig and four hundred and eight (408) employees for the 3 rigs combined. The total cost for drilling one well is estimated as Ksh. **554,675,814.44**. The forty-two wells will therefore cost **KES. 23,296,384,206.48**.

Objective and Justification for the Project

The objective of the proposed project is to enhance geothermal power generation in line with the company's Good-to-Great (G2G) strategy and the government's Bottom-up Economic Transformation Agenda (BETA). The proposed project will contribute towards promotion of renewable energy and phase-out of thermal energy sources in Kenya. Increased integration of renewable energy sources such as hydropower, wind, solar PV, and geothermal accelerates the global goal of "towards net zero emissions". The proposed project aligns to the national target of abating Green House Gas (GHG) emissions by 32% by 2030 relative to the Business as Usual (BAU) scenario of 143 MtCO_{2e} as committed in the updated Nationally Determined Contribution. The Government has set a target of achieving 100% of its electrical energy generation from renewable sources by 2030. The proposed 42 geothermal wells are estimated to generate 200 MW of electricity by 2030. Based on the 92% load factor and an estimated Grid Emission Factor of 0.2 tCO_{2e}/MWh and a project emission of 30,000 tCO_{2e}, the baseline emissions will be 322,368 tCO_{2e} annually. Geothermal energy is cheaper than energy from fossil

fuels hence the project demonstrates the government's commitment to meet its goal of achieving universal access to electricity while improving reliability and lowering the cost of electricity.

Project Location

The proposed drilling of the 42 geothermal wells will take place on land IR 105419/1 (LR NO.12881/5), within Hell's Gate National Park. The site comprises 7 pieces of distinct pieces of land measuring approximately 1580.29 acres (639.52 Ha). The project site has been leased from KWS for fifty (50) years with effect from 16th November 2024. The right to access the project site was granted by KWS on 16th May 2024. Project site details are shown in the table below.

Index	Leased Area/Site	Land Size (Acres)	GPS Coordinates Taken at the Centre	
			Eastings	Northings
i.	Area III	184.59	195436.301	9903389.191
ii.	Area IV	1371.44	197513.401	9901880.142
iii.	905A	1.58	202793.167	9901239.663
iv.	905B	0.81	202537.517	9901209.706
v.	734	7.45	201690.258	9905602.076
vi.	919	9.31	204814.143	9901448.204
vii.	738	5.31	202333.295	9904456.972

Administratively, the sites are located within Olkaria location, Naivasha Sub County in Nakuru County. Geothermal energy resource is potentially concentrated in Olkaria ward. This is located approximately 125 km to the northwest of Nairobi and about 40 km south of Naivasha Town. Areas IV, measuring 1371.44 acres, borders Narasha and Olomayiana Kubwa villages which are inhabited by the Maasai community whereas area III, measuring 184.59 acres, lies between Orpower 4 Inc geothermal power project and Oserian Flower Farm. There are no settlements bordering sites 905A, 905B, 734, 919 and 738.

Screening of the Proposed Project

The proposed drilling 42 geothermal wells falls under the high-risk project category pursuant to Legal Notice No. 31, legislative Supplement No. 16, which amended the second schedule of the Environmental Management and Coordination Act (EMCA), 1999. In accordance with section 58 of EMCA 1999, a proponent intending to implement a high-risk project is required to undertake an Environmental and Social Impact Assessment (ESIA) study and obtain a license from National Environment Management Authority (NEMA). It is worthwhile to note that a stand-alone ESIA study will be carried out for the geothermal power plant upon completion of drilling and testing of the wells.

Terms of Reference (ToR) for the ESIA Study

The ToR for undertaking the ESIA study was submitted to NEMA on 8th October 2024 and approved on 15th October 2024, upon review. The TOR was approved with the following three (3) mandatory conditions which have been adequately addressed as evidenced in this report:

- i. Undertake a detailed Climate Change Risks and vulnerability Assessment for the project to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016.
- ii. Undertake inclusive and detailed Public Participation with the Project Affected Persons (PAPs) in full compliance to Regulations 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and provide evidence of Published Notices for the meetings, dully signed minutes and attendance sheets for at least three consultation meetings.
- iii. Undertake a detailed Baseline Environmental and Social Conditions on Water Quality, Biodiversity, Air Quality and Geophysical conditions and baseline livelihoods for the local community within the proposed project footprint area.

ESIA Study Team and Methodology

The ESIA study was carried out by a team of nine (9) professionals whose background and experience are contained in the approved ToR. The team was spearheaded by a Lead Environmental Impact Assessment/Audit Expert licensed by NEMA (Reg. 1857) as provided for by the Environmental (Impact Assessment and Audit) Regulations, 2003.

The methodology entailed meeting with KenGen's top leadership to understand the scope and objective of the proposed project, scoping to zero in on key issues of the ESIA study, preparation of ToR for submission and approval by NEMA, desktop study, field survey to collect baseline data, laboratory analysis of samples of vegetation, soil and water, public participation by way of key informant interviews with KenGen team, public barazas, questionnaires, one-on-one meetings and key stakeholders consultative meeting and in-house peer review of the ESIA report.

Baseline Information

The baseline soil and vegetation chemistry results for the proposed project sites indicates that the concentration of toxic heavy metals, including mercury, chromium, cadmium, lead, selenium and boron were below 0.01 mg/kg. There is hence no risk of bioaccumulation of heavy metals along the food chain when grazing and browsing by livestock and wild animals takes place.

The physicochemical results for Lake Naivasha water indicate that all the parameters analysed, except *E.coli* and nitrates, were within the maximum recommended limits for sources of domestic water. Each of the rigs incorporates a water treatment plant that will purify the water to be used for domestic purposes during drilling of the 42 geothermal wells.

According to the Lake Naivasha water level trends, the lake level has been rising from September 2023 to September 2024 (1888.726 to 1891.109) as opposed to the period September 2022 and September 2023 where a downward trend was observed (1889.803 to 1888.726 masl). The Amber alert Limit for Lake Naivasha where water abstraction permit holders are only allowed to draw up to 75% of their industrial water use falls between 1885.3 and 1884.6 masl. It can therefore be concluded that owing to the short implementation period for the proposed drilling of 42 geothermal wells coupled with climate change effects, the lake level will not be impacted to a point where abstraction for industrial activities will be restricted by Water Resources Authority. In terms of water consumption, the status quo will remain since no additional rig will be added to the existing ones.

As at June 2023, the Olkaria location had a population size of 45,090 persons comprising of the Maasai pastoralists and other communities. The proposed project sites closely neighbour Olomaiyana Kubwa to the south of the Olkaria KWS gate, Rapland to the southeast of the gate, and Kamere Market nearly 4km north on a straight line. Project site area IV has high voltage electricity transmission lines. The primary stakeholders who may be impacted include KenGen

Housing Estate residents, KWS employees residing at Narasha gate and the Olkaria IV Project Affected Persons (PAPs) who were resettled at Rapland in August 2014, Narasha, Olomayiana Kubwa, Kamere and Oldonyo Kedong communities, Orpower 4 Inc., Kenya Power Company and Oserian flower farm. The main land uses in the project area of influence include wildlife conservation, Maasai settlements, ecotourism, and geothermal resource development. Diseases recorded for children over five years and adults at the RAP Land dispensary, listed in order of priority, are as follows:

- i. Respiratory diseases (tuberculosis, coughing, running nose, asthma etc.)
- ii. Joint pains
- iii. Skin diseases (wounds, cuts, bites, etc.)
- iv. Pneumonia
- v. Eye infections
- vi. Urinary tract infections (UTI)
- vii. Diarrhoea
- viii. Sexually Transmitted Diseases (STD)
- ix. Injuries; and
- x. Dental diseases (mainly fluorosis).

Respiratory ailments could be attributed to exposure to dust and smoke since majority of the households cook with firewood. Shrubs and grasslands predominantly colonize the study area. Bare areas are characterized by rock outcrops, lava flow and scattered vegetation. Built-up areas comprise sites occupied by anthropogenic activities such as geothermal infrastructure including well pads, roads, steam pipes, transmission line masts and power plants. Other human activities noted include clearing of vegetation, restoration of habitats, livestock incursion, charcoal burning, bushfires and tourism. The area around project sites OW738 and 734 drains into sensitive ecological areas such as the vulture cliff located southeast of the site and have *Osyris lanceolate* (a shrub) listed as an endangered plant species under the Wildlife Conservation and Management Act of 2013. Majority of wildlife was observed in area OW734 including buffalos, Maasai giraffe, eland, African hare, zebras, dik-diks and Aardvark. Other species identified in isolated areas included hyenas in gullies and Klipspringers on rocks. Several species of birds were also sighted including sunbirds, starlings and weaver birds. Reptiles observed included blue-headed agama. Insects comprised dung beetles, butterflies and dragonflies.

Public Participation

Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003 requires project proponents to seek the views of the public as part of the ESIA study. In line with this requirement, four (4) public barazas, nine one-on-one meetings and one key stakeholders meeting were carried out. Notices for the public barazas were prepared in Maasai, English and Swahili languages. Invitation letters for the key stakeholders were also prepared and hand delivered to them. The invitation letters and public notices were sent out at least seven days in advance. All the public barazas and the key stakeholders meeting were well attended. The meetings were chaired by the Chief, Olkaria location and the Assistant County Commissioner, Naivasha Central Division. Nine (9) questionnaires were also filled by the key stakeholders and returned for consideration. The stakeholders were in support of the proposed project subject to KenGen adhering to the Environmental and Social Management Plan. KenGen has a Grievance and Complaint Handling Mechanism (GCHM) designed to provide an effective platform for the company to resolve complaints from individuals affected by its projects. The GCHM will be used throughout the project duration.

Positive Impacts of the Proposed Project

The proposed project has the potential of resulting to the following benefits:

- i. Mitigation of climate change when the wells are finalized and connected to a 200 MW geothermal power plant. Based on the 92% load factor and estimated grid factor of 0.2 tCO₂e/MWh and a project emission of 30,000 tCO₂e, emission reduction of the power plant will be 292,368 tCO₂e annually.
- ii. Creation of direct employment opportunities
KenGen rigs will operate under a four-shift program with each shift comprising of thirty-four (34) workers. Out of these, every shift will engage 2 unskilled casual workers (roustabouts) from the local community making a total of twenty (24) direct employment. Through the economic multiplier effect, wages and salaries earned by the drilling crew will generate additional income and jobs in the local and regional economy.
- iii. Promotion of skills and knowledge transfer
The project will provide a learning opportunity for students on attachment and interns under the Government of Kenya (GoK) performance contract.
- iv. Enhancement of Local Development

Implementation of the proposed project will lead to realization of the government's Bottom-up Economic Transformation Agenda (BETA), which is geared towards economic turnaround and inclusive growth through a value chain approach. Corporate Social Responsibility projects sponsored by the project proponent will enhance local development.

v. **Enhanced business opportunities**

Business opportunities will comprise of various consultancy jobs, hotel industry, supply of equipment, spare parts, food and materials, cleaning services, rig camp services, contracted jobs and provision of transportation and logistics services.

vi. **Promotion of tourism**

Various schools, universities and colleges are likely to visit the project for academic reasons during geothermal well drilling phase.

Potential Negative Impacts

The potential negative impacts that would result from implementation of the proposed project will be short lived and reversible to a larger extent. Some of the proposed mitigation measures for the envisaged negative impacts are provided under the risks pinpointed below:

i. **Destruction of land cover and Soil Erosion**

- a. The well pads will be designed to accommodate multiple wells thus reducing project footprint.
- b. Construction activities will be confined within the demarcated areas.
- c. KenGen-KWS joint baseline studies shall be undertaken for each well pad and new roads to facilitate preparation of site specific EMPs.
- d. All disturbed areas will be rehabilitated and soil erosion protection works incorporated.

ii. **Dust Emission**

- a. Application of water to unpaved well pads and road surfaces and
- b. Provision of Personal Protective Equipment (PPEs) to construction workers.

iii. **Risk of Wildlife-vehicle Collision**

- a. Inclusion of education on wildlife protection, in the project employee induction program and toolbox talks.

- b. Influencing driver behaviours through installation of appropriate wildlife warning and information signs along the roads.
- iv. **Poaching of Wildlife**
 - a. Park surveillance and patrols shall be undertaken jointly by KWS rangers and Critical Infrastructure Protection Unit (CIPU) based at Olkaria.
 - b. Public disclosure of KWS incident reporting lines.
 - c. Education and awareness on wildlife conservation. This shall target contracted service providers, suppliers of materials, employees and visitors to the rig sites.
- v. **Geothermal Fluid Withdrawal and Discharge**
 - a. Fencing of drilling fluid recirculation ponds.
 - b. Recirculation of drilling fluid during drilling of the wells.
 - c. Installation of safety signage.
 - d. Pond lining with High-Density Polyethylene (HDPE) Geomembrane.
 - e. Proper siting of the drilling fluid recirculation ponds and close monitoring of the level of fluids.
 - f. Continuation with the reinjection program to avoid potential land subsidence.
- vi. **Pressure on Lake Naivasha**
 - a. Promotion of water conservation measures e.g. prompt fixing of leakages/pipe bursts.
 - b. Catchment conservation initiatives including tree planting.
 - c. Supplementing fresh water with brine during drilling of the geothermal wells.
- vii. **Waste Generation and Disposal**
 - a. Adoption of the 5Rs (Refuse, Reduce, Reuse, Repurpose and Recycle) approach in waste management.
 - b. Waste segregation and proper containment at the source.
 - c. Provision of suitable animal proof waste bins.
 - d. Contracting NEMA licensed waste handlers for the various waste streams.
- viii. **Air Emissions**
 - a. Annual stack emission measurements and instituting effective controls.

- b. Regular inspection, servicing and maintenance of the engines connected to the motor vehicles and diesel generators.
- c. Phase-out of R22 refrigerant in the air conditioning systems.
- d. Open burning of solid waste shall be prohibited.

ix. Conflicts with Neighbours

- a. Continuous engagement with neighbouring communities.
- b. Implementation of Grievance and Complaints Handling Mechanism.
- c. Establishment of adequate buffer between geothermal concession areas owned by Orpower 4 Inc and KenGen.

x. Spread of Communicable Diseases

- a. Enhancement of education and awareness on prevention and control of communicable diseases.
- b. Arrange for mobile Voluntary Counselling and Testing of the workers and the neighbouring communities.
- c. Housing of shift workers in the camping facilities.

xi. Preservation of Archaeological and Cultural Assets

In the event that unexpected archaeological remains are found within the project site, KWS and National Museums of Kenya will be informed.

xii. General Safety and Health Risks

The proponent will implement a process for the elimination of hazards and reduction of Occupational Health and Safety (OH&S) risks using the following hierarchy of controls:

- a. Elimination of the hazards;
- b. substitution with less hazardous processes, operations, materials or equipment;
- c. use engineering controls and reorganization of work;
- d. use administrative controls, including training, toolbox meetings and permit to work system;
- e. use adequate personal protective equipment.

The ESIA team has endeavoured to propose suitable and adequate mitigation measures for the identified negative environmental and social impacts. The measures will be taken into consideration when implementing the proponent's ISO Integrated Management System thereby promoting environmentally sustainable development of the proposed project. KenGen has undertaken drilling of geothermal wells both locally and internationally using internal capacity thus there is no doubt that the ESMP will be implemented.

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LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
BAU	Business as Usual
BETA	Bottom-up Economic Transformation Agenda
BSc	Bachelor of Science
CBO	Community Based Organization
CIPU	Critical Infrastructure Protection Unit
CPR	Cardiopulmonary Resuscitation
CSR	Corporate Social Responsibility
DOHSS	Directorate of Occupational Health & Safety Services
ECDE	Early Childhood Development Education
EMCA	Environmental Management and Coordination Act
EMS	Environmental Management System (
EPRA	Energy and Petroleum Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
G ₂ G	Good-to-Great
GCHM	Grievance and Complaint Handling Mechanism
GDC	Geothermal Development Company
GHG	Green House Gas
GPS	Global Positioning System
Ha	Hectares
HDPE	High Density Polyethylene
HGNP	Hell's Gate National Park
HIV	Human Immunodeficiency Virus
ISO	International Organization for Standardization
JICA	Japan International Cooperation Agency
JSA	Job Safety Analysis
KenGen	Kenya Electricity Generating Company PLC
KETRACO	Kenya Electricity Transmission Company Limited

KMFRI	Kenya Marine and Fisheries Research Institute
KNBS	Kenya National Bureau of Standards
KPLC	Kenya Power and Lighting Company
KWS	Kenya Wildlife Service
LANAWRUA	Lake Naivasha Water Resource Users Association
LCPDP	Least Cost Power Development Plan
LNRA	Lake Naivasha Riparian Association
LPG	Liquified Petroleum Gas
LR	Land Registration
Masl	Metres Above Sea Level
MCM	Million Cubic Meter
MoU	Memorandum of Understanding
MSc	Master of Science
MW	Mega Watt
NEMA	National Environment Management Authority
NGAO	National Government Administration Office
NGO	Non-Governmental Organizations
NIHL	Noise Induced Hearing Loss
OHSMS	Occupational Health and Safety Management System
OSHA	Occupational Health and Safety Act
PM	Particulate matter
ppm	Parts per million
PPE	Personal Protective Equipment
PWD	People Living with Disabilities
QMS	Quality Management System
RAP	Resettlement Action Plan
REREC	Renewable Energy and Rural Electrification Corporation
RoK	Republic of Kenya
SCC	Stakeholder Coordination Committee
SDG	Sustainable Development Goals

STDs	Sexually Transmitted Diseases
TSP	Total Suspended Particulates
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
UNGCK	United Nations Global Compact Kenya
UTI	Urinary Tract Infections
WRA	Water Resources Authority
WRTI	Wildlife Research and Training Institute Naivasha
tCO ₂	Tonnes of Carbon VI Oxide equivalent
μm	Micrometre
μg/M ³	Micrograms per meters cubed
dB(A)	A-weighted decibel level – units for noise measurement
LAq-10hours	Equivalent continuous sound level for 10 hours

1 Introduction

1.1 The Project Proponent

The project proponent is Kenya Electricity Generating Company PLC (KenGen). KenGen is the leading electric power generating company in East Africa with 70% Government of Kenya and 30% public shareholding. The company is licensed to generate energy in bulk with Kenya Power Company being the sole off taker of electricity under competitive Power Purchase Agreements (PPAs). The company's current total installed capacity is 1,904 MW comprising of Geothermal (799 MWe – 42%), Hydro (826 MW – 43%), Thermal (253.5MW – 13%) and Wind (25.5MW – 2%). The company commands a market share of 61% of electricity consumed in the country. KenGen was granted by the Ministry of Energy, geothermal resource license No. 1/2008 dated 19th September 2008 and valid for thirty (30) years (Refer to appendix 1). The license was issued with respect to Olkaria Geothermal Field. The Olkaria geothermal licensed area measures 204 km² (20,400 Ha). While undertaking power generation activities, KenGen conforms to ISO 9001:2015 (Quality Management System), ISO 14001:2015 (Environmental Management System) and ISO 45001:2018 (Occupational Health and Safety Management System) for which the company has certifications. KenGen is a member of the United Nations Global Compact Kenya (UNGCK) which serves as the local network of the United Nations Global Compact. UNGCK is working to accelerate and scale up the collective impact of businesses in Kenya by upholding the 10 principles of the United Nations Global Compact (UNGC) and delivering the Sustainable Development Goals (SDGs) through accountable companies and ecosystems that enable change.

KenGen has developed an ambitious strategy to increase its geothermal power generation capacity. In support of this strategy, the company has entered into a sublease agreement with Kenya Wildlife Service (KWS) for geothermal energy expansion (Refer to appendix 2). The seven (7) distinct pieces of land under IR 105419/1 (LR NO.12881/5) are located within Hell's Gate National Park and measures approximately 1580.29 acres (639.52 Ha) in total. The duration of the sublease agreement is fifty (50) years with effect from 16th November 2024. The right to access the piece of land was granted by KWS on 16th May 2024 (Refer to appendix 2). Among the sub-lease covenants include the requirement for KenGen to comply with the provisions of Environmental Management and Coordination Act (EMCA), 1999 and the Wildlife Conservation and Management Act, 2013. This has necessitated preparation of this Environmental and Social Impact Assessment Study Report.

1.2 Nature of the Proposed Project and its Objective

KenGen proposes to drill forty-two (42) geothermal wells on the subleased land at Olkaria Geothermal Filled in Hell's Gate National Park. The project will comprise of production, monitoring and reinjection wells that will be connected to existing and future geothermal power plants as makeup wells or new wells respectively. The wells will be drilled using three (3) rigs owned by KenGen i.e. KGN1, KGN2 and N370 for an approximate period of five (5) years. Drilling of the wells will be preceded by opening up of new roads where necessary, construction of well pads incorporating cellars, laying of water lines from the existing water storage tanks to the respective well pads and rig move using vehicles owned by KenGen, rigging-up of the rig and installation of associated auxiliaries. The objective of the proposed project is to enhance geothermal power generation in line with the company's Good-to-Great (G2G) strategy and the government's Bottom-up Economic Transformation Agenda (BETA).

1.3 Project Justification

The proposed drilling of forty-two (42) geothermal wells at Olkaria will contribute towards promotion of renewable energy and phase out of thermal energy sources in Kenya. Increased integration of renewable energy sources such as hydropower, wind, solar PV, and geothermal accelerates the global goal of "towards net zero emissions". The proposed project aligns to the national target of abating Green House Gas (GHG) emissions by 32% by 2030 relative to the Business as Usual (BAU) scenario of 143 MtCO_{2e} as committed in the updated Nationally Determined Contribution. The Government has set a target of achieving 100% of its electrical energy generation from renewable sources by 2030. This is in line with the Kenya Energy Transition Investment Plan launched at the United Nations Climate Change Conference (COP 28) in 2023. Implementation of the proposed project will lead to realization of the government's Bottom-up Economic Transformation Agenda (BETA), which is geared towards economic turnaround and inclusive growth through a value chain approach. In particular, the project demonstrates the government's commitment to meet its goal of achieving Universal access to electricity while improving reliability and lowering the cost of electricity. According to the Government's Least Cost Power Development Plan (LCPDP) 2022 -2041, KenGen has lined up implementation of geothermal power plants shown in table 1.

Table 1: KenGen's Project under Updated Least Cost Power Development Plan (LCPDP) 2022 - 2041

Year for System Integration	Plant Name	Net Capacity (MW)
2025	Olkaria I - Unit 1 Rehabilitation	21
	Olkaria I - Unit 2 Rehabilitation	21
	Olkaria I - Unit 3 Rehabilitation	21
	Olkaria I Upgrading (Topping)	20
	Olkaria IV Upgrading (Topping)	20
2029	Olkaria VI	140
2029	Olkaria VII	140
2034	Olkaria VIII	140
2036	Olkaria IX	140
Total		663

Source: Republic of Kenya, 2022

In addition, the company plans to phase-out its thermal power plants as detailed in table 2.

Table 2: KenGen's Phase-out Plan for Thermal Power Plants as per LCPDP 2022 - 2041

Year for Phaseout	Plant Name	Net Capacity (MW)
2025	Muhoroni GT1 (Gas Turbine)	~28
	Muhoroni GT 2	~28
	Kipevu 1 Diesel Engine	~60
2031	Kipevu 3	~115
Total		~231

Source: Republic of Kenya, 2022

1.4 Screening of the Proposed Project

The proposed drilling of forty-two (42) geothermal wells falls under the high-risk project category pursuant to Legal Notice No. 31, legislative Supplement No. 16, which amended the second schedule of EMCA 1999. In accordance with section 58 of EMCA 1999, a proponent intending to implement a high-risk project is required to undertake an Environmental and Social Impact Assessment (ESIA) study and obtain a license from National Environment Management Authority (NEMA). A separate ESIA study will be carried out for the geothermal power plant upon completion of drilling.

1.5 Objective of Conducting the ESIA Study

National Environment Management Authority (NEMA) currently requires project proponents to carry out Environmental and Social Impact Assessments (ESIA) and prepare related reports for developments that have the potential of resulting to negative social and environmental impacts. The overall objective of the ESIA study is to ensure that environmental and social concerns are integrated in all development activities in order to contribute to sustainable development. The specific objectives of conducting the ESIA study for the proposed project were to:

- i. Identify the anticipated environmental and social impacts of the project and the scale of the impacts;
- ii. Identify and analyze alternatives to the proposed project;
- iii. Propose adequate and suitable mitigation measures to be taken during project preparation, operation and decommissioning;
- iv. Carry out public participation, a mandatory requirement of ESIA studies and
- v. Develop an Environmental and Social Management Plan (ESMP) with mechanisms for monitoring and evaluating compliance and environmental performance of the proposed project.

1.6 Terms of Reference (ToR) for the ESIA Study

The Lead ESIA/Audit Expert, in conjunction with KenGen's top leadership, prepared the ToR for conducting ESIA study for the proposed drilling of forty-two (42) geothermal wells. The ToR was submitted to NEMA on 8th October 2024 and approved on 15th October 2024, upon review. The detailed ToR together with the confirmation for approval are attached in appendix 3.

The TOR was approved with the following three (3) conditions:

- i. Undertake a detailed Climate Change Risks and vulnerability Assessment for the project to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016.
- ii. Undertake inclusive and detailed Public Participation with the Project Affected Persons (PAPs) in full compliance to Regulations 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003 and provide evidence of Published Notices for the meetings, dully signed minutes and attendance sheets for at least three consultation meetings.

- iii. Undertake a detailed Baseline Environmental and Social Conditions on Water Quality, Biodiversity, Air Quality and Geophysical conditions and baseline livelihoods for the local community within the proposed project footprint area.

Evidence of fulfilment of the above mandatory conditions has been provided in this ESIA study report.

1.7 ESIA Methodology

The ESIA study process entailed the following steps:

- i. Meeting with KenGen's top leadership to understand the scope and objectives of the proposed project.
- ii. Scoping with an aim of delineating the study area and zeroing in to key issues.
- iii. Preparation of the ToR and submission to NEMA for review and approval.
- iv. Desk top study (literature review) pertinent to the proposed project and its location.
- v. Field survey to collect baseline information through direct observations, sample collection, field measurement, transect walks and photography.
- vi. Laboratory analysis of the collected samples for soil and vegetation.
- vii. Public participation by way of key informant interviews with KenGen team, questionnaires, public barazas, one-on-one meetings and key stakeholders consultative meeting.
- viii. In-house peer review of the draft ESIA study report for ownership by the project proponent as provided for by the KenGen's QMS standard operating procedure.

1.8 ESIA Team Composition

Table 3 shows the team members who conducted the ESIA study for the proposed drilling of 42 geothermal wells:

Table 3: ESIA team composition

Index	Name	Qualifications	NEMA Reg. No.
1.	Philip Barasa	MSc. Geothermal Energy Technology; BSc. Environmental Science.	Lead Expert No. 1857 and Overall Team Leader.

Index	Name	Qualifications	NEMA Reg. No.
2.	Elizabeth Mwangi-Gachau	Master of Environmental Studies; BSc. Environmental Studies; Postgraduate Diploma in Environmental Science.	Lead Expert No. 2399
3.	Douglas Gichangi	MSc. Geo-Information Science & Earth Observation with specialization in Natural Resources Management; BSc. Environmental Conservation & Natural Resource Management.	Lead Expert Reg. No. 8118
4.	Rolex Rangangá	BSc. Environmental Studies	Associate Expert No. 10545
5.	Ruth Cheruiyot	BSc. Environmental Health	Associate Expert No. 9010
6.	Peninah Mbuthi	Master's in Education Management, Bachelor of Arts in Sociology, Postgraduate Diploma in Education.	Not Registered
7.	Preston Mulunda	BSc. Mechanical and Industrial Engineering - Production Option.	Not Registered
8.	Alex Ndwiga	Bachelor of Applied Science Geoinformatics.	Not Registered
9.	Kelly Tamakaro	Dip. Education Science (Physics & Chemistry)	Not Registered

The practising licenses for the NEMA Registered ESIA/Audit experts are attached (Refer to appendix 4).

2 PROJECT DESCRIPTION

2.1 Components of the Proposed Project

The proposed project will comprise of the following components:

- a. New unpaved roads in the project sites III and IV which borders Orpower 4 Inc. and Narasha village.
- b. Well pads complete with cellars.
- c. Water supply line from the existing water storage tanks to the respective well pads.
- d. Forty two (42) geothermal wells drilled using the 3 KenGen rigs.

2.2 Construction of New Unpaved Roads, Water Supply Lines and Well Pads

The project proponent will endeavour to utilize existing roads where practicable. It is envisaged that new unpaved roads will be constructed in the project sites III and IV measuring approximately 1556.03 acres. Well pads will be designed to accommodate multiple geothermal wells thus reducing the project footprint (Refer to appendix 4). Construction of the roads, water lines and well pads will be undertaken by KenGen's Civil Division.

2.2.1 Construction Equipment

Construction of roads, water line and well pads will be carried out using the equipment shown in table 4.

Table 4: Construction Phase Equipment

Index	Type of Equipment	No. Required
1.	Logistic vehicles	2
2.	Bulldozers	2
3.	Tippers	8
4.	Graders	2
5.	Excavators	2
6.	Shovels	2
7.	Water bowzers	2
8.	Rollers	2
9.	Fuel Tanker	1

Index	Type of Equipment	No. Required
10.	Concrete mixer	1
11.	Poker vibrator	1
12.	Portable power generator	1
13.	Portable welding machine for water pipeline connection.	1

2.2.2 Access Road Construction

Construction of unpaved roads will be done as per the approved Route Map of Access Roads. The process entails the following activities: Measurement and pegging, vegetation clearing, topsoil removal, excavation, grading, murrum dumping, final grading and compaction and provision of meter drains using earth moving equipment.

2.2.3 Well Pad and Pond Construction

This involves preparation of a stable, well compacted drilling site that will accommodate all drilling equipment and crew and discharge pond enough to accommodate the discharged fluids as per the approved well pad layouts shown in figures 1 to 4. The activities will include: site marking, vegetation clearing, top soil removal, taking spot heights and fixing depth of cut, excavation of the pad area and pond, levelling and compaction, dumping of murrum, final grading, levelling and compaction of the pad using earth moving equipment.

Well pad for accommodating 4 geothermal wells is shown in figure 1. The drilling fluid recirculation pond will measure 220 by 20 metres whereas the pad will measure 220 by 80 metres. The pond and the pad will be 4 metres apart to allow for ample work area.

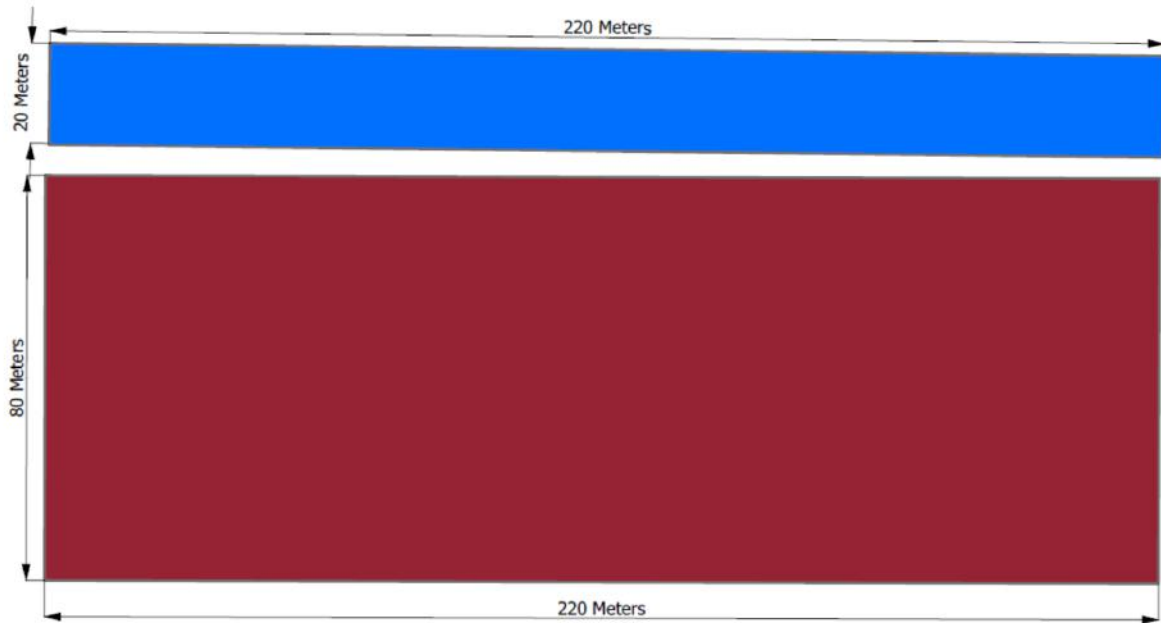


Figure 1: Well Pad for Accommodating 4 Geothermal Wells

Well pad for accommodating 3 geothermal wells is shown in figure 2. The drilling fluid recirculation pond will measure 180 by 20 metres whereas the pad will measure 180 by 80 metres. The pond and the pad will be 4 metres apart to allow for ample work area.

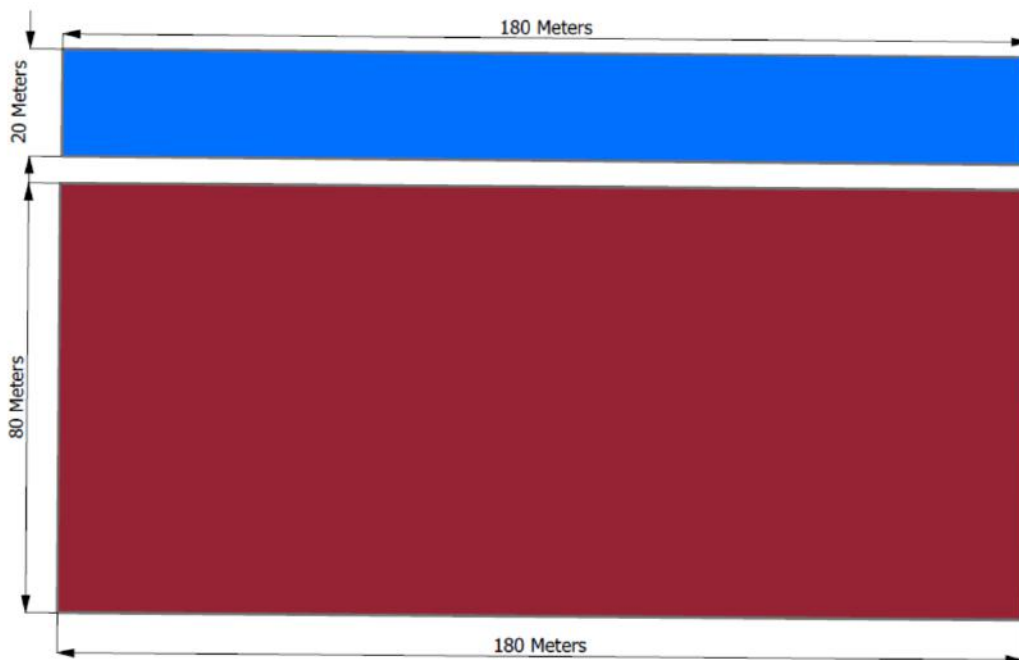


Figure 2: Well Pad for Accommodating 3 Geothermal Wells

Well pad for accommodating 2 geothermal wells is shown in figure 3. The drilling fluid recirculation pond will measure 150 by 20 metres whereas the pad will measure 150 by 80 metres. The pond and the pad will be 4 metres apart to allow for ample work area.

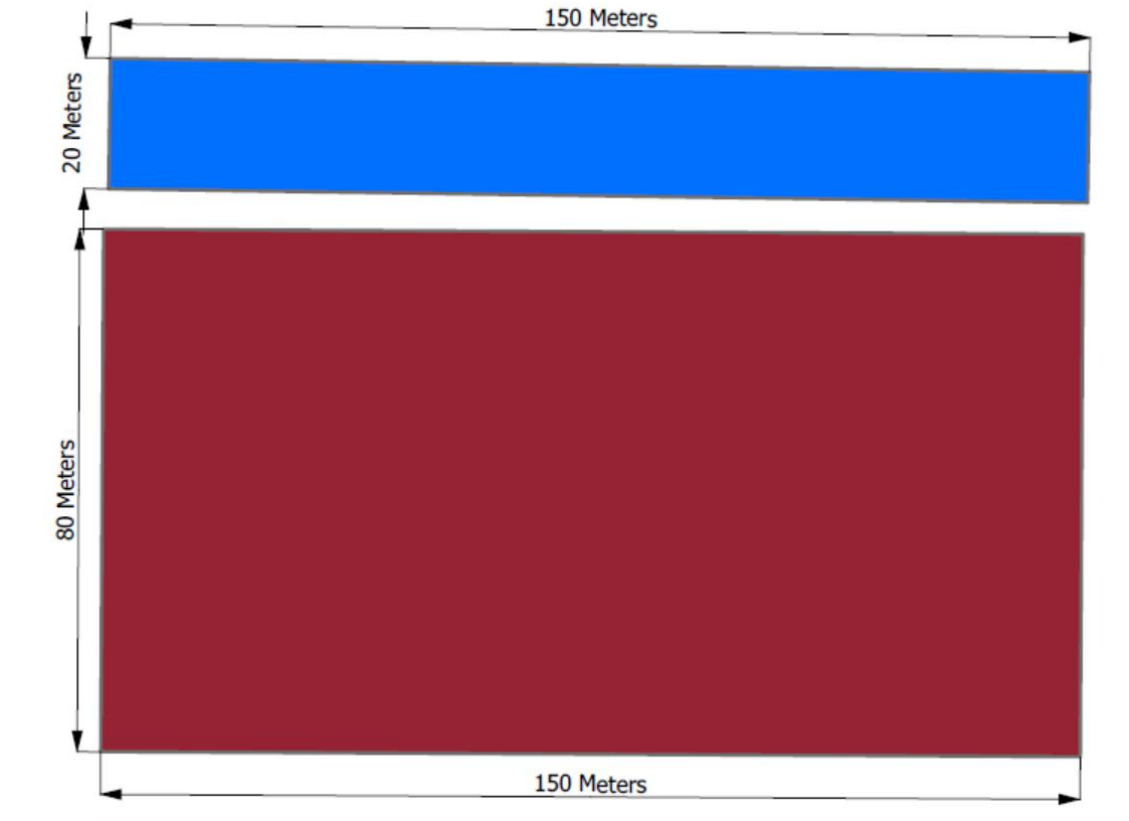


Figure 3: Well Pad for Accommodating 2 Geothermal Wells

Well pad for accommodating a single geothermal well is shown in figure 4. The drilling fluid recirculation pond will measure 110 by 20 metres whereas the pad will measure 110 by 70 metres. The pond and the pad will be 4 metres apart to allow for ample work area.

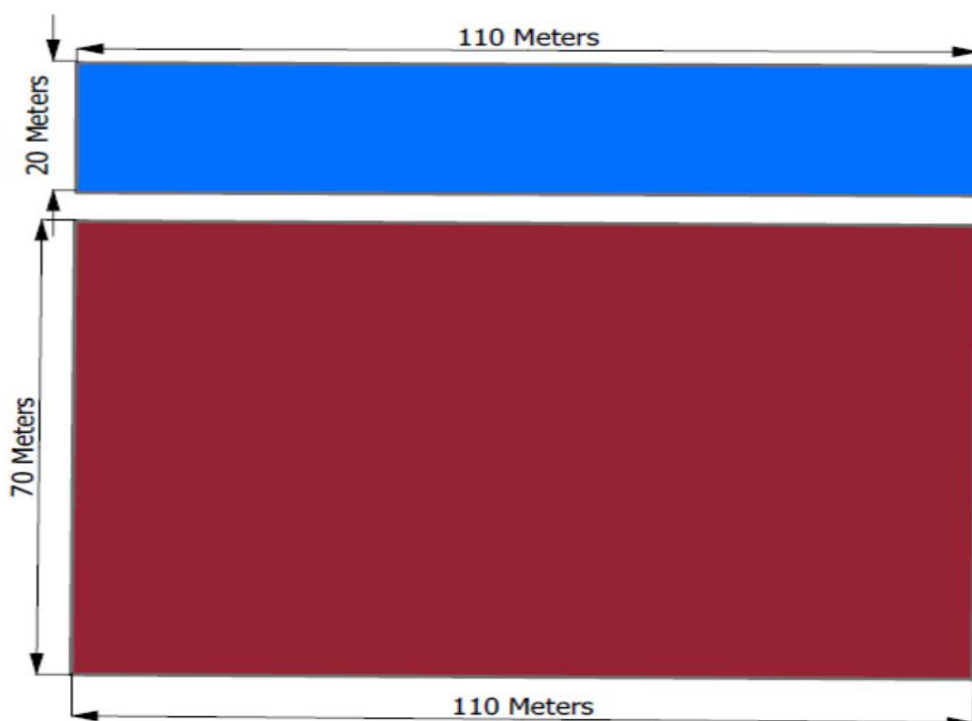


Figure 4: Well Pad for Accommodating 1 Geothermal Wells

All drilling fluid circulation ponds will be lined with High Density Polyethylene (HDPE) membrane. The well pads will be distributed as shown in table 5.

Table 5: Distribution of Well Pads at the Project Site

Site Name as Per Sublease Agreement	Distribution of Well Pads	Number of Wells to be Drilled	Remarks
Site I	Around Pad 734	2	Existing well pad will be expanded to accommodate multiple wells.
	Around Pad 738	3	Existing well pad will be expanded to accommodate multiple wells.
Site 2	Around Pad 905	No well	The site already contains a wellhead power plant.

Site Name as Per Sublease Agreement	Distribution of Well Pads	Number of Wells to be Drilled	Remarks
	Around Pad 919	2	Existing well pad will be expanded to accommodate multiple wells.
Site 3	3 new well pads @ with 3 wells	9	Exact location to be determined by well siting committee.
	1 new well pad with 4 wells	4	Exact location to be determined by well siting committee.
	2 new well pads @ with 2 wells	4	Exact location to be determined by well siting committee.
Site IV	New pad around well OW51	4	Exact location to be determined by well siting committee.
	Around Pad 39	2	Exact location to be determined by well siting committee.
	Around Pad 49	1	Exact location to be determined by well siting committee.
	Around Pad 52	1	Exact location to be determined by well siting committee.
	1 new Pad with 3 wells	3	Exact location to be determined by well siting committee.
	2 Well Pads @ with 3 Wells	6	Exact location to be determined by well siting committee.

Site Name as Per Sublease Agreement	Distribution of Well Pads	Number of Wells to be Drilled	Remarks
	1 Well Pad with 1 well	1	Exact location to be determined by well siting committee.

2.2.4 Construction of the Cellars

A cellar is a concrete structure that provides working space for casing head equipment for the rig. The cellars will measure 3.5m by 3.5m and 2.4m by 3.5m for big and small rigs respectively as per the approved detailed cellar drawing. Construction of the cellar will entail marking of the cellar area, excavation, bar bending, mixing of concrete, casting of reinforced concrete and laying of drainage casing, curing and site clean-up. Materials required will include cement, sand, ballast, metal bars, timber and water.

2.2.5 Laying of Water Lines

The aim of laying the lines is to ensure supply of water for drilling and quenching of the geothermal wells. The activities involve: survey and approval of pipeline route, pipe transportation, pipe arrangement and coupling, fabrication of bends, fixing of valves, bends and flow meters and leakage testing.

2.2.6 Rig Move and Rigging up

The equipment required for drilling is transported using KenGen tracks. The equipment comprises of drilling rigs, tools, and safety equipment. The arrangement of the equipment at the well pads is shown in figure 5 (Refer to appendix 6).

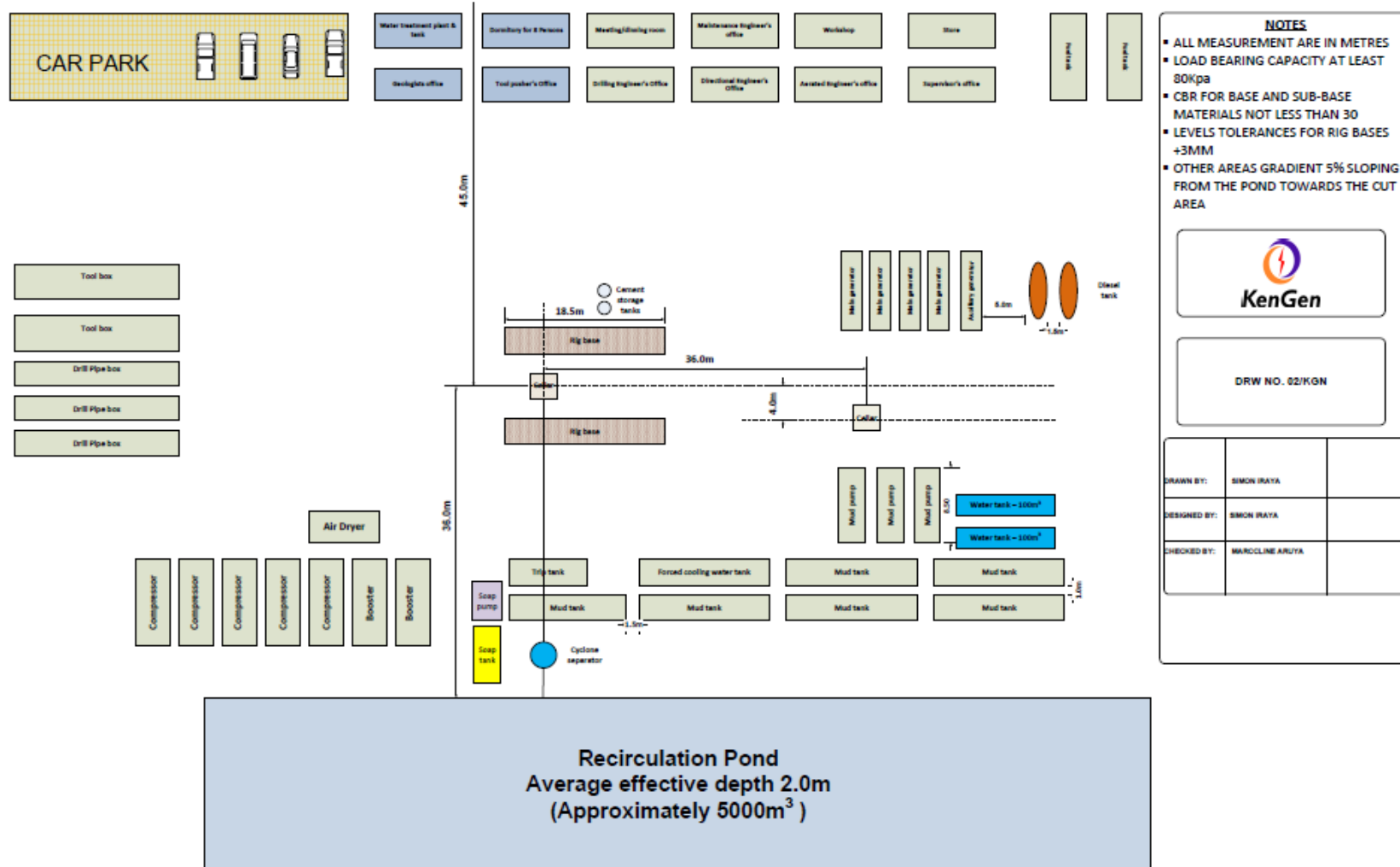


Figure 5: Layout of a Rig Site

2.3 Materials and Equipment Needed

Table 6 indicates the materials that will be used during drilling of the proposed geothermal wells.

Table 6: List of Materials Required for Drilling of Geothermal Wells

Category	Input	Unit	Quantities
Mud and mud materials	Drilling Bentonite	ton	47.50
	Starch	ton	0.60
	Caustic Soda	ton	0.90
	Drilling detergent	210 litre drums	200
	Drilling polymer	210 litre drums	10
Lost circulation materials	Mica-Flakes	ton	0.85
Cement and cement additives	Blended Cement	ton	130.50
	Neat Cement	ton	161.80
	Wyoming (2% BWOC)	ton	2.61
	Mica Flakes (3% BWOC)	ton	3.50
	Fluid Loss (0.3% BWOC)	ton	0.09
	Friction Reducer (0.3% BWOC)	ton	0.09
	Retarder (0.3% BWOC)	ton	0.09
	Mica Flakes (2% BWOC)	ton	0.42
Automotive diesel fuel	Diesel	litres	466,480.00
Others	Drilling water	M ³	140,000.00
	Corrosion Inhibitor	drums	1
	Pipe lax	drums	4

Source: Olkaria Drilling Section

The tools and equipment required to carry out drilling of the geothermal wells are provided below.

- | | | |
|-----------------------------------|---|---|
| 1. Crane | 11. Welding Machine | 22. D-shackles |
| 2. Air winch | 12. Grinding Machine | 23. Trucks |
| 3. Bull dozer & trucks
cathead | 13. Spinning chain | 24. Water pump |
| 4. Drilling Rigs (3
No.) | 14. Chain tong | 25. Generators |
| 5. Hammer Wrenches | 15. Slips | 26. Air compressors |
| 6. Jerks | 16. Bit breaker | 27. Well cementing
equipment |
| 7. Rock bit | 17. Elevators | 28. Variable frequency
drive (VDF) |
| 8. Casings | 18. Rotary tongs | 29. Silicon Controlled
Rectifier (SCR) |
| 9. Sledge hammers | 19. Forklift | |
| 10. Spirit level | 20. Tugging ropes | |
| | 21. Drill pipes, drill
collars & stabilizers | |

2.4 Drilling Process

2.4.1 Well Drilling

- Choose Drilling Method: Select an appropriate drilling technology (e.g., rotary drilling, directional drilling) based on geological conditions. Typically, geothermal wells are drilled to depths ranging from 200 to 1,500 meters depth for low- and medium-temperature systems, and from 700 to 3,000 meters depth for high- temperature systems. Wells can be drilled vertically or at an angle as shown in figure 6.

TYPICAL OLKARIA WELLS PROFILE

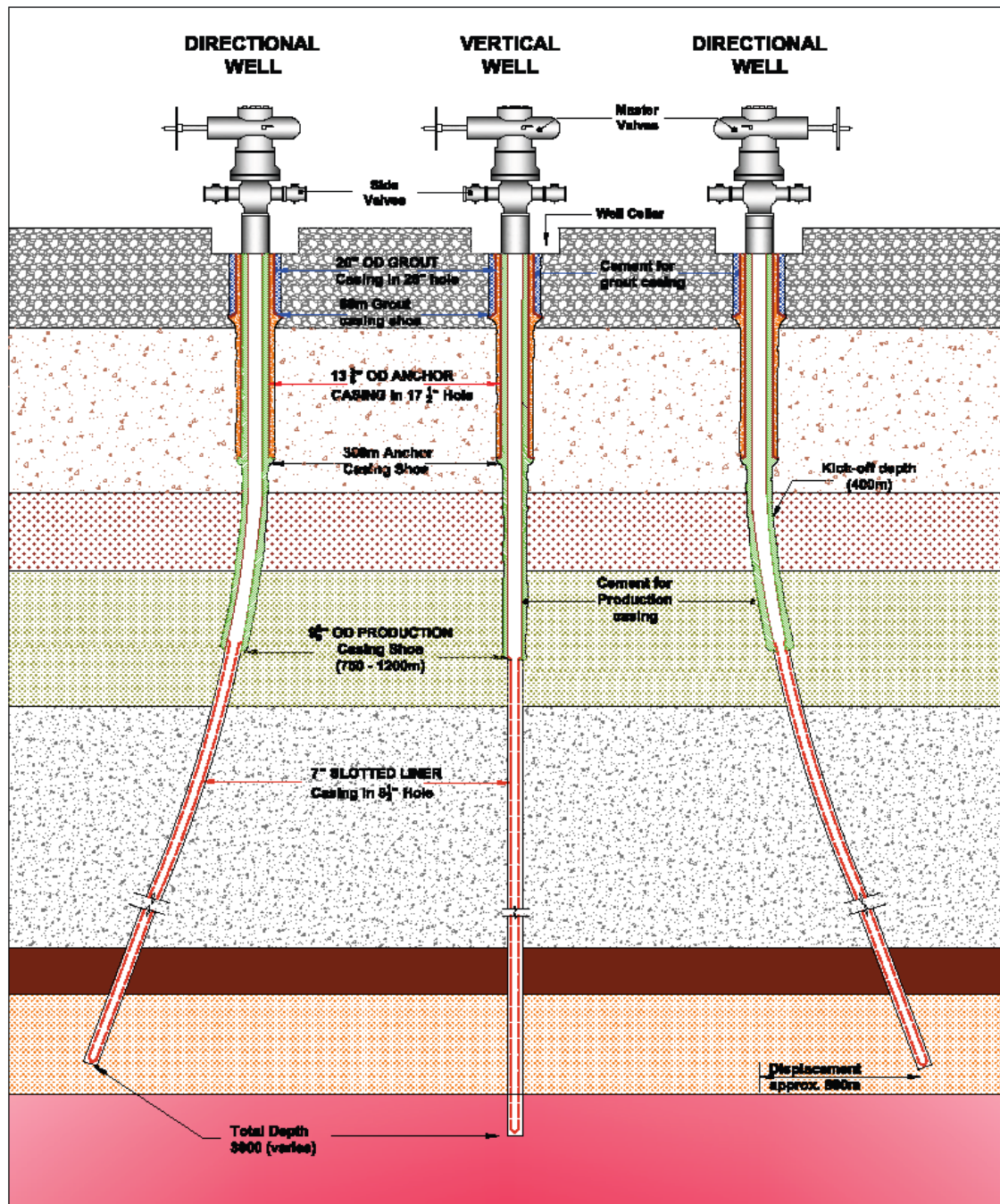


Figure 6: Typical Olkaria wells profile

- **Drilling Operations:** Begin drilling, continuously monitoring parameters like pressure and temperature, and managing cuttings and fluids. The proposed project will entail drilling of 42 geothermal wells. Wells are drilled in a series of stages, with each stage being of

smaller diameter than the previous stage, and each being secured by steel casings, which are cemented in place before drilling the subsequent stage.

- Drilling starts with 26-inch surface hole to 60 m then 20-inch casing run in hole cemented in place to hold loose top formation. 17 ½ inch intermediate section is drilled to 300 m then 13 3/8-inch casing cemented. The production section 12 ¼ inch is drilled to between 750-1200 m then 9 5/8-inch casing cemented in place to seal off all underground cold influx. Lastly the main hole 8 ½ inch is drilled to 3000 m and 7-inch liners run in hole to total depth. The top sections are drilled using water-based mud while production and main holes drilled using aerated water and foam. The casing design is shown in figure 7.

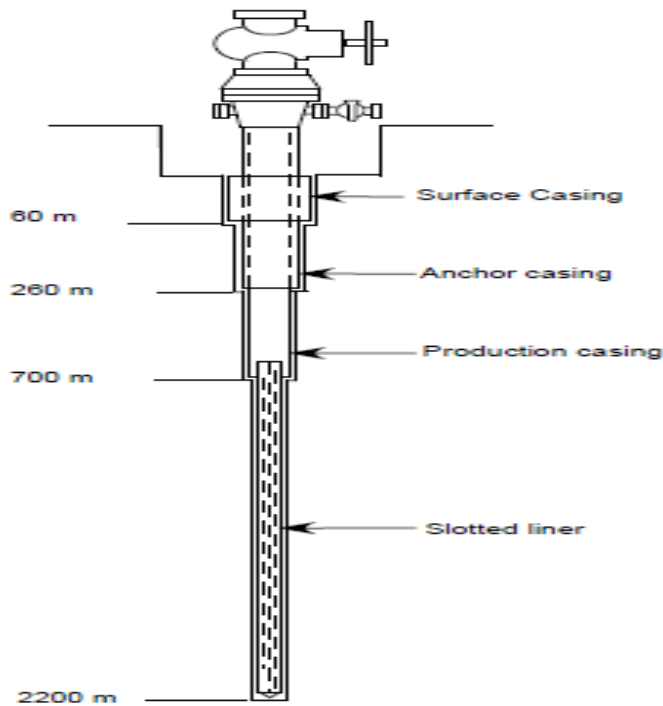


Figure 7: Casing Design

2.4.2 Well Capping

This entails all activities from the time the well is drilled to Total Depth. The master valve is installed and closed after the drilled well is quenched and 13.625" Blow Out Preventer (BOP) is laid down. This is done to facilitate shutting or turning on steam. Quenching is undertaken by pumping cold water in the well to subdue (control) formation pressure.

2.4.3 Well Completion

Well Logging is undertaken to assess the geothermal resource's temperature and flow rate. Cement is pumped through the casing to provide competent bond on casing-casing and casing-formation annuli (the space between the casing-casing or casing-wellbore) with the help of well cementing equipment

2.4.4 Testing and Assessment

Production Testing is done by performing flow tests to evaluate the well's performance and potential output. Resource Assessment is also done to determine the viability of the geothermal resource for long-term use.

2.4.5 Monitoring and Maintenance

Well performance and environmental impacts are continuously monitored during operation and regular maintenance checks on the well and associated equipment done to ensure efficiency and safety.

2.5 Types of Waste to be Generated

Table 7 shows the types of waste that will be generated during drilling of the proposed geothermal wells.

Table 7: Types and Quantities of Waste to be Generated

Type of Waste	Approximate Quantity Generated Per Rig/Service	Proposed Waste Management Option
Used oil filters	8 filters for the 4 generators/rig after every 240 hours, 500 hours and 1000 hours of operation of the drive engine	Accumulated safely and disposed of through licensed hazardous waste handlers.
Used fuel filters	~	Accumulated safely and disposed of through licensed hazardous waste handlers.

Type of Waste	Approximate Quantity Generated Per Rig/Service	Proposed Waste Management Option
Used oil	420 litres per service conducted	Accumulated safely and sold to licensed used oil recyclers.
Worn out casing protectors	600 pieces	Accumulated safely and sold to licensed scrap metal dealers
Empty plastic & metal containers	~	<ul style="list-style-type: none"> • Reused at the drilling detergent manufacturing plant. • Sold to licensed scrap metal dealers.
Empty gunny bags	~	Reused by the proponent.
Geothermal fluid	~	<ul style="list-style-type: none"> • Provide well fenced ponds for temporary holding. • Drilling fluid is recirculated.
Scrap metals	~	Sold to licensed scrap metal dealers
Oily rags	¼ kg per servicing of generator	Accumulated in suitable closed containers and disposed of through NEMA licensed hazardous waste handlers.
Domestic sewage	~	<ul style="list-style-type: none"> • Use of pit latrines. • Backfilling upon completion of well drilling.

2.6 Project Cost

The total cost of drilling one geothermal well up to a depth of 3000 m in 80 days is as tabulated in table 8.

Table 8: Cost of drilling one Geothermal Well

	Activity	Cost (USD)
A	Drilling Operations & Materials Costs	
1	Drilling materials	1,244,600.86
2	Transport and materials handling	30,311.00
3	Drilling operations	2,717,290.17
	Sub-total, USD	3,992,202.04
B	Infrastructure Costs	
3	Well pad preparation, road networks, water supply system	91,554.50
	Sub-total, USD	91,554.50
C	Reservoir Costs	
1	Well completion test	33,000.00
2	Heat-up Profiles	46,638.00
3	Well discharge test	66,019.00
	Sub-total, USD	145,657.00
D	Geology Costs	
1	Thin section preparation	1,170.00
2	XRD analysis	1,650.00
3	Use of binocular microscope	1,200.00
4	Petrographic microscope	520.00
	Sub-total, USD	4,540.00
E	Geochemistry Costs	
1	Analysis of drilling returns	5,925.00
2	Drilling Detergent	18,055.00
3	Water Sampling and Analysis	26,340.00
4	Gas Sampling and Analysis	10,545.00
	Sub-total, USD	60,865.00
	Total Cost per Well, USD	4,294,818.54

	Activity	Cost (USD)
	Total Cost per Well, KES (1 US= KES 129.15)	554,675,814.44

Total cost for 42 geothermal wells will be **KES. 23,296,384,206.48**. KenGen Plc will pay NEMA the upper capping of Five million Kenya shillings (**KES. 5,000,000**) as the EIA license fee.

2.7 Project Implementation Time Frame

Drilling of the proposed geothermal wells will be done to a target depth of 3,000 meters. This is expected to take approximately 80 days. Total project implementation timeline will therefore be 5 years when the 3 rigs are utilized.

2.8 Labour Requirements

The rigs operate on 4 constituted shifts of 34 staff per shift. Total personnel requirement for the three rigs will be 408 as shown in table 9.

Table 9: Shift Staff Constitution

DESIGNATION	NUMBER
Principal rig engineer	1
Principal electrical engineer	1
Principal mechanical engineer	1
Drilling engineer	1
Mechanical engineer	1
Electrical engineer	1
Principal technician Mechanical	1
Principal technician electrical	1
Principal technician operations	1

DESIGNATION	NUMBER
Shift supervisor	1
Shift OHS	1
Driller	1
Derrick man	1
Rig-floor man	4
Roustabout	2
Electrical technician	4
Mechanical Technician	4
welder	1
Geologist	1
Geo- technician	1
Directional engineer	1
Directional technician	3
Total per shift	34
Total number for 4 shifts	136
Total number for 3 rigs	408

2.9 DECOMMISSIONING

A geothermal well may be abandoned for one or more of the following reasons (African Union, 2016):

- a. Resource management, including reduction of draw-off and flow between different sections of a reservoir;
- b. The well has reached the end of its useful life;
- c. Well components have failed or deteriorated in a manner that renders the well potentially unsafe or not economically repairable.

Geothermal well decommissioning is necessary for several reasons. Firstly, decommissioning allows for the removal of the permanent wellhead assembly and retiring the well safely. Secondly, decommissioning is essential for environmental reasons. It ensures that the site is properly restored, minimizing any negative environmental effects. Lastly, decommissioning is necessary to comply with statutory requirements including ESIA license conditions. Pursuant to section 186 (1) of the Energy Act 2019, at the conclusion of activities under this Act, every person shall be required to remove all infrastructure they may have brought to the land for purposes of his or her operations, rehabilitate the land and carry out any other action that may be prescribed. Section 186 (2) provides that all decommissioning activities undertaken pursuant to subsection (1) must meet such good practices as may be prescribed by the Cabinet Secretary in regulations.

The process of geothermal well decommissioning typically involves several key steps as follows:

- i. The well is vented via the venting station to allow for disconnection of the steam pipeline.
- ii. The well is quenched until the pressure drops to zero. The well is allowed to flow under gravity for at least seventy-two hours to allow the well not to come alive during the cementing period.
- iii. Cement is made into a slurry and pumped into the wellbore until it is completely plugged.
- iv. The permanent well head assembly is then removed and disposed of as scrap metal or reused in another geothermal well.
- v. Backfilling of the open cellar and brine pond as appropriate.
- vi. Clean-up of the well pad site and removal of the waste for appropriate disposal.

- vii. Restoration of the well pad to its natural state in case there aren't any other wells on the same well pad.

KenGen will be required to submit a decommissioning plan to NEMA for review and approval prior to decommissioning the proposed geothermal wells. A detailed Job Safety Analysis (JSA) shall be undertaken in line with the established Occupational Health and Safety Management System. Permit to work system shall be used to promote health and safety of workers undertaking decommissioning works. Records of waste disposal including dully filled tracking sheets shall be maintained.

3 BASELINE INFORMATION

3.1 Bio-physical Environment of the Project Area

3.1.1 Location

The proposed project will be located on land IR 105419/1 (LR NO.12881/5), within Hell's Gate National Park. The site comprises 7 pieces of distinct pieces of land measuring approximately 1580.29 acres (639.52 Ha) leased from KWS. The site location map is in appendix 7 while extract of the lease agreement is in appendix 2. The acreage and GPS coordinates for each site are provided in table 10.

Table 10: Details of the Project Sites

Leased Area/Site	Acreage	GPS Coordinates Taken at the Centre	
		Eastings	Northings
Area III	184.59	195436.301	9903389.191
Area IV	1371.44	197513.401	9901880.142
905A	1.58	202793.167	9901239.663
905B	0.81	202537.517	9901209.706
734	7.45	201690.258	9905602.076
919	9.31	204814.143	9901448.204
738	5.31	202333.295	9904456.972

The lease period is fifty (50) years from 16th November 2022, when the sub-lease agreement was signed. Administratively, the sites are located within Olkaria location, Naivasha Sub County in Nakuru County. The County is divided into eleven administrative Sub-Counties namely; Naivasha, Nakuru East, Nakuru West, Molo, Njoro, Kuresoi North, Kuresoi South, Rongai, Bahati, Subukia and Gilgil. Naivasha Sub-County has eight political units (wards) i.e. Biashara, Maiella,

Viwandani, Maai Mahiu, Hells' Gate, Naivasha East, Lakeview and Olkaria wards. Geothermal energy resource is potentially concentrated in Olkaria ward. This is located approximately 125 km to the north west of Nairobi and about 40 km south of Naivasha Town. Areas IV borders Narasha and Olomayiana Kubwa villages which are inhabited by the Maasai community whereas area III lies between Orpower 4 Inc geothermal power project and Oserian Flower Farm. There are no villages bordering sites 905A, 905B, 734, 919 and 738.

3.1.2 Geology of Olkaria Geothermal Field

Olkaria Geothermal Field is a high temperature geothermal system. The system is characterized by Quaternary volcanic centres in the central Kenya Rift Valley. The geology is characterized by alkali rhyolite (comendite) lava and pyroclastic rocks on the surface, and basalts, trachyte and tuffs in the sub-surface (Girma et al. 2001). The surface geology of Olkaria geothermal field is dominated by pyroclastic type of volcanic rocks that comprises of volcanic ashes, volcanoclastic sediments, pumiceous clasts, lithic fragment and lava such as the Olol butot comenditic lavas. These volcanic materials have undergone hydrothermal alteration, oxidation and weathering to yield superficial deposit products such as clays. The clays are enriched with silica and iron-oxides that makes them reddish brown in colour. The superficial deposits are generally loose and unconsolidated hence easily eroded by action of water or wind. As a result, numerous gully and erosional surfaces dominate the area.

During drilling, the rock cuttings that are brought to the surface are daily logged as a function of depth by the Rig site geologist. The Rig geologist then analyses the rock types to identify the lithology with depth among other important parameters that assist to understand the characteristic of the geothermal system. The lithostratigraphy of Olkaria has therefore been found to be comprised of six main groups namely; Proterozoic 'basement' formations, Pre-Mau Volcanic, Mau tuffs, Plateau trachyte, Olkaria Basalts and Upper Olkaria Volcanic (Omenda, 2000, Lagat 2004). Table 10 shows the generalised stratigraphic sequence with depth from the surface to the basement.

Table 11: Generalized Stratigraphic Sequence with Depth from the Subsurface to the Basement

Formation Name	Lithology	Thickness (M)	Characteristic
Upper Olkaria	Comendite Lavas and their pyroclastic equivalents, ashes, minor basalts	0-500 m	Superficial

Formation Name	Lithology	Thickness (M)	Characteristic
	Thomson et al., 1963, Clarke et al., 1990, Omenda, 1998a)		
Olkaria Basalt	Basalt flow, minor pyroclastic and trachyte (Haukwa, 1986, Ambusso and Ouma, 1991, Omenda 1998a)	100-500	Cap-rock
Plateau	Trachyte with minor basalts, tuffs and rhyolites (Odongo 1986, Omenda 1994, 1998a)	1000-2600	Reservoir
Mau Tuffs	Consolidated ignimbrites (Omenda 1994, 1998a)	>2600	Reservoir
Pre Mau	Trachyte, basalts, ignimbrites	unknown	Reservoir
Proterozoic	Gneisses, schists, marbles and quartzite (Shackleton, 1986, Mosley, 1993, Smith and Mosley, 1993, Simiyu et al., 1995, 1996)	5000-6000	Basement

3.1.3 Topography

The topography of the proposed project area represents a hilly region. The terrain is marked by significant elevation changes, with altitudes ranging from 2080 meters to as high as 2411 meters. These elevation differences create a rugged topography, where hills and valleys define much of the terrain. High points such as the 2411 m peak, along with other elevations like 2308 m and 2257 m, dominate the landscape, while lower regions, around 2080-2111 m, provide a more gradual terrain. Roads such as Oserian Road and Gorge Road cut through this varied terrain, connecting geothermal wells and facilitating access across the area. The Moi South Lake Road serves as a main thoroughfare, linking this region to nearby areas.

The landscape is also part of a broader geothermal energy hub. Numerous geothermal wells, such as OW-919 and OW-905, are scattered throughout the region, reflecting significant geothermal resource development. The presence of Hell's Gate National Park adds a unique dimension to this area, blending industrial activity with natural beauty. The park, known for its dramatic cliffs, gorges, and geothermal activity, plays an important role in this geothermal

hotspot. The proximity of this national park highlights the coexistence of natural landscapes and energy extraction in this geothermal region.

3.1.4 Soils and Vegetation Chemistry

The soils are of volcanic origin, mainly of mixed assemblage of acid and basic lavas. Superficial soils occur in the fault troughs of the grid-faulted area. The soils in Lake Naivasha are very porous resulting in the aridity of the land. Sombroek et al. (1982) on basing his classification on soil texture has divided these soils into osols, cambisols, planosols and phaezeoms.

The soil support vegetation such as grasses and herbs that serve as feed for wildlife within the park. Ten (10) samples of soils and vegetation were collected from the project sites as shown in figure 8 (Refer to appendix 8). Vegetation cover within the proposed area is almost similar indicating less changes in soil chemistry.

The baseline soil and vegetation chemistry results for the proposed project sites are as shown in tables 12 and 13. Lab certificates are in appendix 9.

Table 12: Soil Chemistry Results

Project Site	pH	F	SO ₄ ²⁻	Cr	Cu	Zn	Ca	Fe	Cd	Pb	Hg	Se	B
OW 905A	6.98	2.01	29	<0.01	<0.01	91.00	788.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AW 905B	7.08	<0.01	11.5	<0.01	<0.01	117.00	1209.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 919	9.62	1.97	25.00	<0.01	<0.01	113.00	961.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 738	7.03	<0.01	30.00	<0.01	<0.01	94.00	767.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 734	6.25	1.32	22.00	<0.01	<0.01	144.00	440.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4 200N	5.78	<0.01	13.50	<0.01	<0.01	61.00	288.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4 1000W	6.52	<0.01	14.00	<0.01	<0.01	120.00	1674.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4-1000N	6.58	0.97	31.00	<0.01	<0.01	101.00	571.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4E 1000M	6.28	0.89	14.00	<0.01	<0.01	103.00	663.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A3(2)	7.00	<0.01	11.00	<0.01	<0.01	106.00	663.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A3(1)	6.50	5.46	26.00	<0.01	<0.01	116.00	543.00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Source: Laboratory Test Results in Appendix 9

Table 13: Vegetation Chemistry Results

Project Site	pH	F	SO ₄ ²⁻	Cr	Cu	Zn	Ca	Fe	Cd	Pb	Hg	Se	B
OW905A	6.21	0.9	8	<0.01	<0.01	75	2815	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 905B	5.23	<0.01	21	<0.01	<0.01	21	965	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 919	5.23	1.1	28	<0.01	<0.01	68	1685	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 738	6.44	<0.01	12	<0.01	<0.01	77	2725	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
OW 734	5.22	1.1	16	<0.01	<0.01	111	2225	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4 200N	6.13	<0.01	12	<0.01	<0.01	122	2885	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4 1000W	5.73	<0.01	9	<0.01	<0.01	51	3305	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A4 1000N	6.49	<0.01	19.8	<0.01	<0.01	79	3295	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Project Site	pH	F	SO ₄ ²⁻	Cr	Cu	Zn	Ca	Fe	Cd	Pb	Hg	Se	B
A4E 1000M	5.61	2.1	20	<0.01	<0.01	106	1130	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A3/2	6.04	1.7	41	<0.01	<0.01	29	2405	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
A3(1)	5.63	2.2	39.5	<0.01	<0.01	49	2745	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Source: Laboratory Test Results in Appendix 9

The results shown in table 12 and 13 indicates that the concentration of toxic heavy metals, including mercury, chromium, cadmium, lead, selenium and boron were below 0.01 mg/kg. There is hence no risk of bioaccumulation along the food chain when animals browse or graze on the vegetation.

3.1.5 Climate

The project area exhibits a semi-arid type of climate. The Olkaria domes area is located at the floor of the Rift Valley and hence experiences higher temperatures than the adjacent highlands. Naivasha sub-county lies 1,829 m above sea level. The daily recorded minimum temperatures range from 11.4 °C to 16.6 °C whereas the maximum temperatures range from 25.4 °C to 35.5 °C. The average temperature for the project area is 18.4 °C. February is the warmest month, and June/July the coolest. Night time temperatures are occasionally frosty, and mid-afternoon temperatures very hot. Winds are generally South-easterly, except in February to April, when they tend to have a noticeable North-easterly component.

Relative humidity averages 69.6%. Rainfall in the proposed project area is generally low, recording an average of 634 mm. The monthly distribution of rainfall is mainly governed by the movement of Inter-Tropical Convergence Zone (ITCZ). This results in a bimodal pattern of rainfall distribution with long rains occurring in March, April and May while the short rains are received in the months of October, November and December.

3.1.6 Wind Flow

Data collected in Olkaria by KenGen at X-2 using an automatic weather station and manual rain gauges for rainfall has been analysed. The predominant wind direction at Olkaria II over the year is from the South. This is followed by south easterly and westerly winds. The maximum wind speed is ~7.0 m/s. For the Dec-Jan-Feb season, light winds from the west prevailed whereas for Mar-Apr-May and Jun-Jul-Aug seasons, southerlies dominated. Winds blowing from the South and South-East dominated in the Sept-Oct-Nov season. A summary of wind speed, wind direction & frequency over Olkaria is illustrated in figure 9.

Annual and seasonal windroses for Olkaria (UTM Coordinates 198262 mE and 9904950 mN)

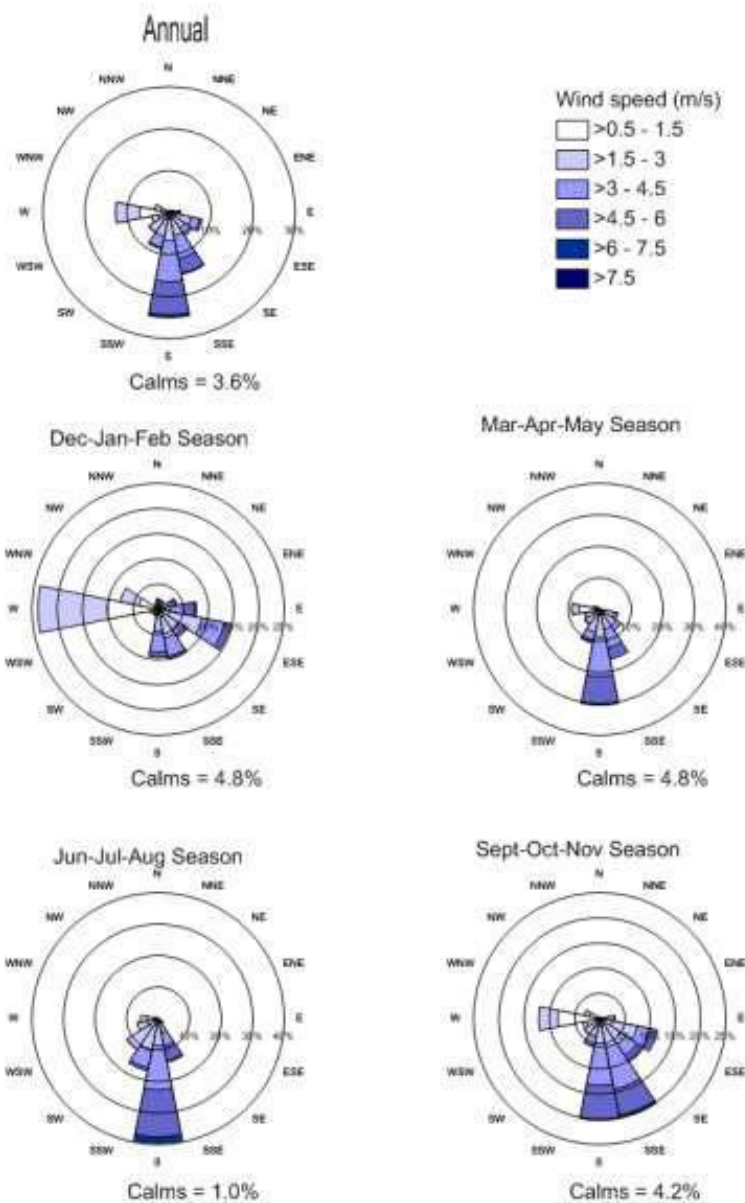


Figure 9: A summary of wind speed, wind direction & frequency at Olkaria (X-2)

3.1.7 Lake Naivasha

Lake Naivasha is the main source of water for geothermal drilling at Olkaria. Lakes can be classified according to their ground water regime as recharge (source), discharge (sink) or flow through. Lake Naivasha is typically a source lake. It does not receive ground water from any other source. As a closed basin lake, Naivasha owes its freshness to underground outflows

estimated at about 50 million cubic meter (MCM) according to many studies. Source lakes discharge water into ground and are often fresh in nature. Southerly flow towards Lake Magadi is exclusively through a deep regional aquifer system while northerly flow towards Elementaita and Nakuru extends towards Lake Baringo through a deep aquifer as well (Wakhungu, 2017).

Inflow into Lake Naivasha is strictly from precipitation and recharge zones within its catchment. The flow towards the lake is from the Mau Escarpment and Kinangop Plateau representing the lateral flow. The bulk of lateral flow from Lake Naivasha is to the South via the Olkaria and Suswa volcanic complexes and North and Northwest towards lakes Elementaita and Nakuru. The Northward flow from Lake Naivasha flows towards and via Eburru hills and Elementaita lake basin (Wakhungu, 2017).

Levels of Lake Naivasha

The long term recorded lake levels are shown in figure 10 while the monthly levels from September 2022 to September 2024 are shown in figure 11.

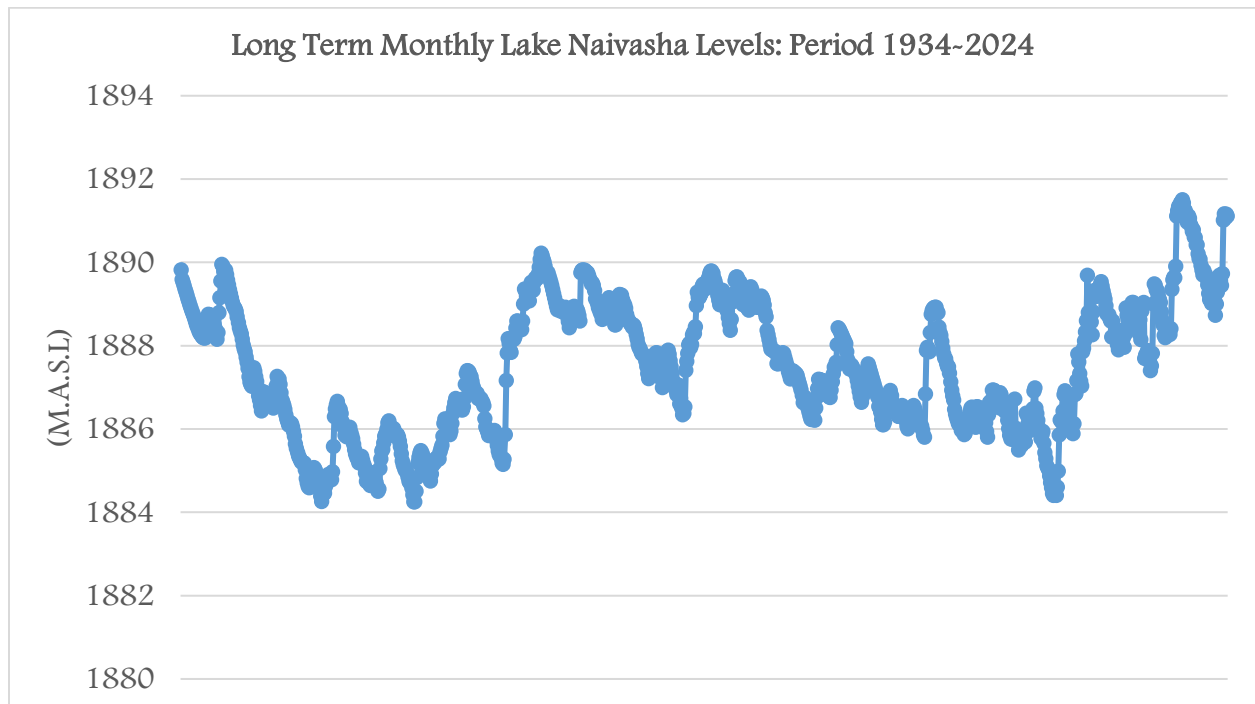


Figure 10: Long term Lake Naivasha water level variations from 1934 to September 2024

From figure 10, the highest recorded lake level was 1891.161 Masl in June 2024 whereas the lowest was about 1884.25 masl in January and February 1954.

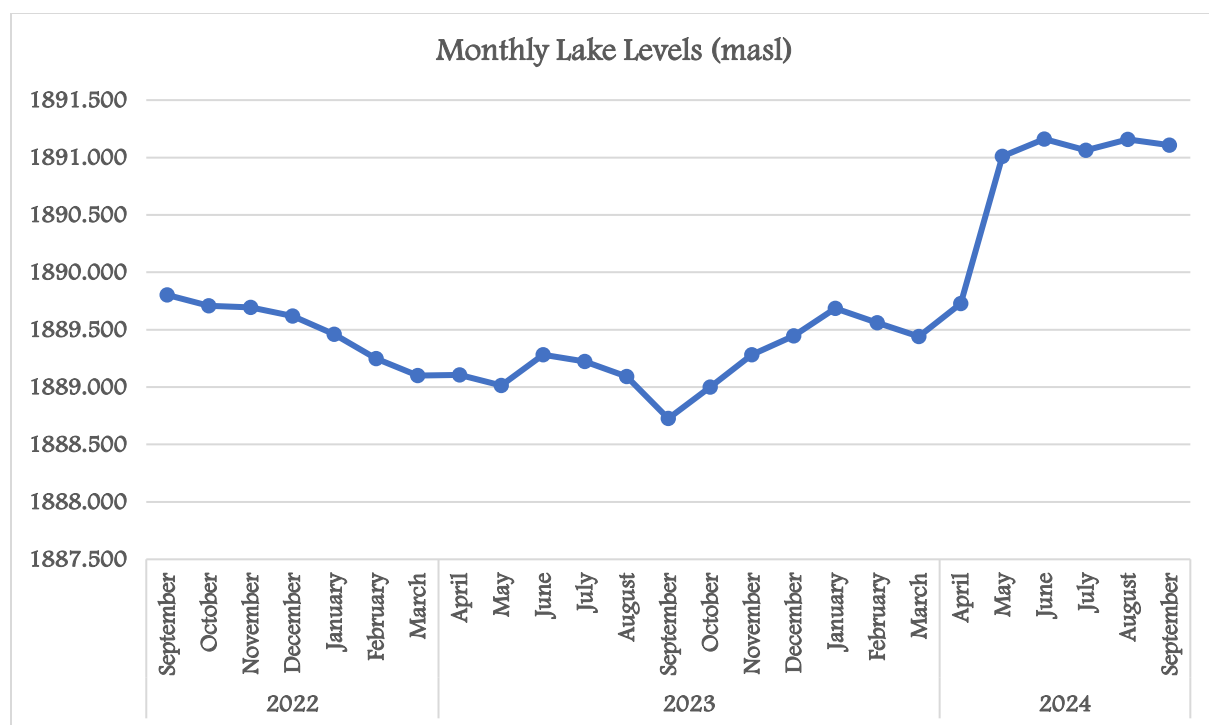


Figure 11: Lake Naivasha water level variations from September, 2022 to September, 2024

The results indicate that the lake level has been rising from September 2023 to September 2024 as opposed to the period September 2022 and September 2023 where a downward trend was observed.

Lake Naivasha Water Quality

The results of Lake Naivasha water quality are presented in table 14.

Table 14: Physicochemical Analysis Results for Lake Naivasha Water

Parameter	Oserian Jetty (mg/L)	NEMA Standard for Sources of Domestic Water (mg/L)
Copper	<0.01	0.05
Arsenic	<0.01	0.01
Selenium	<0.01	0.01
Cadmium	<0.01	0.01
Lead	<0.01	0.05
pH	7.96	6.5-8.5
Fluoride	1.21	1.5
Phenols	<0.01	Nil
Alkyl Benzyl Sulphonates	<0.01	0.5

Parameter	Oserian Jetty (mg/L)	NEMA Standard for Sources of Domestic Water (mg/L)
Total Dissolved Solids	181.12	1200
Total Suspended Solids	5	30
Nitrates	10.33	10
Zinc	<0.01	1.5
Nitrite	<0.01	3
Ammonia	<0.01	0.5
<i>E. coli</i>	10	Nil/100 ml

The physicochemical results for Lake Naivasha water indicate that all the parameters analysed except E.coli and nitrates, were within the maximum recommended limits for sources of domestic water.

3.2 Socio-Economic Environment

3.2.1 Population Distribution Demography

According to the population and housing census conducted in 2019, the population size of Naivasha sub-county was 355,383 comprising of 179,222 male, 179,613 female and 29 intersex. The population density was 210.9 persons per km², at an area of 1,685.8km², with each household having an average of 4.2 persons (*KNBS 2019*).

3.2.2 The population Characteristics of the Project area

The population profile of the sub locations within Hell's Gate location is shown in table 15.

Table 15: Population Profile of Hell's Gate Location in 2019

No	Sub-location	Male	Female	Total Population (2019)	Households (HH)	Area (km ²)	Density
1.	Maiella	4,416	4,804	9,220	2,124	41.9	220
2.	Hells' Gate	43,105	42,002	85,110	29,626	424.9	200

No	Sub-location	Male	Female	Total Population (2019)	Households (HH)	Area (km ²)	Density
3.	Moi Ndabi	3,081	2,889	5,970	1,748	32.6	183
4.	Olkaria	12,195	11,712	23,909	8,745	273.2	88
5.	Malewa	5,853	5,442	11,296	3,993	128.7	88
6.	Kongoni	2,234	2,271	4,505	1,377	57.7	78
7.	Ndabibi	5,099	4,865	9,964	2,846	157.5	63

Source: KNBS, 2019

Hell's Gate location was split to form Olkaria location whose population is shown in table 16.

Table 16: Population of Olkaria Location

No.	Village	Approx. Population
1.	Kamere	23,000
2.	Oserian	9,000
3.	Kwa Muhia	4,000
4.	Rift Camp	3,692
5.	Kasarani	3,308
6.	Majengo	704
7.	YMCA	548
8.	DCK	350
9.	Oldonyo	220
10.	Amunga-Osotua	160
11.	Kimwatu	108
	Total	45,090

Source: Data from Chief Olkaria Location Office June, 2023

The population of Olkaria Location consists of Maasai and other communities residing in the urban areas of the project area. The population of the area has been increasing steadily due to

migration of people in the project's area of influence. This has resulted in the creation of relatively new settlements including Kasarani, Karagita, DCK, Kongoni, Kamere and Kwa Muhia. These settlements are cosmopolitan since they are inhabited by almost all ethnic groups from different parts of Country. Casual labour at KenGen Plc, Orpower 4 as well as the horticultural farms along the lake source is sourced from these settlements. Fishing in Lake Naivasha support a large part of the population.

The proposed project sites closely neighbour Olomaiyana Kubwa to the south of the gate, Rapland to the southeast of Olkaria KWS gate, and Kamere Market nearly 4km north on a straight line. The primary stakeholders that might be impacted include KenGen Housing Estate residents, KWS and the PAPs who were resettled at Rapland in August 2014, Narasha, Olomaiyana Kubwa, Kamere, Oldonyo Kedong, Orpower 4, KPLC and Oserian flower farm.

3.2.3 Income Sources

Naivasha town serves as the main business hub in the region. Over the past 10 to 15 years, several small businesses and trading centres have emerged along Moi South Lake Road due to the growth of horticultural farming. These businesses include small retail shops, food canteens, vegetable stalls, and chemists, catering to the daily needs of the flower farm workers and other low-income earners. Public transport options, such as "Matatus" And "Bodabodas," have also expanded in the area, which previously relied mostly on institutional transport. However, residents still prefer to travel to Naivasha town for major shopping.

Naivasha is rapidly becoming a cosmopolitan destination, serving as a gateway to major tourist attractions like Lake Naivasha, Hell's Gate, and Longonot National Parks. In addition to tourism, geothermal energy exploitation and horticulture, particularly flower farming, are key economic activities in the area. Some of the best rose flowers sold in European markets come from Naivasha's flower farms, such as Oserian, Home grown, and Nini. Nearby market centres that provide labour include Kamere, Kongoni, Karagita, Ndabibi, Maiella, and Suswa.

The local Maasai community operate a cultural centre that showcases the cultural history of a Maasai family to tourists visiting the park. Community members also sell cultural artefacts, such as necklaces, bracelets, "shukas," and Maasai headgear. Livestock trading is also prominent, with local markets operating on specific days, such as Inkorienito on Tuesdays and Suswa market on Wednesdays.

3.2.4 Land Use and Local Economy

The main land uses in the project area of influence include wildlife conservation, ecotourism, Maasai settlement and geothermal resource development. According to the Hell's Gate-Mt. Longonot Ecosystem Management Plan (2010-2015), a total of 1556.03 acres (area III and IV) of the leased project site falls within High Use Zone -Geothermal, where geothermal exploitation is allowed. The Olkaria geothermal projects are distinctive developments within a national park, carefully balancing the preservation of the delicate ecosystem with the construction of power generation facilities. The four conventional power plants owned by KenGen, along with the only geothermal spa in Africa, also attract tourists from both local and international markets. Figure 12 shows the number of local and international tourists who visited Olkaria Geothermal Power Plants and Spa between January and August 2024.

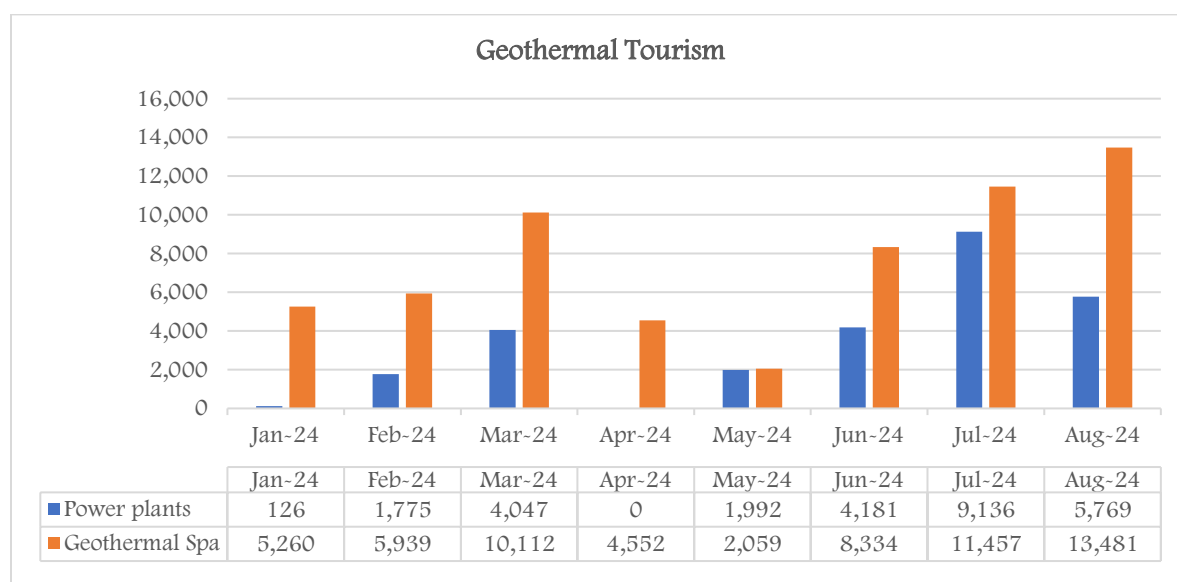


Figure 12: The number of Tourists who visited geothermal power plants and Spa at Olkaria

Pastoralism, primarily involving cattle, sheep, goats, and donkeys, is the dominant land use activity practised by the Maasai community in the neighbourhood of the project sites. Other land use activities include ranching, horticultural farming, tourism, wildlife conservation, human settlements, and infrastructure development.

Farming is practiced in both the highland areas, such as Suswa and Maiella, and the lowland areas of Naivasha, with maize, beans, and potatoes being the main crops cultivated. The Olkaria geothermal field is gazetted for geothermal exploration, and several licensed companies,

including KenGen, Akiira, and Orpower 4, are engaged in commercial steam exploration and development in the region.

3.2.5 Water and Sanitation

The primary source of domestic water for residents in Naivasha Sub County is borehole water. Community members either own private boreholes or obtain their water from Naivasha Water and Sanitation Services, which also relies on boreholes. The second most common water source is Lake Naivasha, used by communities living near its shores. The Lake's water is managed by Water Resources Users Associations. The water resources in the project area of influence falls under the jurisdiction of the Lake Naivasha Water Resource Users Association (LANAWRUA), which is responsible for regulating water abstraction for both private and commercial purposes.

Drilling of water boreholes in Olkaria presents challenges related to sustainability, primarily due to the potential for encountering geothermal steam rather than freshwater. Olkaria is situated within a geothermal field where high subsurface temperatures can lead to the emission of steam during drilling operations. Steam is harvested from geothermal fumaroles and condensed for wild animals at KWS Olkaria Gate.

The main categories of people and businesses reliant on Lake Naivasha include:

- i. Flower farms
- ii. Geothermal development and electricity generation companies
- iii. Tourism-related businesses such as hotels that use significant amounts of water
- iv. Small-scale users like fishermen
- v. Domestic water users

Disposal of domestic sewage around Olkaria is through pit latrines and septic tanks since there is no public sewerage system in the area. The septic tanks at Olkaria facilities are emptied using NEMA licensed sewage exhausters and transported for disposal at the Naivasha sewerage treatment plant. Illegal dumpsites presents the risk of contaminating the water in Lake Naivasha. Solid waste from KenGen installations is collected and transported by NEMA licensed transporters and disposed of at Kayole dumping site which is the approved designated site that serves Naivasha Sub County.

3.2.6 Education Profile

Naivasha Sub-County has a well-established network of educational facilities, with a fairly balanced distribution of primary and secondary schools. There are 72 public primary schools, serving approximately 47,414 children, with nearly equal enrolment of boys and girls. The location of schools within the sub-county largely reflects population density, with schools in more populated areas being crowded, while those in less populated areas tend to have fewer students.

In the project area, several public and private primary schools are present, including Olkaria, Narasha and Mvuke Primary Schools, both closely connected to the community near the project site. There are two Early Childhood Development Education (ECDE) centres, one in Olomayiana Kubwa and another in Kambi Turkana. Mvuke Primary School, sponsored by KenGen, is particularly significant to the local community, boasting the largest enrolment of 1,091 pupils, with 544 girls and 547 boys. The recent introduction of the new Competency-Based Curriculum (CBC) has included a Junior Secondary School (JSS) program, which places additional demands on school resources to accommodate the growing student population.

There are three public secondary schools in close proximity to the project area and surroundings i.e.:

- St. Antony Girls Secondary School located at Kwa Muhia.
- Moi -Ndabi Secondary School in Maiella ward and
- Mirera Secondary School in Karagita with the highest student population in the entire sub-county of 975.

The privately-owned secondary schools within the project area are Sher Moi Academy and Oserian Secondary School which have student population of 187 & 160 respectively. As part of its Corporate Social Responsibility (CSR) initiative launched in 2005, KenGen has consistently extended its scholarship opportunities to the needy and bright students from the neighbouring community in both secondary and University education with 3 slots per category annually. Table 17 shows school enrolment in Naivasha Sub County.

Table 17: Naivasha Educational Zonal Statistics

Sub-county Education Zones	Public Primary & Secondary schools	Student Enrolment		Total Student Enrolment
		Boys	Girls	
Central Zone	15	8,038	7,111	15,149
Longonot zone	16	3,455	3,385	6,840
Maraigushu zone	20	4,611	4,436	9,692
Maiella Zone	21	7,964	7,769	15,733
TOTAL	72	24,068	22,701	47,414

Source: JICA West JEC, 2023 confirm reference

3.2.7 Employment and Economic Activities

Most employment opportunities in the project area are provided by the large-scale flower and horticulture farms around Lake Naivasha. KenGen and other power producers including Oserian Development Company Limited and Orpower 4 engage casual labour force during the construction of the geothermal power plants. These power generating companies also employ security guards and cleaners from the local community to provide security and cleaning services. The hotel and tourism industry, ranching, fisheries, conservation, and business sectors absorb the rest of labour force in the project area.

The Maasai community is predominantly engaged in pastoralism. These activities provide primary revenue streams derived from the sale of livestock and related products including meat and dairy. In addition, the Maasai Cultural Centre plays a pivotal role in generating community income through the collection of entrance fees and the sale of culturally significant items.

3.2.8 Health Profile

Naivasha Sub County has a total of 62 health facilities run by various health providers who include the government, NGOs, FBOs and private institutions. The project area is served by five

health facilities including Mvuke dispensary which is owned by KenGen, RAPland dispensary built for the PAPs by KenGen, Sher hospital, Home Grown Hospital and Oserian Dispensary. The Naivasha Sub County Level 4 Hospital in Naivasha town serves as the nearest Referral Hospital for region. A section of the local residents would prefer going to the Sub-county hospital which is about 43 km away. The main reason being that they are assured of getting better medical treatment than what they would have got at the local private and government centres.

According to the data available with the Public Health Officer Naivasha Sub – County, the most prevalent diseases within Naivasha area are ranked as follows; upper respiratory diseases, skin infections, water borne diseases such as typhoid and Malaria in mild levels. Physical injuries, HIV/AIDS and tuberculosis due to poor housing conditions. At the Rap Land health dispensary in the project area, the most common diseases for the under 5 children were tabulated as follows:

- i. Respiratory ailments (coughs, asthma, running nose);
- ii. Diarrhoea
- iii. Pneumonia
- iv. Skin diseases (fungi, scabies, wounds and cuts)
- v. Eye infections; and
- vi. Injuries (attributed to “*bodaboda*” accidents)

Diseases recorded for children over five years and adults at the RAP Land dispensary are listed as follows:

- i. Respiratory diseases (tuberculosis, coughing, running nose, asthma etc.));
- ii. Joint pains;
- iii. Skin diseases (wounds, cuts, bites, etc.);
- iv. Pneumonia,
- v. Eye infections;
- vi. Urinary tract infections (UTD);
- vii. Diarrhoea;
- viii. Sexually Transmitted Diseases (STD);
- ix. Injuries; and
- x. Dental diseases (mainly fluorosis).

Based on this analysis, the most prevalent diseases in the project area are respiratory diseases.

3.2.9 Energy Sources

In the larger Olkaria area, the primary source of energy for cooking is firewood. This is largely due to the fact that the project area, including Olkaria villages, is situated in rural parts of the country where firewood is easily accessible. Charcoal and firewood are the most commonly used energy sources for cooking and other household activities in most homes.

Table 18 provides an overview of the main energy sources and their various uses among communities living around the project area.

Table 18: Energy Mix in the Project Area

Source of energy	Use	Estimated percentage of the users
Firewood/Charcoal/Kerosene	Cooking	65
Electricity/LPG	Heating/Lighting/Cooking	32
DC batteries/Solar	Lighting/Charging electronic gadgets	3

Source: KenGen, ESIA report for Olkaria VII

A small percentage of households use a combination of more than one source of energy for either cooking, heating or lighting.

3.2.10 Infrastructure and Amenities

Within Hell's Gate National Park (HGNP) and KenGen land adjacent to the Park, the access roads are either tarmacked or gravelled to allow all-weather accessibility. Electrical power and water reticulation infrastructure have also been established to serve the various installations within the area. The road, power and water supply infrastructure extend from Oloomayiana Kubwa, Narasha, Iseneto, and Orpower 4 to RAP Land where the Maasai community that was resettled in 2015 currently reside. The projected increase in population and subsequent revenue growth due to the upcoming projects is also likely to enhance the development of social amenities such as power supply, water supply, public sewerage network and medical facilities in the project area of influence.

3.2.11 Cultural/Archaeological Sites

Hell's Gate National Park was added to UNESCO's tentative world heritage candidate list by the Kenyan Government in February 2010, under reference number 5511. This was due to its remarkable geological features, such as hot water geysers, hot springs, unique land formations, and ongoing geological processes. The park supports plant species adapted to high-temperature environments, making it a candidate for world heritage recognition.

Apart from HGNP, there are no officially registered national cultural or world heritage sites in the Olkaria area. However, the Hell's Gate-Mt. Longonot Ecosystem Management Plan (2010-2015), published by KWS, and identifies several key geological and cultural landmarks in the region, including Fischer's Tower, Central Tower, Jorowa Gorge, Obsidian Caves, Hell's Kitchen, Hobley's Volcano, The Crater, and Parasitic Cone.

Cultural resources of significance in the area include red ochre (altered clay) from Olkaria, traditionally used by Maasai Morans for their hair, and white soil from Narasha, used by elders during wedding ceremonies.

3.3 Ecosystem and Biodiversity

3.3.1 Hell's Gate National Park

The proposed drilling of 42 geothermal wells will be undertaken in Hell's Gate National Park on a land area subleased to KenGen by the Kenya Wildlife Service (KWS). The national park, covering 68.25 Km², was gazetted under legal notice number 13 of 2nd February 1984 to conserve unique biological and geomorphological features of national and international importance. The park is rich in biodiversity and it's characterized by unique physiographic features such as volcanic cliffs, Ol Njorowa Gorge, Volcanic plugs (Fischer's Tower and Central Tower), Hobley's Volcano and Olbutot Lava, Olkaria hill and hot springs. Moreover, Hell's Gate is one of its kind National Parks in the country where visitors are allowed to alight the vehicles to engage in wildlife viewing and picnic activities such as biking, rock climbing, and hiking in the gorge. Geothermal infrastructure such as power plants, geothermal wells and Spa offers a unique experience to the tourists who visit Hell's Gate National Park.

3.3.2 Ecological Assessment of the Proposed Project Sites

Several methods of ecological assessment were used. Land cover was assessed through analysis and interpretation of the Sentinel 2 world land cover map. Baseline habitat condition was assessed through field study of vegetation, wild animals and landscape. Field methods such as observation, photography, measurements and GPS recording were used to record the ecological condition. Secondary materials such as guidebooks, topographical base maps and reports were referenced. The findings of the assessments are presented below.

3.3.2.1 Land cover

As shown in the land cover map in figure 13, shrubs and grasslands predominantly colonized the study area. Bare areas are characterized by rock outcrops, lava flow and scattered vegetation. Built-up areas comprise sites occupied by anthropogenic activities such as geothermal infrastructure including well pads, roads, steam pipes, transmission line masts and power plants. There exists developments in the new sublease areas including geothermal wells OW-905B, OW-905A, OW-919C, OW-919B, OW-919A, OW-919, OW-919D, OW-39D, OW-39A, OW-39, OW-39B, OW-49C, OW-49, OW-52, OW-52A, OW-734A and wellhead 905, 39 & 919.

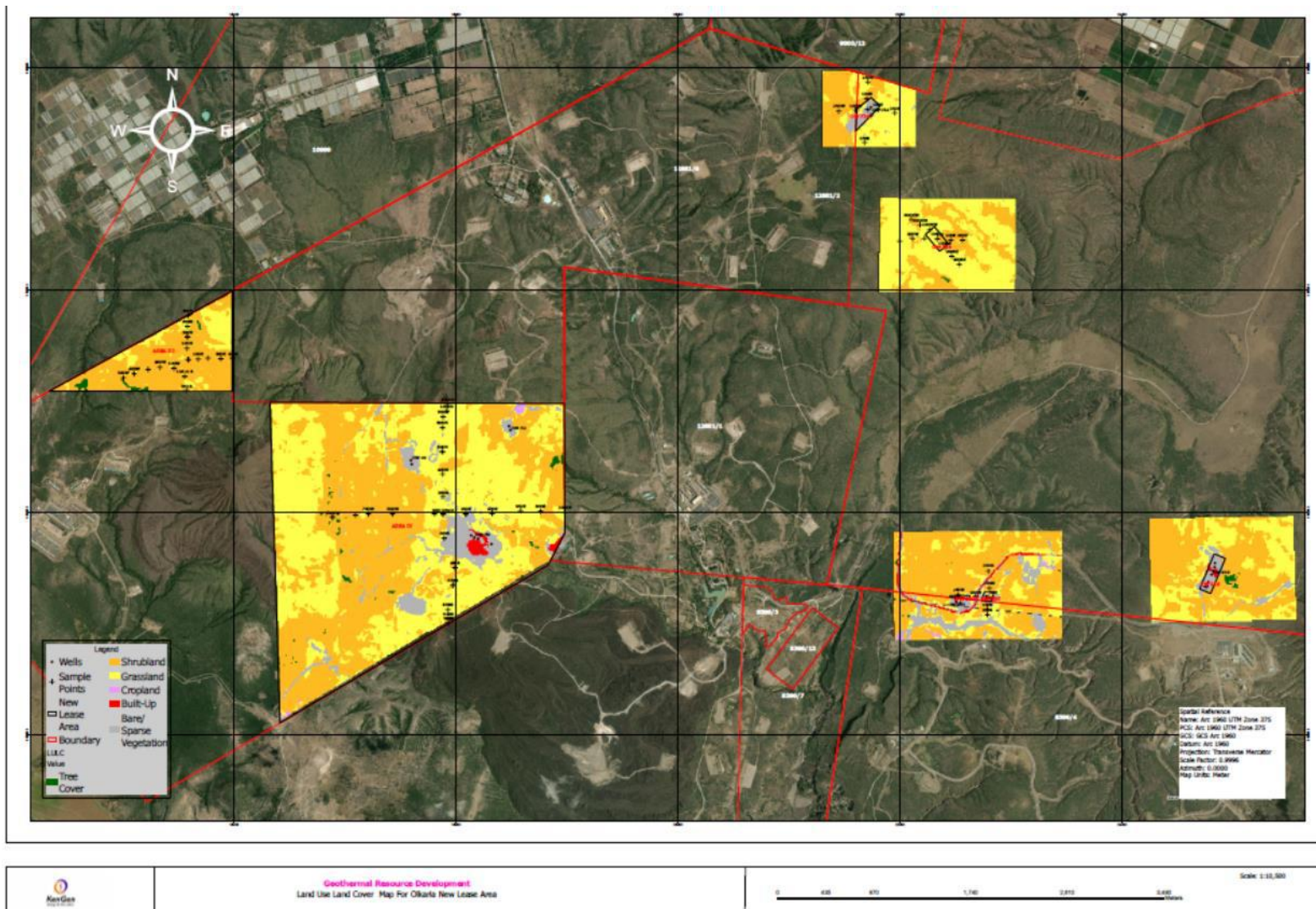


Figure 13: Sentinel 2 ESA 10m resolution land cover

3.3.2.2 Flora and Fauna Assessment

Data was collected and recorded along the transects of varying lengths relative to the extent of the study area (plot). The transects were undertaken on each of the four cardinal points of the compass (East, West, North and South). Biodiversity data, was collected using plots of 10m by 10m at a frequency of 100-200 m. The other habitat characteristics such as topography were collected along the transect. A handheld Global Positioning System (GPS) device was used for navigation to and from the centre point. The sampling methodology is illustrated by the topographical map in figure 14.

The habitat condition and natural and anthropogenic features were identified and described through visual observation. Direct sighting, animal tracks, herbivory, animal droppings, nests, burrows and spoor, were used to identify fauna. On the other hand, the flora was identified in the field and samples collected for further research through reference guidebooks. Photos of major features and species of flora and fauna were captured by the use of hand-held cameras. Vegetation composition was estimated based on ground percentage cover. Additionally, topography and signs of soil erosion were also observed.

Flora

The study area was characterized by an assemblage of plant species of different forms including trees, shrubs, scrubs, herbs, grasses, ferns and epiphytes. The plant species colonization varied largely depending on soil composition, topography, moisture, herbivory and anthropogenic activities. These anthropogenic activities include the clearing of vegetation, restoration of habitats and infrastructure development, livestock incursion, charcoal burning, bushfires and tourism. Human activities alter the natural composition of the ecosystems through the introduction of alien invasive species, erosion, fires, overgrazing, and overexploitation.

Vegetation assessments were undertaken at each of the areas including site (Area) 3, area 4, OW-738, OW-734, OW-905 and OW-919.

1. Area 3 Findings

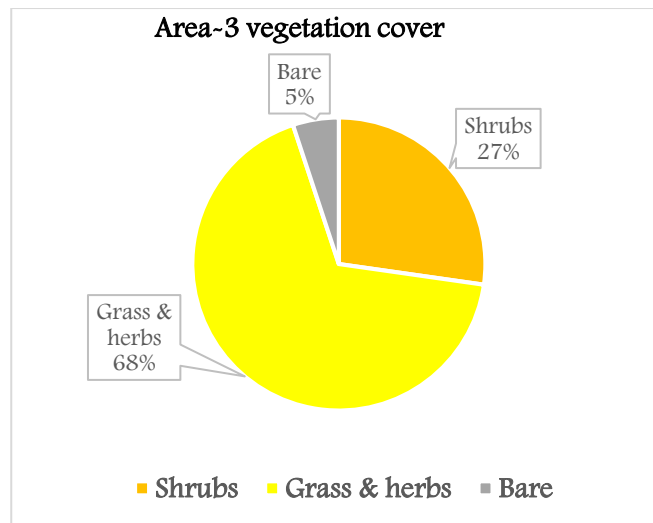


Figure 15: vegetation composition in area 3

Area 3 is characterised by natural vegetation that is barely altered by human activities. As shown in figure 15, the area is largely colonized by grasses and herbs (68%) such as *Cymbopogon citratus*, and *Fimbritylis exilis*, *Hyparrhenia hirta* and *Felicia muricata*. Trees and shrubs representing (27%) are dominated by *Tarchonanthus comporatus*, *Acacia drepanolobium* and *Erica aborea*. The area was rugged and characterized by gullies. Within the gully, specific unique species of plants such as *Pittosporam viridiflora* (Cape cheesewood), *Scadoxus multiflorus* (Blood lily) and *Cussonia holstii* (cabbage tree) were found. Invasive species included *Solanum incanum*, *Hypoestes forskalii* and *Conyza bonariensis*.

2. Area 4

The largest study site was area 4, which is colonized by grasses (26%) trees and Shrubs (16%) as shown in figure 16. The area was prominently bare (58%) due to existing geothermal activities such as well head 39 power plant, High voltage power evacuation lines, steam evacuation pipes, geothermal wells OW-39D, OW-39A, OW-39, OW-39B, OW-49C, OW-49 and OW-52. Moreover, the area is characterized by lava flow (Olbutot lava) and rock outcrops that are largely bare. *Fimbristylis exilis* (Geothermal grass) and *Cymbopogon citratus* (Lemon grass) are the dominant grass species. Geothermal grass is used as an indicator of geothermal resources underneath an area. Like in other areas, *Tarchonanthus comporatus* is the dominant shrub while *Rapanea melanophoes* represent a unique species of tree thriving in rocky areas. Other species found in the Lava flow and rocks includes *Ficus ingens*, *Dodonea viscosa*, *Erica aborea* and *Asparagus flagellaris* (lace fern). Exotic trees such as *Grevillea robusta* were also found to colonize the Olbutot lava flow. Invasive species include *Nicotiana glauca*, *Ricinus communis* and *Solanum incanum* which colonize gullies and disturbed bare areas such as roads and well pads.

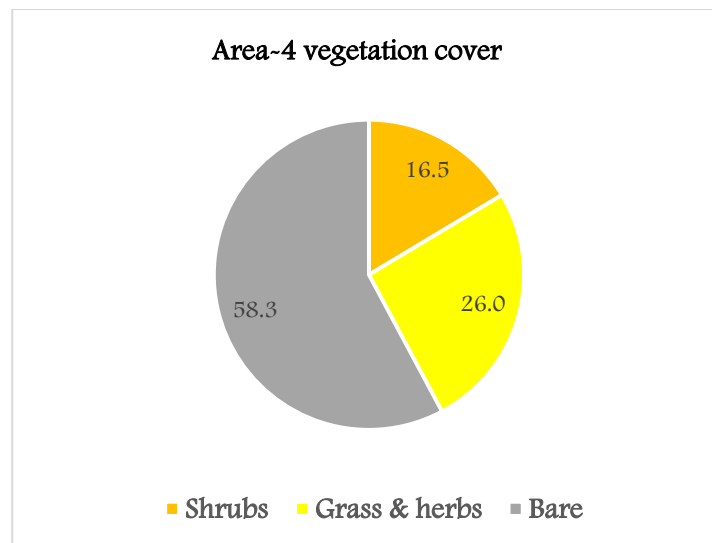


Figure 16: Vegetation composition in area 4

3. OW-738 & OW-734 Sites

Similar to area three, the area was characterized by natural vegetation with minimal anthropogenic interference as shown in figure 17 below. The area is rugged with steep slopes and gullies. The area drains into sensitive ecological areas such as the vulture cliff located southeast of the site. The vegetation cover is mainly grass and herbs (57%), trees and shrubs (21%). Steep slopes and ridges are largely bare (22%) and characterized by shallow, and highly

drained soils and rocks. The bare areas are due to nutrient-poor soils leading to slow primary succession by plant communities. Grasses included *Cymbopogon citratus*, geothermal grass, *Hyperhennea hirta* and *Digitaria fruginea*, *Elmus repens*. Herbs included *Chamaecrista fasciculata*, *Satureja montana*, *Euphorbia crotonoides*, *Linum tenuifolium*, *Lobelia holstii* and *Mimosa pudica*. Tree species include *Acacia drepanolobium*, *Rapanea melanophloeos* and *Cussonia holstii*. Shrubs included *Tarchonathus camphoratus*, *Dodonaea viscosa*, *Osyris lanceolata* and *Erica aborea*. Invasive species include *Nicotiana glauca*, *Hypoestes Foscaolii*, and *Conyza bonariensis* which were largely found at the waterways and gullies. *Osyris lanceolate* is listed as an endangered plant species under the Wildlife Conservation and Management Act of 2013.

Area OW-734 exhibit composition of natural vegetation similar to that of OW-738. Notably, the proportion of bare areas (33%) is higher than in OW-738 due to anthropogenic activities such as roads, well pads, geothermal wells (OW-734A), brine ponds, charcoal burning and livestock incursion. Trees and Shrubs comprise 39% while grasses and herbs cover 28%. Due to human activities, new species of plants have been introduced including *Pennisetum clandestinum*, *Pluchea dioscoridis*, *Sida tenuicarpa*, *Psiadia paniculata* and *Nicotiana glauca*. *Pennisetum clandestinum* is used in the rehabilitation of slopes while the others are invasive. Both sites OW-738 and OW-734 are located within the low use zone - conservation as per Hell's Gate and Mt. Longonot Ecosystem (HG-LE) Zonation scheme.

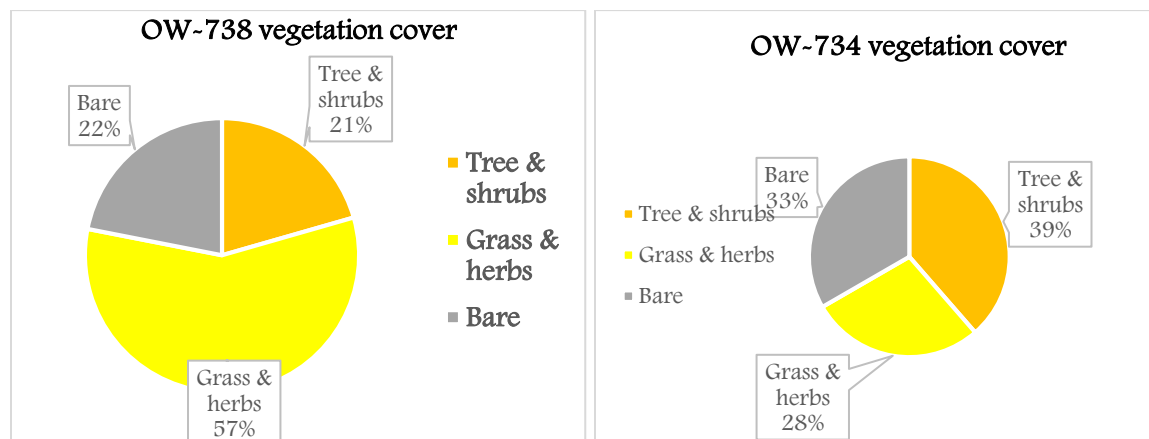


Figure 17: Vegetation Composition around OW 734 and 738

4. OW-905 & OW-919 Project Sites

OW-905 and OW-919 project sites are also located in the Low Use Zone (LUZ)-conservation as per the HG-LE zonation scheme. The two sites already have wells and the associated infrastructure including OW-905, OW-905B, OW-905A, OW-919C, OW-919B, OW-919A, OW-919, OW-919D. The two sites are dominated by grasses and herbs (59%). Trees and shrubs cover 26% while bare areas occupy 15% as shown in figure 18. The identified grasses and herbs include *Pennisetum clandestinum*, *Elmus repens*, *Sida tenuicarpa*, *Hypoestes foscaolii* and *Pluchea dioscoridis*. Trees and Shrubs include *Tarchonanthus camphoratus*, *Acacia xanthophloea*, *Olea Africana*, and Giant stinging nettle. *Viscum album* is a species of epiphyte that is parasitic on other shrubs such as Comphor bush. *Solanum incanum* and *Nicotiana glauca* are the dominant invasive plant species in this area.

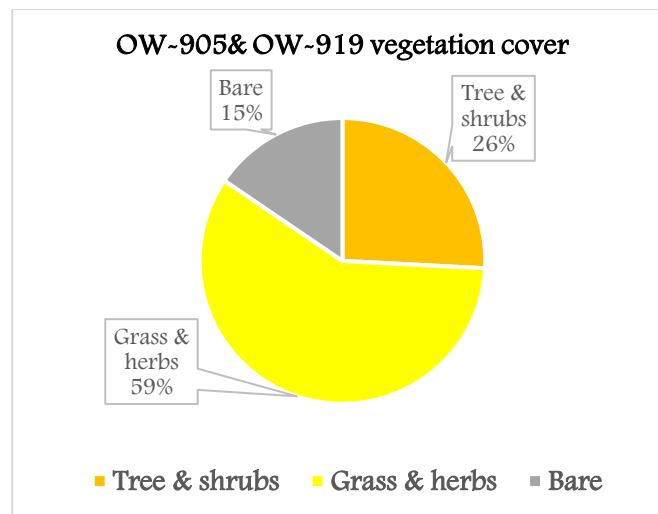


Figure 18: Vegetation Cover at Project Sites OW 905 & 919

3.3.2.3 Fauna Assessment

The proposed project sites are rich in biodiversity. In all areas assessed, wild animals were encountered. Several species of fauna were observed including mammals, birds, reptiles and insects shown in table 19. Due to minimal disturbance, majority of wildlife was observed in area 3 including Buffalos, Maasai giraffe, Eland, African hare, Zebras, dikdiks and Aardvark. Other species identified in isolated areas included hyenas in gullies and Klipspringers on rocks. Several species of birds were also sighted including sunbirds, starlings and weaver birds. Reptiles observed included blue-headed agama. Insects include dung beetles, butterflies and dragonflies.

Dragonflies, which are used as an indicator of a healthy ecosystem, was sighted at the water bodies.

Table 19: Fauna Observed at the Project Sites

No.	Common name	Scientific Name	Objective Evidence
1.	Spotted hyena	<i>Crocuta crocuta</i>	scat
2.	African buffalo	<i>Syncerus caffer</i>	Live sighted, tracks and scat
3.	Mountain Reedbuck	<i>Redunca arundinum</i>	Droppings
4.	Common Eland	<i>Taurotragus oryx</i> ,	Dropping
5.	Maasai Giraffe	<i>Giraffa camelopardalis masaicus</i>	Dropping
6.	Common Zebra	<i>Equus burchellii</i>	scat
7.	Impala	<i>Aepyceros melampus</i>	droppings
8.	Klipspringer	<i>Oreotragus oreotragus</i>	Dropping
9.	Aardvark	<i>Orycteropus afer</i>	Burrows
10.	African hare	<i>Lepus microtis</i>	Droppings
11.	Common warthog	<i>Phacochoerus africanus</i>	Burrows
Birds			
1.	Superb starling		sighting
2.	Weaver bird		sighting
3.	Sun bird		sighting
Insects			
1.	African dung beetle	<i>Neateuchus proboscideus</i>	sighting
2.	Desert locust	<i>Schistocerca gregaria</i>	sighting
3.	Dragon flies	<i>Anisoptera</i>	sighting
Reptiles			
1.	black-necked agama	<i>Acanthocercus atricollis</i>	sighting

3.3.3 Conservation Initiatives

3.3.3.1 Social afforestation

KenGen undertakes social afforestation programme at Olkaria and Eburru geothermal project areas with tree nurseries located at Olkaria X-2, Karagita, GK Naivasha prison and Eburru. For about 20 years, 2.9m seedlings have been issued to the public for planting as shown in figure 19.

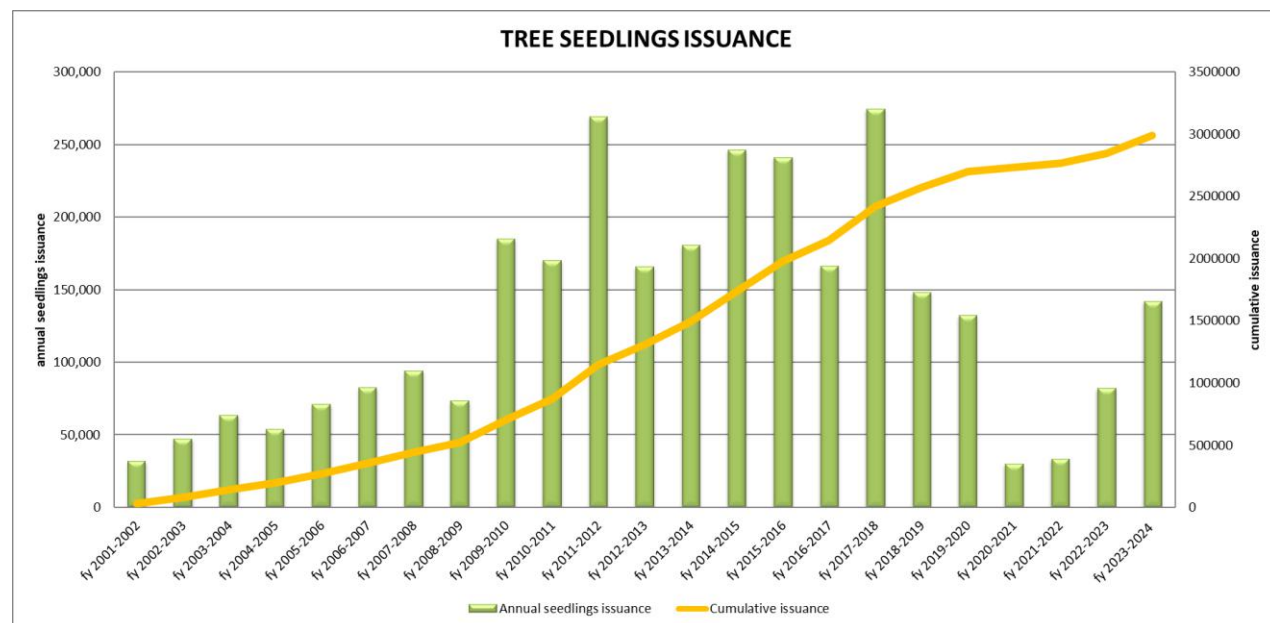


Figure 19: Tree Seedlings Issuance to the Public for Planting

In line with the government's target of achieving 30% of tree cover in Kenya by the year 2032, KenGen has also established woodlots shown in table 20.

Table 20: Woodlots Established by KenGen

Index	Location of Woodlot	Number of Seedlings Planted	Approx. area (Ha) at (2.5mx2.5m spacing)
1.	Olkaria	11,000	6.875
2.	Eburru	12,000	7.5
3.	Enoosupukia	20,000	12.5
	Total	43,000	26.875

3.4 Baseline Noise Conditions

3.4.1 Background Noise Levels

There is an existing proponent's in-house noise monitoring program in place for all workplaces in geothermal facilities and sensitive receptors at the environs of the establishment. Noise measurements were conducted at all sensitive receptors in the vicinity of the sub-lease area. The results are shown in the figure 20.

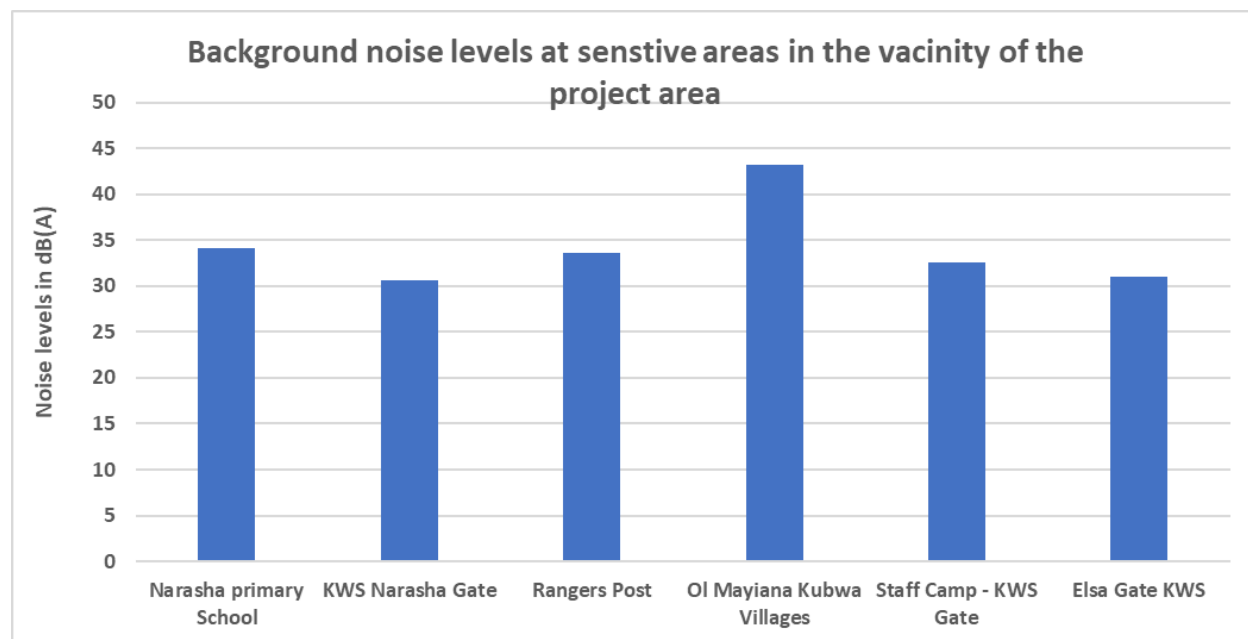


Figure 20: Background noise levels at sensitive receptors within the project area of influence

3.4.2 Noise Dispersion Modelling

Further to routine noise monitoring, and as a form of field planning during implementation of new geothermal power projects at Olkaria, noise dispersion modelling has been conducted to ensure nearest receptor points are not impacted by spread of noise. Noise dispersion modelling for all existing power plants and wellheads in Olkaria, with a total generation capacity of 799 MWe was conducted using SOUNDPLAN software. The nearest residential areas Narasha, Ol Mayiana Kubwa and Rapland were shown to exhibit noise levels below the maximum night-time recommended limit of 35 dB(A). Modelling results are shown in the figure 21.

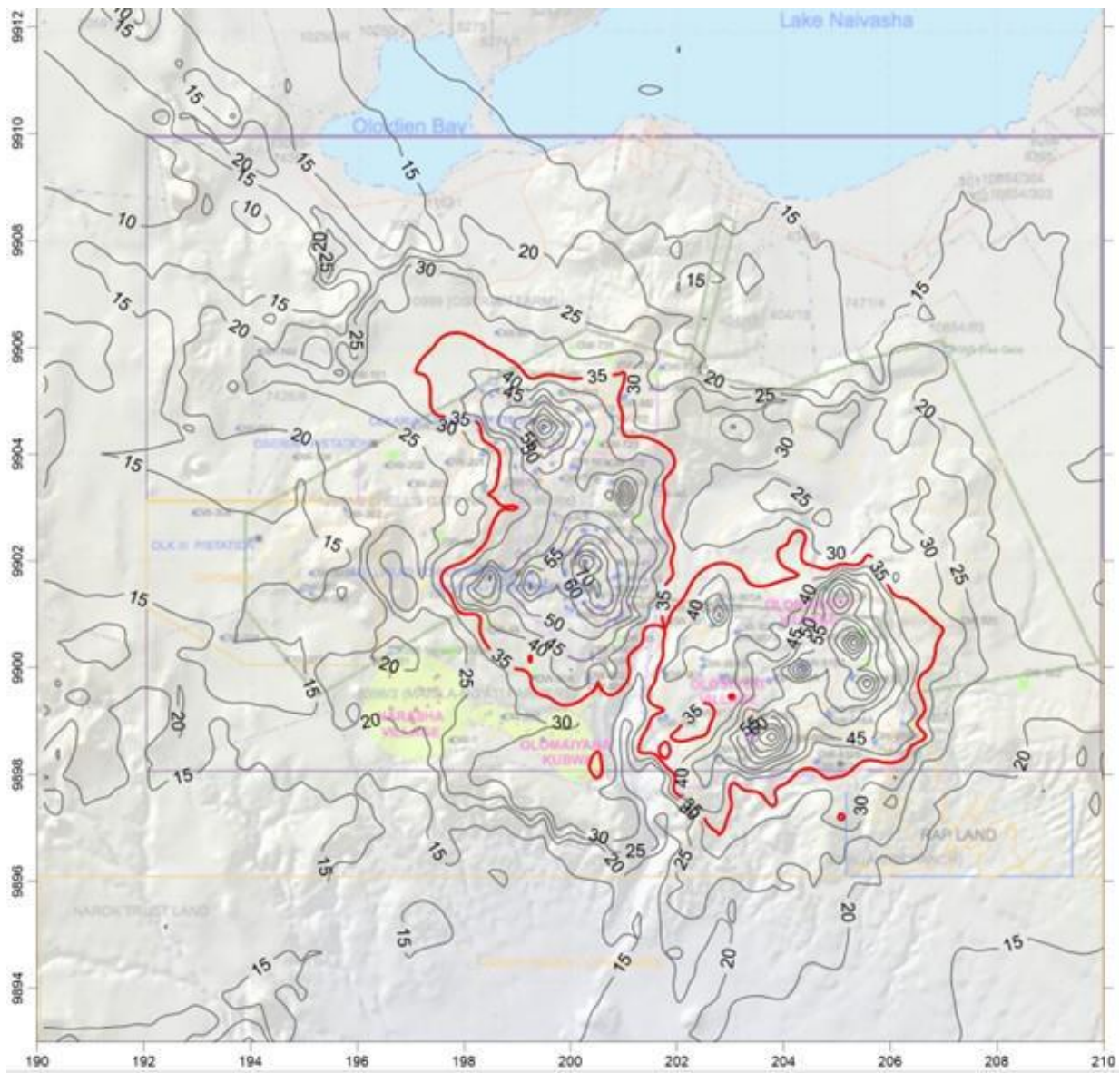


Figure 21: Noise dispersion modelling for all existing power plants and wellheads, LAeq-10 hours

3.5 Background Air Quality Conditions

3.5.1 Gas Concentrations in the Air

Similar to noise monitoring, there is an existing in-house air emissions monitoring program for all workplaces in geothermal facilities at Olkaria and sensitive receptor at environs of the establishment. Air quality measurements were conducted for seven gases and particulates in the air. Five gases, namely, hydrogen sulphide, nitrogen dioxide, Sulphur dioxide, carbon monoxide and methane were below detection level of 0.1ppm. Carbon dioxide was within typical atmospheric range of concentrations from 400 ppm to 500 ppm. Occupational Safety Limit for carbon dioxide gas is 5,000 ppm. Oxygen levels were within the acceptable human health range of 19.5% to 23.5%. Summary of the gas sampling results are shown in table 21.

Table 21: Background air quality parameters – gases

No	Receptor/Measuring locations	Gaseous parameters						
		H ₂ S (ppm)	O ₂ (%)	NO ₂ (ppm)	SO ₂ (ppm)	CO (ppm)	CO ₂ (ppm)	CH ₄ (ppm)
1	Narasha primary School	0.0	20.9	0.0	0.0	0.0	450	0.0
2	KWS Narasha Gate	0.0	20.8	0.0	0.0	0.0	450	0.0
3	Rangers Post	0.0	20.7	0.0	0.0	0.0	440	0.0
4	OI Mayiana Kubwa Villages	0.0	20.9	0.0	0.0	0.0	430	0.0
5	Staff Camp - KWS Gate	0.0	21.0	0.0	0.0	0.0	500	0.0
6	Elsa Gate KWS	0.0	20.9	0.0	0.0	0.0	420	0.0

3.5.2 Particulates in the Air

Particulate matter (PM) in the air consists of tiny particles and droplets suspended in the atmosphere, including dust, soot, smoke and liquid droplets. These particles vary in size and composition, and their health effects depend on their size and ability to penetrate the respiratory system. The limits for particulates in air are 75 µg/M³ for PM₁₀ and 500 µg/M³ for TSP. These limits were not exceeded as shown in table 22.

Table 22: Background Particulates in the Air

No	Receptor/measuring locations	Particulates in air parameters ($\mu\text{g}/\text{M}^3$)		
		2.5 μm	10 μm	TSP
1	Narasha primary School	2	10	16
2	KWS Narasha Gate	10	18	40
3	Rangers Post	12	24	64
4	Ol Mayiana Kubwa Villages	30	41	65
5	Staff Camp - KWS Gate	29	36	73
6	Elsa Gate KWS	16	44	98

3.5.3 Hydrogen Sulphide Gas Modelling

As part of field planning and locating construction point for a power plants, H_2S gas dispersion modelling has been conducted for all existing power plants and wellheads at Olkaria using CALPUFF software. The project boundary limit of 0.1ppm has not been exceeded at all residential areas in proximity to the geothermal field. The modelling results are shown in the figure 22.

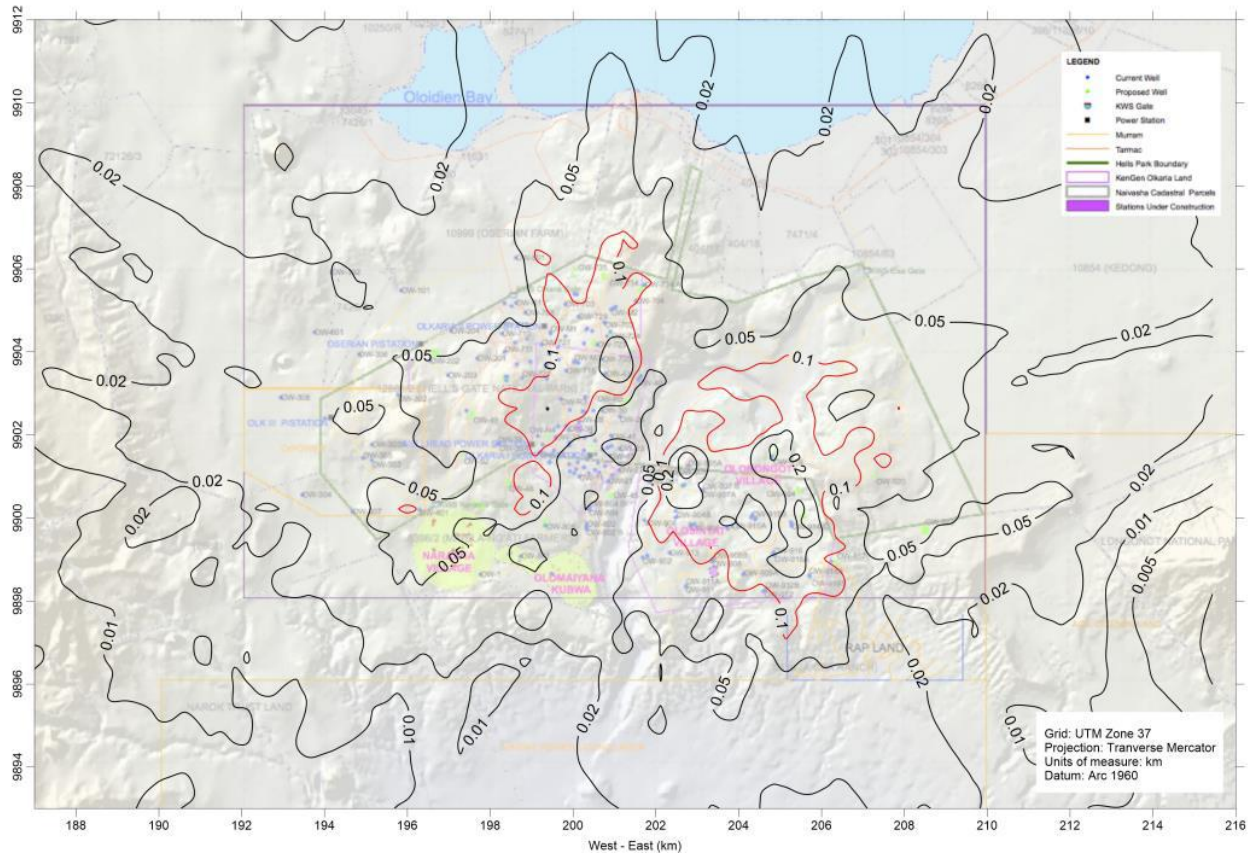


Figure 22: Maximum 24-hours H₂S gas spread from existing power plants and wellheads, PPM

Appendix 10 shows calibration certificates for the gas analyzer, sound level meter and sound level meter calibrator that enabled collection of the baseline noise and gas data.

4 LEGAL AND REGULATORY FRAMEWORK

4.1 GENERAL OVERVIEW

Several Acts of Parliament and the Constitution have been enacted in Kenya. Amongst these include legal provisions for managing natural resources. The Environmental Management and Co-ordination Act (EMCA) of 1999 is the umbrella legal framework under which the environment is managed. EMCA (1999) provided for the establishment of National Environment Management Authority (NEMA), which became operational in July 2002, with the statutory mandate to co-ordinate all environmental activities in the country.

Kenya is a signatory to various international environmental laws including the Ramsar Convention, Convention on Biological Diversity, the Montreal Protocol, United Nations Framework Convention on Climate Change, and the Kyoto Protocol. The proposed project of drilling of forty-two wells requires enormous financial capital to establish and hence require development partners such as the World Bank, European Investment Bank African Development Bank, Japan International Cooperation Agency (JICA) among others. Thus, environmental policies of funding institutions have been considered.

The applicable legislative and regulatory frameworks that will impact on the proposed drilling of forty-two geothermal wells' project are discussed below.

4.2 KENYA'S LEGISLATIVE AND REGULATORY FRAMEWORK

4.2.1 The Constitution of Kenya, 2010

This Constitution is the supreme law of the Republic of Kenya and binds all persons and all State organs at both levels of county and national government. Article 42 provides that every person has the right to a clean and healthy environment, which includes the right to have -

- (a) the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69 and
- (b) obligations relating to the environment fulfilled under Article 70. Article 69 (1) stipulates that the state shall -
 - a) ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits;

- b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;
- c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;
- d) encourage public participation in the management, protection and conservation of the environment;
- e) protect genetic resources and biological diversity;
- f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment;
- g) eliminate processes and activities that are likely to endanger the environment; and
- h) utilize the environment and natural resources for the benefit of the people of Kenya.

Article 69 (2) provides that every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources. According to Article 70 (1), if a person alleges that a right to a clean and healthy environment recognized and protected under Article forty-two has been, is being or is likely to be, denied, violated, infringed or threatened, the person may apply to a court for redress in addition to any other legal remedies that are available in respect to the same matter. Article 70 (2) stipulates that on application under clause (1), the court may make any order to,

- a) prevent, stop or discontinue any act or omission that is harmful to the environment;
- b) compel any public officer to take measures to prevent or discontinue any act or omission that is harmful to the environment; or
- c) provide compensation for any victim of a violation of the right to a clean and healthy environment.

Article 70 (3) does not require an applicant to demonstrate that any person has incurred loss or suffered injury. *KenGen is required to put in place necessary measures to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources throughout the proposed drilling of forty-two geothermal wells' project cycle.*

4.2.2 The Environmental Management and Coordination Act (EMCA), Cap 387

This Act of parliament establishes appropriate legal and institutional framework for the overall environmental management in Kenya. The Act was enacted in 1999 and since then it has been amended

twice, in 2015 and 2016 to conform to the Constitution of Kenya, 2010 requirements. Some clauses of the principal Act that are applicable to the proposed project are as detailed below.

Section 3 stipulates that -

- (1) Every person in Kenya is entitled to a clean and healthy environment in accordance with the Constitution and relevant laws and has the duty to safeguard and enhance the environment.
- (2) The entitlement to a clean and healthy environment under subsection (1) includes the access by any person in Kenya to the various public elements or segments of the environment for recreational, educational, health, spiritual and cultural purposes.
- (3) Every person shall cooperate with state organs to protect and conserve the environment and to ensure the ecological sustainable development and use of natural resources.
- (4) If a person alleges that the right to a clean and healthy environment has been, is being or is likely to be denied, violated, infringed or threatened, in relation to him, then without prejudice to any other action with respect to the same matter which is lawfully available, that person may on his behalf or on behalf of a group or class of persons, members of an association or in the public interest -
 - (a) prevent, stop or discontinue any act or omission deleterious to the environment;
 - (b) compel any public officer to take measures to prevent or discontinue any act or omission deleterious to the environment;
 - (c) require that any on-going activity be subjected to an environment audit in accordance with the provisions of this Act;
 - (d) compel the persons responsible for the environmental degradation to restore the degraded environment as far as practicable to its immediate condition prior to the damage; and provide compensation for any victims of pollution and the cost of beneficial uses lost as a result of an act of pollution and other losses that are connected with or incidental to the foregoing.

Subject to section 29 of the Act, every Governor shall by notice in the Gazette, constitute a County Environment Committee of the respective County. Section 57 (1) requires that all Policies, Plans and Programmes for implementation be subject to Strategic Environmental Assessment (SEA). According to section 58, the proponent of any project specified in the second schedule is required to undertake Environmental Impact Assessment (EIA) study and submit the EIA study report to NEMA prior to being issued with the license. The revised second schedule is contained under legal notice No. 150. The projects that are required to undergo EIA have been classified into three broad categories namely Low risk, Medium risk and

High-risk projects. Geothermal development and projects located in sensitive sites fall under the high-risk category which are required to be subjected to a full EIA study.

Section 68 provides that –

- (1) The Authority or its designated agents shall be responsible for carrying out environmental audit of all activities that are likely to have significant effect on the environment. An environmental inspector appointed under this Act may enter any land or premises for the purposes of determining how far the activities carried out on that land or premises conform to the statements made in the environmental impact assessment study report issued in respect of that land or those premises under section 58(2).
- (2) The owner of the premises or the operator of a project for which an EIA study report has been made shall keep accurate records and make annual reports to the Authority describing how far the project conforms to the statements made in the EIA study report submitted under section 58(2).

According to section 129 (1) any person who is aggrieved by: -

- a) the grant of a licence or permit or a refusal to grant a licence or permit, or the transfer of a licence or permit, under this Act or regulations made thereunder.
- b) the imposition of any condition, limitation or restriction on his licence under this Act or regulations made thereunder;
- c) the revocation, suspension or variation of his licence under this Act or regulations made thereunder;
- d) the amount of money which he is required to pay as a fee under this Act or regulations made thereunder;
- e) the imposition against him of an environmental restoration order or environmental improvement order by the Authority under this Act or regulations made thereunder; may

Within sixty days after the occurrence of the event against which he is dissatisfied, appeal to the National Environment Tribunal in such manner as may be prescribed by the Tribunal.

Pursuant to section 145 (1) when an offence against this Act, is committed by a body corporate, the body corporate and every director or officer of the body corporate who had knowledge of the commission of the offence and who did not exercise due diligence, efficiency and economy to ensure compliance with this Act, shall be guilty of an offence.

KenGen requires to exercise due diligence when implementing the proposed drilling of forty-two geothermal wells' project to ensure protection of the environment and safety of workers and the surrounding community. Implementation of the proposed project should be preceded with

acquisition of the EIA license which shall set out mandatory conditions to be fulfilled in line with sustainable development goals.

4.2.3 The Environmental Management and Co-ordination (Waste Management) Regulations, 2006

The regulations provide details on management (handling, storage, transportation, treatment and disposal) of various waste streams including:

- domestic waste
- industrial waste,
- hazardous and toxic waste
- pesticides and toxic substances
- biomedical wastes and
- radioactive waste

Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include:

- i. Improvement of production process through-
 - Conserving raw materials and energy
 - Eliminating the use of toxic raw materials and wastes
 - Reducing toxic emissions and wastes
- ii. Monitoring the product cycle from beginning to end by-
 - Identifying and eliminating potential negative impacts of the product
 - Enabling the recovery and re-use of the product where possible, and
 - Reclamation and recycling and
- iii. Incorporating environmental concerns in the design and disposal of a product

Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 14 (1) requires every trade or industrial undertaking to install at its premises anti-pollution equipment for the treatment of waste emanating from such trade or industrial undertaking. Regulation 15 prohibits any industry from discharging or disposing of any untreated waste in any state into the environment.

Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA. Regulation 40 requires all waste transporters to obtain a license from NEMA for the transportation of waste.

KenGen requires to ensure sound management of all solid waste generated throughout the proposed drilling of forty-two geothermal wells' project cycle by: Providing solid waste containers for onsite use, segregating waste at the source, ensuring final disposal of solid waste at designated sites, contracting NEMA licensed waste transporter and maintaining tracking records on site.

4.2.4 The Environmental Management and Co-ordination (Water Quality) Regulation, 2006

The regulations provide for sustainable management of water resources including prevention of water pollution and protection of water sources (lakes, rivers, streams, springs, wells and other water sources). It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution.

Regulation No. 11 further makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radio-active waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.

During implementation of the proposed drilling of forty-two geothermal wells' project, KenGen will refrain from any actions, which may directly or indirectly cause water pollution.

4.2.5 The Environmental Management and Co-ordination (Air Quality) Regulations, 2014

The objective of these Regulations is to provide for the prevention, control and abatement of air pollution to ensure clean and healthy ambient air.

According to Regulation 5 (1) No person shall-

- (a) act in a way that directly or indirectly causes, or is likely to cause immediate or subsequent air pollution; or
- (b) emit any liquid, solid or gaseous substance or deposit any such substance in levels exceeding those set out in the First Schedule.

Regulation 15 provides that no person, owner or operator of a facility shall cause or allow the emission of air pollutants in excess of the limits stipulated under the Third Schedule.

Regulation 20 (l) prohibits any person, operator or owner of any facility to cause or allow fugitive emissions to cause the ambient air quality at its property boundary to exceed the limits prescribed under the First Schedule.

Regulation 25 (l) provides that No person shall cause or allow the emission of visible air pollutants from a stationary vehicle in excess of the limits set out under the prescribed Standard.

According to Regulation 30 (l) the occupier or operator of premises shall ensure that exposure of indoor air pollutants does not exceed the exposure limits stipulated under the Factories and Other Places of Work (Hazardous Substances) Rules or under any other relevant law.

Regulation 33 prohibits any person operating construction equipment or handling construction material to allow emission of particulate matter so as to exceed the limits set out in the First schedule.

Regulation 34 stipulates that No person shall cause or allow emission of particulate matter during the demolition of structures, buildings, or parts of buildings in such a manner as to exceed the limits set out in the First Schedule.

According Regulation 35 No person shall cause or allow stockpiling or other storage material in a manner likely to cause ambient air quality levels set out under the First Schedule to be exceeded.

KenGen is required to implement appropriate measures to prevent air pollution during drilling of the proposed forty-two geothermal wells.

4.2.6 The Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009

These regulations being subsidiary legislation to the Environmental Management and Co-ordination Act, 1999 provide information on the following:

- i. Prohibition of excessive noise and vibration
- ii. Provisions relating to noise from certain sources
- iii. Provisions relating to licensing procedures for certain activities with a potential of emitting excessive noise and/or vibrations and
- iv. Noise and excessive vibrations mapping

According to regulation 3 (1), no person shall make or cause to be made any loud, unreasonable, unnecessary, or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

Regulation 4 prohibits any person to *(a)* make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or *(b)* cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 meters from any moving source.

Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property. Table 23 shows the maximum permissible noise levels during day and night times.

Table 23 : First schedule - Maximum Permissible Noise Levels

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

Time Frame:

Day: 6.01 am - 8.00 pm (Leq, 14 h)

Night: 8.01 pm – 6.00 am (Leq, 10 h)

Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which- *(a)* produces any loud and unusual sound; and *(b)* exceeds 84 dB(A) when accelerating. According to sub regulation 2 of this regulation,

No person shall at any time sound the horn or other warning device of a vehicle except when necessary to prevent an accident or an incident.

Regulation 13 (1) provides that except for the purposes specified in sub-regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations (Table 24).

Table 24: Second Schedule ~ Maximum Permissible Noise Levels for Construction Sites (Measurement taken within the facility)

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

Time Frame:

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

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

Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub-regulation 4, such permit shall be valid for a period not exceeding three months.

KenGen will observe policy and regulatory requirements and implement the measures provided in this regulation in an effort to ensure compliance with the stipulated provisions during the drilling of the proposed forty-two geothermal wells.

4.2.7 The Occupational Safety and Health Act, 2007

This is 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.

The key areas addressed by the Act include:

- General duties including duties of occupiers, self-employed persons and employees
- Enforcement of the act including powers of an occupational safety and health officer
- Registration of workplaces
- Health General Provisions including cleanliness, ventilation, lighting and sanitary conveniences
- Machinery safety including safe handling of transmission machinery, hand held and portable power tools, self-acting machines, hoists and lifts, chains, ropes & lifting tackle, cranes and other lifting machines, steam boilers, air receivers, refrigeration plants and compressed air receiver
- Safety General Provisions including safe storage of dangerous liquids, fire safety, evacuation procedures, precautions with respect to explosives or inflammable dust or gas
- Chemical safety including the use of material safety data sheets, control of air pollution, noise and vibration, the handling, transportation and disposal of chemicals and other hazardous substances materials
- Welfare general provisions including supply of drinking water, washing facilities, and first aid
- Offences, penalties and legal proceedings

Under section 6 of this Act, every occupier is obliged to ensure safety, health and welfare of all persons working in his workplace. The occupier shall achieve this objective by preparing and as often as may be appropriate, revising a written statement of his general policy with respect to the safety and health at work of his employees and the organization and arrangements for the time being in force for carrying out that policy (Section 7). He is also required to establish a safety and health committee at the workplace in a situation where the number of employees exceeds twenty (section 9) and to cause a thorough safety and health audit of his workplace to be carried out at least once in every period of twelve months by a registered safety and health Advisor (Section 11). In addition, any accident, dangerous occurrence, or occupational poisoning which has occurred at the workplace needs to be reported to the occupational safety and health officer of the respective area by an employer or self-employed person (section 21).

According to section 44, potential occupiers are required to obtain a registration certificate from the Director for all premises intended for use as workplaces. Such places shall be maintained in a clean state during the operation phase (section 47).

In relation to fire safety, section 81 requires necessary precautions for dealing with fire incidents to be implemented including provision of means for extinguishing fire and means for escape, in case of fire, for

the persons employed in any workplace or workroom. As far as disaster preparedness and emergency response program is concerned, section 82 (1) makes it a mandatory requirement for every occupier of a workplace to design evacuation procedures to be used during any emergency situation and to evaluate them at regular intervals.

The employers' positive contribution towards the welfare of the employees includes provision and maintenance of adequate supply of wholesome drinking water - section 91 and a first aid box or cupboard of the prescribed standard – section 95 at suitable point (s) conveniently accessible to all employees.

KenGen will ensure adherence to the provisions of OSHA, 2007 during the construction, operation and decommissioning of the proposed drilling of forty-two geothermal wells. Some of the measures to be put in place include constituting a functional health and safety committee, conducting statutory inspections of relevant equipment and providing applicable trainings, wholesome drinking water to employees, first aid boxes and firefighting equipment.

4.2.8 The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007

The rules provide for fire safety measures with specific focus on the following critical requirements:

- Safe handling and storage of flammable substances
- Provision of fire escape exits
- Formation of firefighting team
- Functions of a firefighting team
- Fire safety training
- Conducting fire drills
- Installation, maintenance, inspection and testing of fire equipment
- Documentation of a fire safety policy and
- Annual fire safety audits.

KenGen will ensure implementation of the fire rules during the proposed drilling of forty-two geothermal wells' project. Some of the measures to be implemented include training of some staff on firefighting, provision of fire protection system comprising of portable fire extinguishers, hose reels, hydrants, smoke detectors, fire alarm and fire water tank, provision of safe storage for flammable materials, conducting fire audits, designating emergency assembling points and providing emergency exits as necessary.

4.2.9 The Factories and Other Places of Work (Hazardous Substances) Rules, 2007

The rules provide for safety measures in handling of hazardous substances at workplaces including:

- Occupational exposure limits
- Control measures
- Maintenance of Material Safety Data Sheets
- Provision and use of personal protective equipment
- Sound disposal of hazardous materials
- Provision of training and information to employees and
- Air monitoring and measurement
- Medical examination and
- Duties of employees

KenGen will ensure compliance with the hazardous substances' rules by;

- *Documenting safe working procedures on the use, handling and storage of hazardous materials*
- *Providing suitable personal protective equipment to employees including coveralls, helmets, safety boots, gloves*
- *Providing first aid boxes at strategic points*
- *Carrying out regular monitoring of the levels of hydrogen sulphide gas emissions and*
- *Maintaining at the point of use MSDS for the various materials in use.*

4.2.10 The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005 –Legal Notice No.25

According to Rule 5, where noise in a workplace exceeds the continuous equivalent of 85 dB (A), the occupier must develop and implement an effective noise control and hearing conservation programme which must be in writing and should address:

- a) Noise measurement
- b) Education & training
- c) Engineering noise control
- d) Hearing protection

- e) Posting of notices in noisy areas
- f) Annual programme review

Rule 8 provides that all noise measuring equipment should be regularly calibrated, maintained, inspected and operated according to manufacturer's instructions. Rule 10 (2) requires occupiers to carry out regular inspection and maintenance of machines and installations to ensure that noise emission is prevented or controlled. Rule 13 provides that where the noise level is above 90 dB (A), the employer shall:

- i. Post a sign at the entrance to and in every room or conspicuous place, clearly and prominent marked "DANGER HEARING PROTECTION MUST BE WORN"
- ii. Supply hearing protection to all persons required to enter such an area and
- iii. Ensure that all workers and any other person entering this area wear hearing protectors.

KenGen requires to implement the above-mentioned provisions during drilling of the proposed forty-two geothermal wells so as to mitigate against any negative impacts associated with noise emission.

4.2.11 The Factories (Building Operations and Works of Engineering Construction) Rules, 1984

Rule 7 requires every contractor who employs more than twenty persons to appoint a safety supervisor who should be experienced in the works being carried out at the site. Rule 48 (1) prohibits any timber or material with projecting nails to be placed or be allowed to remain in any place at a site where they are a source of danger to persons employed. Rule 55 (C) provides that properly maintained scaffolds or, where appropriate, ladders or other means of support which shall be sufficient and suitable for the purpose shall be provided, placed and kept in position for use where work cannot be safely done on or from the ground or from part of a building or other permanent structure.

Rule 109 (1) prohibits any crane, crab or winch to be used unless it has been tested and thoroughly examined by a competent person within the previous four years and no pulley block, gin wheel or sheer legs shall be used in the raising or lowering of a load weighing one tone or more unless it has been tested and thoroughly examined by a competent person.

Rule 132 provides that where a contractor has more than five persons in his employment on a site, he shall provide and keep clean and in good repair a sufficient number of suitable first aid boxes, which shall, while work is going on, be reasonably accessible to all positions on the site where persons in his employment are working.

KenGen will comply with the above-mentioned measures throughout the proposed drilling of forty-two geothermal wells' project.

4.2.12 The Work Injury Benefits Act, 2007

This is an Act of Parliament to provide for compensation to employees for work related injuries and diseases contracted in the course of their employment and for connected purposes.

The salient features addressed by the act include the following:

- i. Obligations of employers
- ii. Right to compensation
- iii. Reporting of accidents
- iv. Compensation
- v. Occupational diseases
- vi. Medical aid and
- vii. Appeals

According to section 7 (1) of the act, every employer is required to obtain and maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under the act to any of his employees. In addition, every employer carrying on business in Kenya shall within the prescribed period and in the prescribed manner register with the Director - section 8 (1). Pursuant to section 10 (2) of the act, it is the duty of every employee to ensure his/her safety at the place of work and hence where an accident, not resulting in serious disablement or death, is caused by the deliberate and wilful misconduct of the employee, such an employee is not entitled to compensation. However, according to section 12 if an employee is injured in an occupational accident or contracts an occupational disease while the employee, with the consent of the employer, is engaged in any organized first aid, ambulance or rescue work, fire-fighting or other emergency service, the accident or disease is for the purposes of this Act, deemed to have arisen out of and in the course of the employee's employment. In a circumstance where an accident occurs in the course of employment, section 21 makes it a requirement for a written or verbal notice of such an accident to be given by or on behalf of the employee concerned to the employer who shall send a copy of the notice to the Director within twenty-four hours of its occurrence in the case of a fatal accident. In line with section 22 (1), an accident that has occurred should be reported to the Director by the employer in the prescribed manner within seven days from the date of receiving a notice of the accident or having learned that an employee has been injured in an accident. Similarly, it is the responsibility of the employee to report to his/her employer the occurrence of an accident not later than 12 months from the date of such an accident or else the right to benefits, in

accordance with section 27 (1), shall lapse if the accident is not reported within such a period of time (12 months). According to section 46 (1), the employer shall be responsible for availing necessary means of transport where an employee is injured in an accident, which necessitates his conveyance to a hospital medical facility and from a hospital or medical facility to his residence.

KenGen will ensure adherence to this Act by observing the following measures in the proposed drilling of forty-two geothermal wells' project;

- ***Provision of an ambulance***
- ***Maintaining an insurance policy cover for its employees***
- ***Maintaining a record of accidents***
- ***Carrying out proper accident investigations and***
- ***Organizing for pre-employment and regular medical surveillance for staff.***

4.2.13 The Wildlife Management and Conservation Act, No. 47 of 2013

This is an Act of Parliament to provide for the protection, conservation, sustainable use and management of wildlife in Kenya. Section 26(1) stipulates that the provisions of this Act with respect to conservation, protection and management of the environment shall be in conformity with the provisions of the Environmental Management and Coordination Act, 1999.

Section 30 prohibits any activity which is likely to have adverse effects on the environment, including the seepage of toxic waste into streams, rivers, lakes and wetlands.

Pursuant to section 44 (1) every national park, marine protected area, wildlife conservancy and sanctuary shall be managed in accordance with a management plan that complies with the requirements prescribed by the Fifth Schedule.

Subject to section 45 (1) No person shall mine or quarry in a national park without the approval and consent of Kenya Wildlife Service (KWS). Where this is approved an EIA license shall be mandatory. Section 89 (1) provides that any person who-

- (a) discharges any hazardous substances or waste or oil into a designated wildlife area contrary to the provisions of this Act and any other written law;
- (b) pollutes wildlife habitats and ecosystems;

- (c) discharges any pollutant detrimental to wildlife into a designated wildlife conservation area contrary to the provisions of this Act or any other written law, commits an offence and shall be liable upon conviction to a fine of not less than two million shillings or to imprisonment of not less than five years or to both such fine and imprisonment.

Section 93 stipulates that any person who –

- (a) knowingly introduces an invasive species into a wildlife conservation area; or
- (b) fails to comply with the measures prescribed by the Cabinet Secretary set out under this Act, commits an offence and shall be liable upon conviction to a fine of not less than three hundred thousand shillings or to imprisonment of not less than one year or to both such fine and imprisonment.

According to section 111 (1) any authorized officer of or above the rank of assistant warden may erect a temporary barrier across any road or place and any person approaching the barrier shall, on being required by the officer so to do, stop and allow the officer to carry out search of his own person and of any vehicle as may appear to the officer to be necessary or expedient. The Sixth Schedule to the Act provides the nationally listed critically endangered, vulnerable, nearly threatened and protected species of fauna and flora.

The proposed drilling of forty-two geothermal wells area is within Hell's Gate National Park and could potentially affect wildlife.

KenGen in collaboration with KWS will put in place necessary measures to ensure harmonious coexistence of the proposed drilling of forty-two geothermal wells' project with wildlife conservation.

4.2.14 The Forest Conservation and Management Act, 2016

The Act led to the establishment of Kenya Forest Service (KFS) which is charged with management of forests in consultation with the forest owners. The body enforces the conditions and regulations pertaining to logging, charcoal making and other forest utilization activities.

To ensure community participation in forest management, the service collaborates with other organizations and communities in the management and conservation of forests and for the utilization of the biodiversity.

Section 46 (4) Stipulates that the conditions on which a licence for quarrying or any allied activity carried out in the forest, shall, where the activity concerned is likely to result in the depletion of forest cover in any forest,

include a condition requiring the licensee to undertake compulsory restoration and re-vegetation immediately upon the completion of the activity.

Section 46(5) states that re-vegetation shall be undertaken in consultation with the Service, which shall determine the seeds and seedlings proposed to be used in such re-vegetation.

The proposed drilling of forty-two geothermal wells is not on a forest reserve or near one.

However, KenGen in collaboration with the local community and KWS will initiate a social afforestation program to compensate for vegetation cleared during the proposed drilling of forty-two geothermal wells' project.

4.2.15 Climate Change Act, 2016

The Act provides a legal framework for enhancing climate resilience and low carbon development. It aims to guide the country in mitigating and adapting to climate change. Section 15 (5) provides that each state department and national government public entity shall have the following duties;

- a) integrate the climate change action plan into sectoral strategies, action plans and other implementation projections for the assigned legislative and policy functions;
- b) report on sectoral greenhouse gas emissions for the national inventory;
- c) designate a unit with adequate staff and financial resources and appoint a senior officer as head of the unit to coordinate the mainstreaming of the climate change action plan and other climate change statutory functions and mandates into sectoral strategies for implementation;
- d) regularly monitor and review the performance of the integrated climate change functions through sectoral mandates;
- e) put in place and implement mechanisms for sustainability in performance of sectoral mandates; and
- f) report annually to the Council on the status and progress of performance and implementation of all assigned climate change duties and functions.

KenGen, being a state department, has conducted climate risk and vulnerability assessment for the proposed drilling of forty-two geothermal wells project to inform appropriate adaptation and mitigation measures in line with the provisions of the Act.

4.2.16 Standards Act Cap 496

The Act is meant to promote the standardization of the specification of commodities, and code of practice; to establish a Kenya Bureau of Standards (KEBS), to define its functions and provide for its management and control.

KenGen in collaboration with KEBS will ensure that commodities and codes of practice utilized in the drilling of forty-two geothermal wells adhere to the provisions of this Act. Such commodities include the drilling materials and potable water.

4.2.17 Nakuru County Public Health and Sanitation Act, 2017

The Nakuru County Public Health and Sanitation Act, 2017, is a comprehensive legislative framework aimed at securing and maintaining high health standards within the county. The Act outlines various sections, including the establishment of the County Board of Health, its functions, and the general duties of health officers. Key provisions include the inspection of premises, management of infectious diseases, maintenance of cleanliness, provision of sanitary facilities, and the management of solid and liquid waste. The Act also addresses environmental pollution, food hygiene, and public health nuisances, with penalties for non-compliance. The overarching objective is to ensure every resident has access to a clean and healthy environment, as stipulated in the Constitution of Kenya.

KenGen will ensure promotion of a clean and healthy environment during implementation of the proposed drilling of forty-two geothermal wells.

4.2.18 Physical and Land Use Planning Act No.13 of 2019

This is an Act of Parliament to make provision for the planning, use, regulation and development of land; and for connected purposes. The objectives of this Act are to provide:

- The principles, procedures and standards for the preparation and implementation of physical and land use development plans at the national, county, urban, rural and cities level;
- The administration and management of physical and land use planning in Kenya;
- The procedures and standards for development control and the regulation of physical planning and land use;
- A framework for the co-ordination of physical and land use planning by county governments;
- A mechanism for dispute resolution with respect to physical and land use planning;

- A framework for equitable and sustainable use, planning and management of land;
- The functions of and the relationship between planning authorities;
- A robust, comprehensive and responsive system of physical and land use planning and regulation; and
- A framework to ensure that investments in property benefit local communities and their economies.

Section 57 (1) of the act prohibits carrying out development within a county without a development permission. According to section 71 (2), all physical and land use development plans shall take into account and record all heritage sites declared or deemed to have been declared under the national Museums and heritage Act, 2006.

KenGen will secure all mandatory approvals and permits as required by the law during implementation of the proposed drilling of forty-two geothermal wells' project.

4.2.19 The Energy Act, 2019

This is an Act of Parliament enacted to amend and consolidate the laws relating to energy, to provide for the establishment, powers and functions of the Energy and Petroleum Regulatory Authority (EPRA) and the Renewable Energy and Rural Electrification Corporation (REREC) for rural electricity connection purposes. The Energy Act, 2019 amongst other issues, deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply, and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

Section 78 of the act provides that notwithstanding anything to the contrary in any written law or instrument of title, no person shall sink a well, tap, take, use or apply geothermal resources for any industrial or commercial purpose unless he is granted authority or licence under this Act. A licensee shall be liable for any loss, damage or injury to any person or property resulting from the licensee's works or operations, whether as a result of negligence or otherwise as stipulated by section 87 of the act.

The Energy Act, 2019 established EPRA whose mandate is to regulate all functions and players in the energy sector. One of the duties of EPRA is to ensure compliance with Environmental, Health and Safety Standards in the Energy Sector, as empowered by Section 98 of the Act. In this respect, the following environmental issues will be considered before approval is granted:

- The need to protect and manage the environment, and conserve natural resources;
- The ability to operate in a manner designated to protect the health and safety of the project employees; the local and other potentially affected communities.

Licensing and authorization to generate and transmit electrical power must be supported by an Environmental Impact Assessment Report (EIA) approved by NEMA.

KenGen was granted by the Ministry of Energy, geothermal resource license No. 1/2008 dated 19th September 2008 and valid for thirty (30) years. The license was issued with respect to Olkaria Geothermal Field. The proponent is required to comply with Environmental, Health and Safety Standards during construction and drilling of the proposed forty-two geothermal wells.

4.2.20 Occupiers Liability Act (Cap 34)

Section 3(4) of this act stipulates that in determining whether the occupier of premises has discharged the common duty of care to a visitor, regard is to be had to all the circumstances, so that (e.g.) -

- (a) where damage is caused to a visitor by a danger of which he had been warned by the occupier, the warning is not to be treated without more as absolving the occupier from liability, unless in all the circumstances it was enough to enable the visitor to be reasonably safe; and
- (b) where damage is caused to a visitor by a danger due to the faulty execution of any work of construction, maintenance or repair by an independent contractor employed by the occupier, the occupier is not to be treated without more as answerable for the danger if in all the circumstances he had acted reasonably in entrusting the work to an independent contractor and had taken such steps (if any) as he reasonably ought in order to satisfy himself that the contractor was competent and that the work had been properly done.

KenGen will exercise due diligence when implementing the proposed drilling of forty-two geothermal wells' project and to sensitize visitors on safety measures to be observed while accessing all work areas.

4.2.21 The Public Health Act (Cap. 242)

Section 115 of the Act prohibits causing nuisance or other condition liable to be injurious or dangerous to health. Section 118 provides a list of nuisances which includes any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.

KenGen will take necessary measures to prevent public nuisance that may arise from the proposed drilling of forty-two geothermal wells' project.

4.2.22 The Public Health (Drainage and Latrine) Rules

Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide proper and sufficient latrines for use by employees. Rule 87 requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in an approved position sufficient and convenient temporary latrine for use by such workmen. Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority, which is at a suitable level, and where there is sufficient water supply.

KenGen will construct suitable pit latrines or water closets for use by workers and visitors when implementing the proposed drilling of forty-two geothermal wells' project.

4.2.23 The Water Act 2016

Section 21 of this Act stipulates that the Authority shall ensure that there is in place a national monitoring and geo referenced information system on water resources. Following on this, sub- Section 2 mandates the Authority to demand within a reasonable time or on a regular basis, from any person or institution, specified information, documents, samples or materials on water resources.

Section 143 (l) Stipulates that a person shall not, without authority conferred under this Act -

(a) willfully obstruct, interfere with, divert or obstruct water from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction; or (b) throw, convey, cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive matter or thing into or near to any water resource in such manner as to cause, or be likely to cause, pollution of the water resource.

KenGen abstracts water from Lake Naivasha for commercial and domestic uses at Olkaria by virtue of water abstraction permit Ref. WRMA/20/NSA/2GD/22/S which expires on 24th November 2027. The maximum permitted water abstraction limit is 248,000M³ per month. The proponent will ensure implementation of appropriate measures to prevent potential contamination of surface water sources during the proposed drilling of forty-two geothermal wells.

4.2.24 Water Resources Management Rules, 2007, Legislative Supplement No.52

Rule 23 (1) stipulates that any person whose works or water use activity falls within Category A is required to notify the Authority, prior to construction or installation of works. Rule 81 prohibits pollution of water by discharging or applying any poisonous, toxic, noxious or obstructing matter, radioactive waste or other pollutants into any water resource unless such discharge meets the permissible water quality standards recommended by the Authority.

Rule 88 provides that No person shall willfully and deliberately allow any substance to spill out into any water resource or onto land where such spillage may or is likely to contaminate anybody of surface or groundwater.

KenGen will put in place necessary measures to prevent the potential of polluting surface water sources during the proposed drilling of forty-two geothermal wells' project.

4.2.25 The HIV and AIDS Prevention and Control Act No.14 of 2006

According to section 4 (1) the Government shall promote public awareness about the causes, modes of transmission, consequences, and means of prevention and control of HIV/AIDS through a comprehensive nationwide educational and information campaign conducted by the Government through its various Ministries, Departments, authorities and other agencies.

Pursuant to subsection (2), the educational and information campaign referred to in subsection (1) shall-

- (a) employ scientifically proven approaches;
- (b) focus on the family as the basic social unit;
- (c) encourage testing of individuals; and
- (d) be carried out in schools and other institutions of learning, all prisons, remand homes and other places of confinement, amongst the disciplined forces, at all places of work and in all communities throughout Kenya.

Subsection (3) provides that in conducting the educational and information campaign referred to in this section, the Government shall collaborate with relevant stakeholders to ensure the involvement and participation of individuals and groups infected and affected by HIV and AIDS, including persons with disabilities.

According to section 31 (1) no person shall be-

- (a) denied access to any employment for which he is qualified; or

- (b) transferred, denied promotion or have his employment terminated, on the ground only of his actual, or suspected HIV status.

KenGen, being a government entity, will promote educational and information campaign and organize for Voluntary Counselling and Testing throughout the drilling of forty-two geothermal wells' project. Further, the Company will ensure that discriminate workers on the basis of their HIV status. Does not take place.

4.2.26 The Public Roads and Roads of Access Act (Cap 399 Revised 2010)

Section 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road.

Section 10 and 11 allows for notices to be served on the adjacent landowners seeking permission to construct the respective roads and to compensate project affected persons as may be deemed fit. This Act consolidates the law relating to traffic on all public roads. The Act also prohibits encroachment on and electrical damage to roads including land reserved for roads.

The design of the proposed new roads would incorporate the required road reserves and relevant road widening surrenders.

4.2.27 The Way Leaves Act Cap 292

According to the Way Leaves Act cap 292 Section 2, Private land does not include any land sold or leased under any Act dealing with Government lands.

Section 3 of the Act states that the Government may carry any sewer, drain or pipeline into, through, over, or under any lands whatsoever, but may not in so doing interfere with any existing building.

Section 8 further states that any person who, without the consent of the Permanent Secretary to the Ministry responsible for works (which consent shall not be unreasonably withheld), causes any building to be newly erected over any sewer, drain or pipeline the property of the Government shall be guilty of an offence and liable to a fine of one hundred and fifty shillings, and a further fine of sixty shillings for every day during which the offence is continued after written notice in that behalf from the Permanent Secretary; and the Permanent Secretary may cause any building erected in contravention of this section to be altered, demolished or otherwise dealt with as he may think fit, and may recover any expense incurred by the Government in so doing from the offender.

The proposed drilling of forty-two geothermal wells will be undertaken in Hell's Gate National Park on leased land. Installation of the water supply line along the existing roads will take into consideration the way leaves.

4.2.28 The Registration of Titles Act Cap 281

This Act provides for the transfer of the land by registration of titles. Parts within the Act elaborate on mechanisms of bringing lands under the Act, and for related purposes. The Act also elaborates on the incorporation of group representatives and the administration of groups.

Section 34 of this Act states that when land is intended to be transferred or any right of way or other easement is intended to be created or transferred, the registered proprietor or, if the proprietor is of unsound mind, the guardian or other person appointed by the court to act on his/her behalf in the matter, shall execute, in original only, a transfer in form F in the First Schedule, which transfer shall, for description of the land intended be dealt with, refer to the grant or certificate of title of the land, or shall give such description as maybe sufficient to identify it, and shall contain an accurate statement of the land and easement, or the easement, intended to be transferred or created, and a memorandum of all leases, charges and other encumbrances to which the land maybe subject, and of all rights-of-way, easements and privileges intended to be conveyed.

The proposed drilling of forty-two geothermal wells will be undertaken in Hell's Gate National Park on land that has been leased by KenGen. The reference number is IR 105419/1 (LR NO.12881/5) while the lease period is 50 years from 16th November 2022.

4.2.29 National Museums and Heritage Act Cap 216 Revised Edition 2012 (2006)

Section 30 provides that where a person discovers a monument or object of archaeological or palaeontological interest, the person shall, within seven days, give notice thereof, indicating the precise site and circumstances of the discovery, to the National Museums, and in the case of an object, shall deliver the object to the National Museums or to the District Commissioner to keep it for any particular purpose or for any particular period.

KenGen shall put in place measures to comply with the above mentioned requirement during well pad and road construction.

4.2.30 The Land Acquisition Act Chapter 295 Laws of Kenya

The Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public.

Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to do things such as survey upon necessary authorization will be undertaken in accordance with section 5 of the Act, Likewise where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10 along the following parameters: Area of land acquired; The value of the property in the opinion of the Commissioner of land (after valuation), Amount of the compensation payable, Market value of the property etc.

Part III of the Act (section 24) allows for the temporary acquisition of the land for utilization in promotion of the public good for periods not exceeding 5 years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to restore the land to the conditions it was before. Any damages or reduction of value shall be compensated to the landowners.

The proposed drilling of forty-two geothermal wells will be undertaken in Hell's Gate National Park on land that has been leased by KenGen. The project will therefore not result to land acquisition.

4.2.31 Climate Change Act, 2016

Section 9 (8) (d) (ii) of the act stipulates that the Climate Change Directorate, in collaboration with other agencies at the national and county government levels, shall develop strategies and coordinate actions for building resilience to climate change and enhancing adaptive capacity.

According to section 15 (5) of the act, each state department and national government public entity shall integrate the climate change action plan into sectoral strategies, action plans and other implementation projections for the assigned legislative and policy functions and report on sectoral greenhouse gas emissions for the national inventory.

KenGen being a state corporation will be required to comply with the above legal requirement.

4.3 INTERNATIONAL LAWS AND GUIDELINES

4.3.1 The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer

The Montreal Protocol establishes firm targets for reducing and eventually eliminating consumption and production of a range of ozone depleting substances. These substances are provided under annexes A-E of the Protocol and are to be phased out within the schedules given in articles 2A-21 as shown in table 25.

Table 25: The 1987 Montreal Protocol's Phase-Out Timetable for Developing Nations

Item	Substance	Developing Countries' Reduction (%)
1.	Chlorofluorocarbons (CFC's)	0% in 1999
		20% in 2003
		50% in 2005
		85% in 2007
		100% in 2010
2.	Halon	0% on 2002
		50% in 2005
		100% in 2010
3.	Carbon Tetrachloride	85% in 2005
		100% in 2010
4.	1,1,1,-trichloroethane	0% in 2003
		30% in 2005
		70% in 2010
		100% in 2015
5.	Hydrobromofluorocarbons (HBFCs)	100% in 1996
6.	Hydrochlorofluorocarbons (HCFCs)	0% in 2016
		100% in 2040
7.	Methyl bromide	0% in 2002
		20% in 2005
		100% in 2015
8.	Bromochloromethane	100% in 2002

Appropriate measures will be put in place to prevent the introduction of ozone depleting substances during the drilling of forty-two geothermal wells. The R22 refrigerant in the air conditioning system will be phased out.

4.3.2 The United Nations Framework Convention on Climate Change (UNFCCC), 1992

The objective of UNFCCC is to tackle the negative effects of climate change. The aim of the convention is to stabilize greenhouse gas concentrations at a level that allows ecosystems to adapt naturally to climate change so that food production is not threatened, while enabling economic development to proceed in a sustainable manner. According to Article 4(1), the convention provides that all parties make general commitments regarding:

- a) The establishment of national inventories of greenhouse emissions and sinks
- b) The promotion of scientific and technical cooperation
- c) The sustainable management of forests, oceans and ecosystems and
- d) The integration of climate change considerations in national social, economic and environmental policies.

KenGen will implement necessary measures aimed at reduction of greenhouse gas emissions during implementation of the proposed drilling of forty-two geothermal wells.

4.3.3 Paris Agreement, 2015

Article 6 section 4 provides that a mechanism to contribute to the mitigation of greenhouse gas emissions and support sustainable development is hereby established under the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Agreement for use by Parties on a voluntary basis. It shall be supervised by a body designated by the Conference of the Parties serving as the meeting of the Parties to this Agreement, and shall aim:

- (a) To promote the mitigation of greenhouse gas emissions while fostering sustainable development;
- (b) To incentivize and facilitate participation in the mitigation of greenhouse gas emissions by public and private entities authorized by a Party;
- (c) To contribute to the reduction of emission levels in the host Party, which will benefit from mitigation activities resulting in emission reductions that can also be used by another Party to fulfil its nationally determined contribution;
- (d) To deliver an overall mitigation in global emissions.

Article 13 section 7 provides that each Party shall regularly provide the following information:

- (a) A national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases, prepared using good practice methodologies accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Agreement;
- (b) Information necessary to track progress made in implementing and achieving its nationally determined contribution under Article 4.

Section 8 provides that each Party should also provide information related to climate change impacts and adaptation under Article 7, as appropriate.

The proposed drilling of geothermal wells will contribute towards greenhouse gas reduction by phasing out thermal energy power plants. A detailed Climate Change Risks and Vulnerability Assessment for the project has been undertaken to inform the appropriate adaptation and mitigation measures to climate proof the project.

4.3.4 The 1971 Ramsar Convention on Wetlands of International Importance

Article 1 of the Ramsar Convention defines a wetland as “areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”. The purpose of the convention is to stop the loss of wetlands and to promote their conservation and wise use as a means to achieving sustainable development. According to Article 2(1), each state party shall designate at least one wetland for inclusion in a List of Wetlands of International Importance (“Ramsar List”) and ensure the maintenance of the ecological character of each Ramsar Site.

KenGen will endeavour to promote conservation and wise use of water from L. Naivasha, a Ramsar Site, in line with sustainable development goals during the proposed drilling of forty-two geothermal wells’ project.

4.3.5 The Convention on Biological Diversity

The Convention on Biological Diversity outlines three main objectives, as stipulated under Article 1:

- a) conservation of biological diversity
- b) sustainable use of the components of biological diversity and
- c) fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate

transfer of relevant technologies, considering all rights over those resources and to technologies, and by appropriate funding.

The Convention provides, in Article 6, that parties shall develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity and endeavour to integrate the conservation and sustainable use of biological diversity into relevant sectoral or cross sectoral plans, programmes and policies. Article 7 of the Convention requires parties to identify components of biodiversity important for conservation and sustainable use and to monitor the components so identified, paying particular attention to those requiring urgent conservation measures and those with potential for sustainable use. In addition, parties are required to identify and monitor processes and activities which may have significant adverse impacts on conservation and sustainable use of biodiversity. Article 8 requires parties to put in place *in situ* conservation measures including:

- a) The establishment of a system of protected areas
- b) The promotion of the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings
- c) Promotion of environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering the protection of these areas.
- d) The rehabilitation and restoration of degraded ecosystems and the recovery of threatened species and
- e) Prevention, control and eradication of alien invasive species.

Necessary measures will be implemented to promote environmentally sound and sustainable development of the proposed forty-two geothermal wells in Hell's Gate National Park.

4.4 Environmental and Social Safeguards Standards and Guidelines for Funding Institutions

4.4.1 World Bank Environmental and Social Framework

The World Bank Environmental and Social Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity. The framework was operationalized on 4th August 2016 and it establishes ten Environmental and Social Standards that Borrowers and the project are required to meet through the project life-cycle, as follows:

- i. Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;

- ii. Environmental and Social Standard 2: Labour and Working Conditions;
- iii. Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management;
- iv. Environmental and Social Standard 4: Community Health and Safety;
- v. Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- vi. Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- vii. Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
- viii. Environmental and Social Standard 8: Cultural Heritage;
- ix. Environmental and Social Standard 9: Financial Intermediaries; and
- x. Environmental and Social Standard 10: Stakeholder Engagement and Information disclosure.

4.4.2 JICA Guidelines for Environmental and Social Considerations

The guidelines were operationalized in April 2010. The objectives of the guidelines is to encourage Project proponents to ensure appropriate consideration for environmental and social impacts and to facilitate JICA's support for and examination of environmental and social considerations. By so doing, the guidelines help to avoid or minimize development projects' impacts on the environment and local communities, and to prevent the occurrence of unacceptable adverse impacts. "Environmental and social considerations" means considering environmental impacts on air, water, soil, ecosystem, flora, and fauna, as well as social impacts including involuntary resettlement and respect for the human rights of Indigenous people.

These guidelines are anchored on the following seven principles:

1. A wide range of impacts must be addressed. These comprise of environmental and social issues.
2. Measures for addressing environmental and social impacts must be implemented throughout the project cycle. Policies, plans and programmes must be subjected to Strategic Environmental Assessment (SEA) and Environmental and Social Impact Assessments must be conducted for individual projects.
3. JICA is responsible for accountability when implementing projects it funds.

4. JICA requires stakeholders to participate in decision making. JICA incorporates stakeholder opinions into decision-making processes regarding environmental and social considerations thereby ensuring consensus building.
5. JICA ensures disclosure of information on environmental and social considerations. This is done in collaboration with project proponents thus promoting accountability and stakeholders' participation.
6. JICA enhances organizational capacity. JICA endeavours to enhance the capacity of staff working for organizations it funds so as to ensure effective implementation of measures to address environmental and social considerations.
7. JICA is committed to promptness when it comes to decision making. Any requests received by JICA must be addressed within the shortest time possible while ensuring adherence to the environmental and social considerations for the specific projects under consideration.

JICA classifies projects into four categories according to the extent of environmental and social impacts, taking into account an outline of project, scale and site condition. The four categories are as follows:

Category A: These are projects which are likely to have significant adverse impacts on the environment and society or those which may have complicated or unprecedented impacts that are difficult to assess, or projects with a wide range of impacts or irreversible impacts. The impacts may affect an area broader than the sites or facilities subject to physical construction. Category A, in principle, includes projects in sensitive sectors, projects that have characteristics that are liable to cause adverse environmental impacts, and projects located in or near sensitive areas.

Category B: These are projects whose potential impacts on the environment and society are less adverse than those of Category A projects. They are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily.

Category C: Proposed projects are classified as Category C if they are likely to have minimal or little adverse impact on the environment and society.

Category FI: Proposed projects are classified as Category FI if they satisfy all of the following requirements: JICA's funding of projects is provided to a financial intermediary or executing

agency; the selection and appraisal of the sub-projects is substantially undertaken by such an institution only after JICA's approval of the funding, so that the sub-projects cannot be specified prior to JICA's approval of funding (or project appraisal); and those sub-projects are expected to have a potential impact on the environment.

Necessary measures to avoid or minimize adverse environmental and social impacts associated with the proposed drilling of forty-two geothermal wells will be put in place in line with JICA guidelines.

4.5 KenGen-KWS Memorandum of Understanding (MoU)

The MoU was signed by the two parties on 8th February 2008 to ensure proper coexistence and safeguard the interests of the two parties. Article 1 of the MoU provides that KWS shall regularly educate KenGen staff on the national park's rules and regulations with regards to their interaction with wild animals, proper disposal of waste and handling of visitors to the park. Some of the measures recommended for protection of wildlife include:

- a) Minimal clearance of vegetation where it is deemed absolutely necessary.
- b) Reinjection of geothermal fluids.
- c) Reduction of vertical well discharge and well testing period to the lowest minimum possible.
- d) Control of invasive species that may be introduced in the process of earthworks.
- e) Rehabilitation of disturbed sites with indigenous vegetation.
- f) Joint monitoring of the abundance and diversity of natural vegetation.
- g) Limit areas to be fenced to those deemed to be unsafe for people.
- h) Proper designing of the pipelines and earthworks to prevent obstruction of animal migratory routes.
- i) Erect bumps at on road sections identified by KWS as having animal migratory paths so as to prevent potential for animal kills due to over speeding vehicles.
- j) Night movement of vehicles shall only be permitted for essential company operations and park patrols.

Other measures include:

- Continuous measuring of hydrogen sulphide gas and noise emissions associated with geothermal development.
- Camouflaging of steam gathering pipelines with colours approved by KWS.
- Establishment of a Joint MoU Implementation Committee.

KenGen will need to participate actively in the ongoing review of the MoU and to ensure implementation of the agreed measures throughout the drilling of forty-two geothermal wells cycle.

4.6 KenGen's Capacity to Ensure Compliance with Legal and Regulatory Requirements

KenGen is fully committed to long-term environmentally sustainable development that is consistent with National and International standards. In line with this commitment, the Company is certified with respect to Quality Management System (QMS), Environmental Management System (EMS), and Occupational Health and Safety Management System (OHSMS) based on ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 standards, respectively and maintains continual improvement of its processes. Through the Environmental Management System, KenGen has identified and documented its significant environmental aspects and impacts on the environment and set in place interventions to manage these aspects.

KenGen has also articulated its commitment in environmental management to various stakeholders including the public through an Environmental Sustainability Policy Statement which is aligned with its mission and vision statements. The Environmental Sustainability Policy Statement commits the organization to compliance with applicable laws and regulations.

The Company has a fully-fledged and operational Sustainability Development unit. Further, the Sustainability Development-Geothermal Section at Olkaria will coordinate the implementation of environmental management plans for the proposed drilling of forty-two geothermal wells' project and conduct monitoring and reporting of the respective parameters.

5 PUBLIC CONSULTATION AND PARTICIPATION

5.1 General Overview

Public participation and consultation are integral to ESIA process. They ensure that the voices of primary and secondary stakeholders are heard and considered in project's decision-making processes. Development of geothermal power projects at Olkaria Geothermal Field has, in the past, triggered socioeconomic and environmental concerns, particularly related to land use, displacement of local communities, water usage, and impacts on traditional livelihoods like pastoralism. Effective public participation ensures that these concerns are adequately addressed, fostering transparency, accountability, and better relations between the developers and the affected populations. In addition, this process helps to identify potential environmental and social risks early in the project and ensures that mitigation measures are developed in line with the concerns raised.

The need for public consultation and participation when carrying out ESIA studies is underscored by the Kenyan Constitution, 2010 and EMCA, 1999. Regulation 17 of the Environmental (Impact Assessment and Audit) Regulations, 2003 requires project proponents to seek the views of the public pertaining to the ESIA study being conducted for projects listed under the second schedule of EMCA, 1999. According to this regulation, when carrying out public participation, the Lead EIA Expert in consultation with the project proponent and NEMA, shall:

- a) publicize the project and its anticipated effects and benefits by -
 - i. posting posters in strategic public places in the vicinity of the site of the proposed project informing the affected parties and communities of the proposed project;
 - ii. publishing a notice on the proposed project for two successive weeks in a newspaper that has a nation-wide circulation; and
 - iii. making an announcement of the notice in both official and local languages in a radio with a nation-wide coverage for at least once a week for two consecutive weeks;
- b) hold at least three public meetings with the affected parties and communities to explain the project and its effects, and to receive their oral or written comments;
- c) ensure that appropriate notices are sent out at least one week prior to the meetings and that the venue and times of the meetings are convenient for the affected communities and the other concerned parties; and

- d) ensure, in consultation with the Authority that a suitably qualified coordinator is appointed to receive and record both oral and written comments and any translations thereof received during all public meetings for onward transmission to the Authority.

In line with the above requirement, four (4) public barazas, one-on-one meetings and key stakeholders meetings were carried out as part of the ESIA study. The public was notified of the public barazas at least a week in advance. The notices for the public barazas were done in Maasai, Swahili and English languages and conspicuously displayed in the respective villages. Invitation letters were written to the key stakeholders informing them of the purpose, date and venue of the meeting (Refer to appendix 11).

5.2 Objectives of Public Participation and Consultation

By incorporating public input, the ESIA process ensures that the proposed drilling of 42 Geothermal Wells in Olkaria Geothermal Field is not only environmentally and socially sustainable but also economically beneficial for local communities and aligned with national development goals. Therefore, the ESIA team conducted the public consultation and participation, with respect to the proposed Drilling of 42 Geothermal Wells, to fulfil the following objectives:

- For Compliance to the legal requirement as per Environmental Management and Coordination Act, 1999 and Part (V) Regulation (31) of the Environmental (Impact Assessment and Audit) Regulations, 2003.
- To raise awareness, get feedback from the stakeholders and improve decision-making by tapping on local knowledge and information through the involvement of individuals, groups and organizations with a stake in the proposed project.
- Disclose the findings of the ESIA study for the drilling of the 42 geothermal wells to stakeholders at large.
- Provide an opportunity to the interested parties and those directly/indirectly affected by the project to give their views and suggestions about the proposed drilling of geothermal wells project, ways of enhancing the identified positive impacts and mitigation measures for the anticipated negative impacts, and hence participate in decision making.
- Ensure a sense of responsibility and commitment towards implementing the ESMP

5.3 Public Consultation and Participation Approach

To ensure meaningful engagement with the neighboring communities and key stakeholders during the ESIA study for the geothermal drilling project, a structured, inclusive, and transparent approach was essentially designed. It was basically designed to address both the local community's concerns and the expectations of all stakeholders, promoting trust, cooperation, and informed decision-making. The approach used in this public participation and consultation involved:

- Identification of relevant stakeholders through stakeholders mapping
- One-on-one consultation meetings with selected key stakeholders
- Public barazas held with neighboring local communities
- Key stakeholders' consultative meeting

Participatory public consultation for this project was carried out with a wide range of stakeholders in the project area, relevant government institutions, Non-Governmental Organizations (NGO's), Community Based Organizations (CBO's) and other interested parties. In particular, the team held interviews and discussions with the several key Government and parastatal organizations. They included those with interests to the proposed development (positive & negative interest) and those directly/indirectly affected by the proposed development and relevant professional experts. Table 26 shows the stakeholders who were identified for public consultation and participation.

Table 26: The stakeholders identified for public consultation and participation

No.	Stakeholder
1.	Kenya Electricity Transmission Company Limited (KETRACO)
2.	Energy and Petroleum Regulatory Authority (EPRA)
3.	Kenya Power & Lighting Company (KPLC)
4.	Akiira One Geothermal Company Limited
5.	Orpower 4 Incl Ltd
6.	National Environment Management Authority (NEMA) Naivasha Sub-County
7.	Oserian Development Company Ltd
8.	National Government Administration Office (NGAO), Olkaria Location
9.	Imarisha Naivasha Trust
10.	Lake Naivasha Riparian Association (LNRA)

No.	Stakeholder
11.	WWF –Naivasha
12.	Elsamere Conservation Centre
13.	Kenya Marine and Fisheries Research Institute (KMFRI)
14.	Lake Naivasha Water Resource Users Association (LANAWRUA)
15.	KWS –Hell’s Gate & Mt. Longonot National Parks
16.	Kedong Ranch Company Ltd
17.	Water Resources Authority (WRA)
18.	Directorate of Occupational Health & Safety Services (DOHSS) Naivasha Sub-County
19.	Naivasha Sub-County Environment Office
20.	Naivasha Sub-County Public Health Office
21.	Naivasha Sub-County Veterinary Office
22.	Naivasha Sub-County Livestock Office
23.	Naivasha Sub-County Public Works & Infrastructure Office
24.	Member of County Assembly- Olkaria Ward
25.	Nurse in charge Olkaria RAP land Community Dispensary
26.	Head Teacher Olkaria Primary School, RAPland
27.	Headteacher Mvuke Primary School
28.	Geothermal Development Company (GDC)
29.	Neighboring Communities: Kamere Trading Centre, Olomayiana Ndogo, RAPLand, Narasha, Kasarani, Kwa Muia, and Hell’s Gate.
30.	Narasha Community Development group-NGO
31.	Naivasha Water and Sewerage Company
32.	Kenya Police - OCS Kongoni Police Post
33.	NGAO, Assistant County Commissioner
34.	NGAO, Deputy County Commissioner
35.	Lake Naivasha Growers’ Association
36.	Wildlife Research and Training Institute Naivasha (WRTI)

One-on-one meetings in regard to the proposed drilling of 42 geothermal wells project were held between 2nd and 8th October 2024 with the following stakeholders:

- i. Kenya Wildlife Service (KWS)-Hell's Gate National park
- ii. NGAO – DCC, Naivasha Sub-County
- iii. NGAO Olkaria Location
- iv. Narasha Community Development group
- v. Akiira Geothermal Ltd.
- vi. Water Resources Authority (WRA)
- vii. Kedong Ranch Company Ltd
- viii. Olkaria RAP land Community Dispensary
- ix. Lake Naivasha Riparian Association (LNRA)

5.3.1 Public Barazas

The ESIA team held four (4) community engagement meetings (barazas) and interviews with local communities in the project area that were likely to be affected in one way or another by the proposed project. These included Narasha Maasai community, Olomaiyana Kubwa Maasai community, RAP Land Maasai community & Kambi Turkana community and Kamere community (Hell's Gate, Kwa Muhia, DCK, Kasarani, Oldonyo, and Sher). The Assistant County Commissioner, Chief Olkaria Location & Assistant Chief of Olkaria sub location assisted to moderate the public barazas. Notices inviting the local communities to the public barazas were translated to Kiswahili and Maasai languages. They were then conspicuously displayed at strategic positions and announced in the local churches by the community representatives that were identified by the ESIA team. Table 27 shows the calendar of Community Engagement Meetings or Public Barazas were held.

Table 27: Community Engagement Meetings or Public Barazas

No.	Date	Time	Community/villages	Venue
1.	October 7, 2024	10:30am	Olomomaiyana Kubwa	Olomayiana Water point
2.	October 7, 2024	2.30pm	Narasha, Olomunyak, Inkorienito & Oltepesi	Nalepo Harvest Church
3.	October 8, 2024	10.30am	Rapland and Kambi Turkana	Rap Land Social Hall
4.	October 9, 2024	10.30am	Kamere, Hell's Gate, Kwa Muhia, DCK, Kasarani, Oldonyo, and Sher	KenGen Mvuke Social Hall
5.	October 11, 2024	10.00am	Key Stakeholder Consultative Meeting	Astorian Grand Hotel – Naivasha Town

Note: Minutes, Stakeholder invitation letter and public notices are in appendix 10.

5.3.2 Key Stakeholders' Consultative Meeting

A one-day workshop for the key stakeholders was held on October 11, 2024 at the Astorian Grand Hotel, Naivasha Town, and chaired by the Assistant County Commissioner, Naivasha Central Division. Participatory public consultation for this project was carried out with a wide range of stakeholders in the project area, relevant government institutions and Non-Governmental Organizations (NGO's), Community Based Organizations (CBO's) and other interested parties. Stakeholders' consultation and participation enabled interested and affected parties to give their views and opinions on the proposed project, which might have been omitted during the scoping exercise. Invitation letters were sent to the relevant key stakeholders in advance, with a questionnaire attached. The stakeholders' input is incorporated in the final report. It is indeed expected that consultations for the proposed project will continue throughout the project implementation phase. Table 28 shows the pictorial evidences for the public barazas and key stakeholders meeting.

Table 28: Photos of the public barazas and key stakeholders' consultative meeting are shown in plates below.



Plate 1: Public baraza at Narasha Village held on 7th October 2024



Plate 2: Public baraza at RAP Land held on 8th October 2024



Plate 3: Public baraza at Olomayiana Kubwa village held on 7th October 2024



Plate 4: Key Stakeholders consultative meeting held on 11th October 2024

5.4 Results of Stakeholder Consultative Meetings

The ESIA team informed stakeholders about the expected impacts related to the proposed project and outlined potential mitigation measures that may arise during the preconstruction, construction, operation, and decommissioning phases.

The stakeholders' views/comments are summarized in Tables 29 and 30. The minutes of the meetings are attached in appendix 11.

Table 29: Summary of views from public barazas held at Narasha, RAPLand, Kamere & Olomayiana Kubwa communities

No	Questions/Comments/Clarification	Response from KenGen
1.	<p>a. Lack of employment opportunities ranging from skilled, non-skilled, casuals and permanent jobs for the local communities</p> <p>b. The KenGen contractors should also bring social benefits to the communities</p>	<p>KenGen as a public institution is mandated by the law, rules and guidelines on employment issues.</p> <p>a. KenGen, on permanent employment has an equal employment opportunity policy and the community will be informed when such opportunities arise.</p> <p>b. Semi and non-skilled skilled labor opportunities are 100% reserved for the local community and administered through Stakeholder Coordination Committee (SCC).</p>
2.	<p>a. Gender insensitivity on the womenfolk since they are not equally considered when job opportunities arise.</p> <p>b. The local community want to feel the direct positive impact of the projects to them and their children through job offers.</p>	<p>a. KenGen is an equal opportunity employer and takes matters of gender equality with a lot of importance.</p> <p>b. KenGen has established a forum dubbed KenGen Pink Energy to address gender issues</p>
3.	The youth alleged that they do not benefit from the business opportunities and tenders arising from the project	KenGen explained the procedure of application for tenders and what is required for one to be a successful bidder.
4.	The women, PWD and youth some have formed business groups to help them get some of the tenders given to the contractors. However, they have never been considered.	<p>– The community was informed that the government has set up to 30% of the tenders to be given to youth and women groups and KenGen is not exceptional.</p> <p>– KenGen tenders are also publicized on the website and members are encouraged to apply</p>

No	Questions/Comments/Clarification	Response from KenGen
		<ul style="list-style-type: none"> – KenGen trains business people from the local community annually to empower them with knowledge on how to conduct business with KenGen and other government agencies.
5.	KenGen Education Scholarships for the bright needy and Vulnerable children – Children from the local communities living within the operation areas not benefitting enough from the program as the slots are too few.	KenGen disclosed that they offer few educational scholarship slots for both Secondary & University education. However, the criteria used to qualify beneficiaries is quite competitive and based on clustered schools. Olkaria is seeking approval to have additional slots.
6.	Which measures will KenGen put in place to mitigate against animals drowning in the brine ponds and impacts of brine flow to downstream villages?	KenGen will ensure all brine ponds are fenced and continuous monitoring done to prevent overflow. KenGen will utilize re-injection of brine technology to abate brine flow.
7.	How will the boundary between KenGen's and community land be accurately established?	The drilling of the geothermal wells will be done within the KWS land which has been leased to KenGen. Cadastral survey was jointly undertaken by KenGen and KWS and the boundaries established.
8.	Concerns on the safety of the Community populace on the exposure to high levels of H ₂ S during and after drilling	<ul style="list-style-type: none"> – The risk of H₂S poisoning is low due to the distance between the villages and drilling sites. – Real-time monitoring of H₂S will be done at the drilling sites and appropriate measures taken where high levels are detected
9.	How will KenGen ensure that a Memorandum of Understanding (MOU) with the Narasha & Olomaiyana communities are established before the	MOU-agreement-the ESIA team plan to communicate to KenGen management however, MOUs are entered into where human or assets are displaced.

No	Questions/Comments/Clarification	Response from KenGen
	commencement of the proposed projects to facilitate follow-up on agreed issues?	
10.	<p>a. Very little CSR support done in the villages especially Olomayiana Kubwa, Narasha and Kamere.</p> <p>b. Need to assist the villages get electricity connectivity, domestic water and school infrastructure support.</p>	<p>a. The Government austerity measures have made it difficult for KenGen to put budgetary allocation to CSR activities and programs, However, the management still incurs expenditure on few community requests. Need to make formal requests.</p> <p>b. Advised to seek support on electricity connectivity from KPLC/REREC</p>
11.	KenGen uses the local as a gate pass to project implementation without benefitting the locals so they requested KenGen to consider the locals for benefits arising from the proposed projects	Semi and non-skilled skilled labor opportunities are 100% reserved for the local community and administered through Stakeholder Coordination Committee (SCC).
12.	Noted invasion of baboons and other wild animals in the neighbourhood resulting in incidences of human-wildlife conflict. Alleged that this is caused by geothermal development activities that have continuously reduced wildlife habitat in the park.	Advised to report cases of human-wildlife conflict to KWS.

Table 30: Summary of issues raised during the key stakeholders' consultative meeting held on October 11, 2024 at Astorian Grand Hotel-Naivasha

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
1.	Agnes Koilel-NGO-Narasha Development Group	<p>a. What plans do KWS have to minimize Human-Wildlife conflicts?</p> <p>b. How will KenGen ensure sufficient supply of water to the Narasha Community?</p> <p>c. Can the proponent supply electricity to the neighbouring communities?</p>	<p>a. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife and reporting human-wildlife incidences; animal control measures like: animal translocation and sacrificing the alpha males or females; KWS initiates the process and the government have plans to speed up the compensatory procedures</p> <p>b. KenGen has a CSR program of supplying water to the neighbouring communities including Narasha community and the proposed drilling of wells won't interfere with this program</p> <p>c. The proponent is mandated by law to only generate electricity, the community is advised to channel their requests to KPLC & REREC for consideration especially through the last mile connection</p>
2.	Jane Kioko-Imarisha Naivasha	Does KenGen have plans to undertake water balance study?	<p>The proponent has no plans to undertake water balance study. This is a mandate of the WRA</p> <p>KenGen has a permit to abstract water from Lake Naivasha. Quantities abstracted are monitored on a monthly basis</p>

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
3.	Hannah Macharia-Orpower4	<p>a. What is the distribution of wells in the Southeast Geothermal Field?</p> <p>b. Is there a buffer zone between KenGen and other developers like Orpower4?</p> <p>c. Is KenGen intending to apply for a new water abstraction permit from WRA?</p> <p>d. Will there be relocation or resettlement during the implementation of the proposed project?</p> <p>e. Is security aspect incorporated in the proposed project?</p> <p>f. Is KenGen open to joint H₂S Monitoring with Orpower 4?</p> <p>g. Does KenGen have a community support program?</p> <p>h. Is there a possibility of constructing a power plant with the proposed project?</p> <p>i. Will the commencement date be shared for traffic management?</p>	<p>a. The well distribution in the South East Field was demonstrated during the meeting (Area III-12; Area IV-13, Area I & II-7 of the sublease)</p> <p>b. The Ministry of Energy should advise on the buffer zone based on geothermal license</p> <p>c. WRA response: Lake Naivasha has enough water to support the proposed project; the current water abstraction permit will suffice hence no need for a new water abstraction permit application</p> <p>d. The proposed project will not displace any persons hence no compensation anticipated</p> <p>e. Critical Infrastructure Protection Unit (CIPU) post is in place at the Olkaria Geothermal Field to secure the KenGen installations</p> <p>f. Orpower 4 is requested to communicate officially to the proponent for consideration</p> <p>g. Power plant may come at a later stage. A separate ESIA will be done.</p> <p>h. The power point will be shared as requested.</p> <p>i. Yes. Orpower 4 will be engaged on commencement</p> <p>j. ESIA study will be disclosed in the media, Kenya Gazette and local newspaper where stakeholders will submit comments within 30 days.</p>

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
		j. Will the presentation be shared?	
4.	Joyce Ndegwa- LANARUA Naivasha	<p>a. Does the proponent have a plan to plant trees within Hell's Gate National Park?</p> <p>b. How will the proponent prevent against siltation in Lake Naivasha?</p> <p>c. How will human –wildlife conflict be addressed?</p>	<p>a. KenGen has a tree nursery near Geothermal Spa where trees seedlings are issued free of charge to support social afforestation. KenGen has a target to contribute to the government target to plant 15 billion trees and Hell's Gate is one of the areas under consideration</p> <p>b. KenGen will put in place suitable measures to control siltation. Other stakeholders should also do the same.</p> <p>c. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife and reporting human-wildlife incidences; animal control measures like: animal translocation and sacrificing the alpha males or females; and KWS have plans to speed up the compensatory procedures. Communities were encouraged to embrace eco-tourism as an economic opportunity</p>
5.	Margaret Kuibita- Sub-County Public Health Officer	<p>a. Will the stakeholders be updated on the progress of the project?</p> <p>b. Is the proponent undertaking underground or borehole water monitoring within the Olkaria Geothermal Field?</p>	<p>a. The proponent agreed to share with the stakeholders any updates regarding the status of the proposed project through established stakeholder's engagement structures</p>

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
		<p>c. Does KenGen has platform for handling issues that may crop out during project implementation?</p> <p>d. The office has received complaints from the local community alleging death of livestock due to ingestion of geothermal effluents. She recommended monitoring of geothermal emissions and its effects on animals and human health.</p> <p>e. Does KenGen have an ambulance and other facilities required to respond in case an emergency situation arises?</p>	<p>b. WRA response: there are no boreholes within the Olkaria Geothermal Field hence no monitoring conducted by WRA.</p> <p>c. KenGen has (SCC) chaired by the Deputy County Commissioner, Naivasha sub county. Three subcommittees form the SCC: Employment, Economic opportunities and Safety, Health and Environment (SHE)</p> <p>d. KenGen and Livestock Department initiated a joint research to establish the effects of geothermal effluents on livestock which is ongoing.</p> <p>e. KenGen has a standby ambulance in place, well stocked first aid kits and the proponent has plans to procure a fire engine to respond fire emergencies. Mvuke Clinic handles emergency situations before referrals.</p>
6.	Anthony Karange- Elsamere Conservation Centre	<p>a. The ESIA should consider measures to address subsistence poaching?</p> <p>b. The baboon population increased drastically despite attempts to cull alpha males.</p>	<p>a. Measures to mitigate subsistence poaching will be included in the ESIA report</p> <p>b. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife. The community was advised to report human-wildlife incidences for follow up action.</p>

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
7.	Peter Mwangi -KWS	<p>a. Does steam pipelines fall under the scope of the proposed project? If yes, no mitigation measures had been discussed.</p> <p>b. What will be the extent of vegetation clearance within each well pad?</p> <p>c. Will there be need for additional road infrastructure to the well pads?</p> <p>d. What is the mitigation plans in place to curb against the impacts associated with well-testing especially wellsite OW-738 with respect to risk of brine overflow towards the vulture cliff?</p>	<p>a. The project will not have steam gathering system.</p> <p>b. The project proponent will maximize on the number of wells per well pad thereby minimizing ecological footprint</p> <p>c. The proponent will optimize the existing roads and create new roads where it's absolutely necessary</p> <p>d. Joint KWS-KenGen baseline studies will be done prior to preparing the well pads and site specific EMPs prepared. Lessons learnt from OW-40 incidence will be incorporated. E.g. the use of improved design silencers and lining of brine ponds with HDPE</p>
8.	Beatrice Mwangi-WRA	<p>a. Does KenGen has controls to prevent brine discharge to the environment? WRA and NEMA visited Olkaria and collected brine samples from OW-R3 for analysis after which the report will be shared.</p>	<p>a. Brine discharge will be controlled through re-injection.</p> <p>b. Brine ponds will be lined with HDPE neo-membrane.</p> <p>c. Through the leadership of Lead Expert, the ESIA Team is guided by the code of conduct for the experts. ToR was submitted to NEMA for review and approval.</p>

No.	Stakeholder	Question/comment/clarification	Response from ESIA team
		<p>b. Is the proponent planning to have brine ponds lined to prevent seepage into the ground?</p> <p>c. Why is KenGen undertaking ESIA using in-house experts?</p>	
9.	Silas Wanjala-Lake Naivasha Riparian Association	Is it possible to reduce the number of well pads by maximizing the number of wells per well pad?	Yes. The project proponent will maximize on the number of wells per well pad by utilizing directional drilling technology as discussed under project alternatives i.e. 2-4 wells per well pad.

5.5 Analysis of Filled in Questionnaires

The ESIA team administered questionnaires to various stakeholders to obtain their views on the proposed project. The feedback contained in the filled in questionnaires is provided below:

5.5.1 Benefits of the Proposed Project

From the analysis of the filled in questionnaires, the following are the perceived benefits likely to arise from implementation of the proposed Drilling of 42 Geothermal Wells project:

- ✓ Clean energy production
- ✓ Employment to the residents
- ✓ Economic opportunities
- ✓ Knowledge/technology transfer
- ✓ Social afforestation program
- ✓ Education scholarship opportunities
- ✓ Supporting wildlife conservation
- ✓ Increase in energy output
- ✓ CSR opportunities
- ✓ Energy independence and security i.e. reduce electricity imports
- ✓ Improvement of infrastructure
- ✓ Revenue generation for the county and national government
- ✓ Boost of tourism
- ✓ Lowering the cost of electricity
- ✓ Improve the living standards
- ✓ Revenue to KWS
- ✓ Improvement of social infrastructure
- ✓ Urban development

5.5.2 Concerns, Comments and Suggested Mitigation Measures

Concerns, comments and suggested mitigation measures are provided in table 31.

Table 31: Stakeholder concerns and suggested mitigation measures

No.	Environmental or Social concerns	Suggested Mitigation Measures	EIA Expert Remarks
1.	Loss or degradation of habitat	<ul style="list-style-type: none"> ✓ Minimize the vegetation clearance ✓ Restoration of the degraded areas through planting of trees ✓ Assist in raising tree seedlings through the KenGen Olkaria Tree Nursery ✓ Drill in areas where there's less vegetation cover ✓ Drill more wells per well pad to minimize the number of well pads ✓ Limit the destruction of wildlife habitat ✓ Identification of critical habitats and species which are likely to be affected ✓ Identification of feasible easements to reduce the impact on critical habitats and species (both Flora and Fauna) 	Mitigation measures covered under section 7.2.1 of the report
2.	H ₂ S Emission/Air pollution	<ul style="list-style-type: none"> ✓ Monitor H₂S levels ✓ Install gas capturing system to limit gas emission ✓ Regular vehicle maintenance 	Mitigation measures covered under section 7.2.5.4 of the report.
3.	Dust generation	<ul style="list-style-type: none"> ✓ Minimize excavation works and if necessary do it with restrictions ✓ Sprinkle water to reduce the dust 	Mitigation measures covered under section 7.2.2 of the report.

No.	Environmental or Social concerns	Suggested Mitigation Measures	EIA Expert Remarks
4.	Noise pollution	<ul style="list-style-type: none"> ✓ Monitor the noise level regularly ✓ Install noise barriers ✓ Restrict the operations to certain hours of the day ✓ Use advance modern technology with low noise pollution 	Mitigation measures covered under section 7.2.5.2 and 7.2.5.3 of the report.
5.	Brine overflow	<ul style="list-style-type: none"> ✓ Ensure full re-injection of brine ✓ Use pond liners to prevent the underground seepage ✓ Prepare and implement the spill management plan 	Mitigation measures covered under section 7.2.6 of the report.
6.	Vegetation clearance	<ul style="list-style-type: none"> ✓ Minimize the vegetation clearance ✓ Restoration of the degraded areas through planting of trees ✓ Assist is raising tree seedlings through the KenGen Olkaria Tree Nursery ✓ Drill in areas where there's less vegetation cover ✓ Drill more wells per well pad to minimize the number of well pads 	Mitigation measures covered under section 7.2.1 of the report.
7.	Water and soil pollution	<ul style="list-style-type: none"> ✓ Ensure full re-injection of brine ✓ Use pond liners to prevent the underground seepage 	<ul style="list-style-type: none"> • Mitigation measures covered under section 7.2.6 of the report.

No.	Environmental or Social concerns	Suggested Mitigation Measures	EIA Expert Remarks
8.	Risk of wildlife accidents especially from the traffic	<ul style="list-style-type: none"> ✓ Put traffic control plans ✓ Install speed limits signage 	Mitigation measures covered under section 7.2.3 of the report
9.	Spread of diseases like HIV/AIDs	<ul style="list-style-type: none"> ✓ Conduct civic education on the impacts of diseases to health ✓ Organize sensitization programs 	Mitigation measures covered under section 7.2.12 of the report
10.	Conflicts are likely to arise	<ul style="list-style-type: none"> ✓ Stakeholder engagement plans ✓ Prepare and implement grievance redress mechanism 	Mitigation measures covered under section 7.2.11 of the report.
11.	Land loss and displacement of communities	Have plans to resettle the displaced people	The proposed project will be implemented in the KWS land leased to KenGen hence no relocation or resettlement of any household.
12.	Access of brine ponds	Fence-off the brine ponds if any	Mitigation measures covered under section 7.2.6 of the report.
13.	Displacement/Reduction of wild animals	Limit the destruction of wildlife habitat	Mitigation measures covered under section 7.2.1 of the report.
14.	Proliferation of invasive species	Put in place an invasive weeds control measures and restoration plans	Mitigation measures covered under section 7.2.1 of the report.
15.	Risk of erosion	Minimize excavation works and if necessary do it with restrictions	Mitigation measures covered under section 7.2.1 of the report.

No.	Environmental or Social concerns	Suggested Mitigation Measures	EIA Expert Remarks
16.	Human-wildlife conflicts	Enhance security to prevent human-wildlife conflict	Mitigation measures covered under section 7.2.4 of the report.
17.	Risk of accidents	Put traffic control plans	Mitigation measures covered under section 7.2.3 of the report.
18.	Solid waste	Proper waste disposal i.e. no onsite burning	Mitigation measures covered under section 7.2.9 of the report.
19.	Ground water contamination	Proper surveillance of the groundwater levels for proper reverse pumping	Mitigation measures covered under section 7.2.7 of the report.
20.	Visual disruption	Minimize visual disruption by strategically placing equipment and landscape restoration	Mitigation measures covered under section 7.2.1 of the report.
21.	Labor influx	Prepare and implement labor influx management plan	Mitigation measures covered under section 7.2.12 of the report.

Stakeholder concerns for which mitigation measures have been provided in the ESIA report include:

- ✓ Seismic activity
- ✓ Interference of cultural heritage
- ✓ Interference of the wildlife movement
- ✓ Land use changes
- ✓ Sexual abuse, exploitation & harassment
- ✓ Occupational, health and safety risks
- ✓ Gender based violence
- ✓ Cultural dilution
- ✓ Pressure on social amenities

Other comments from the filled in questionnaires

- ✓ Proper fencing of work areas
- ✓ Regular community engagements and consultations should be held to keep residents and other stakeholders informed
- ✓ The project to include CSR initiatives to improve local infrastructure and provide educational opportunities in geothermal energy
- ✓ Geothermal energy is green and sustainable
- ✓ Employment opportunities to the nation
- ✓ KenGen to continue supporting conservation education
- ✓ Well pads in the conservation zone to maintain eco-friendly initiatives
- ✓ Regular public consultation during the project life cycle
- ✓ Adherence to various legislations during construction and operational phases

NB: The ESIA Team has developed an ESMP to ensure minimal impacts arise from the anticipated negative impacts

5.6 Social Acceptance of the Project and Further Public Consultations

The participants at the key consultative meeting fully endorsed the project, with the condition that any potential negative impacts are addressed through the mitigation measures outlined in the Environmental and Social Management Plan (ESMP). The ESIA team assured stakeholders that their feedback would be included in the final report. The participants were informed that a notice for the public to submit oral or written comments concerning the proposed development

will be published for two consecutive weeks in a newspaper with nation-wide circulation, in the Kenya Gazette and announced over the radio as provided in EMCA, 1999.

5.7 Grievance and Complaint Handling Mechanism (GCHM) Principles

Due to the complexity and scale of KenGen's projects, grievances and complaints are inevitable. Therefore, it is essential to have accessible, low-cost, and timely processes in place to address and resolve them. A transparent, accountable, and fair in-house grievance mechanism is crucial to reducing the number of complaints and fostering stronger community engagement. In cases where the internal mechanism is deemed unsatisfactory, KenGen also acknowledges the need for external resolution options, such as judicial tribunals, community adjudicators, or mediation. The GCHM is designed to provide an effective platform for KenGen to receive and resolve complaints from individuals affected by its projects.

5.7.1 Grievance & Complaint Handling Procedures:

1. **Receiving Complaints:** Complaints can be submitted at any KenGen office and are forwarded to the Community Relations Office for processing. Complaints may be submitted verbally in person or in written form via hand delivery, mail, email, hotline, voice recording, or written phone messages. Complaints can include the sender's name and address, but all submissions, are valid and must be addressed.
2. **Anonymous Complaints:** Even anonymous complaints are taken seriously and will be addressed through public communication channels such as community forums, Chief's Barazas, or any other method KenGen deems appropriate.
3. **Registration and Handling:** All complaints are registered at the Community Relations Office. If multiple complaints share similar facts and issues, they will be addressed collectively as a single case, and joint meetings will be organized, where complainants can select representatives if necessary.
4. **Confidentiality:** Complaints requesting confidentiality will be processed with the utmost discretion, and responses will be provided in confidence.

This mechanism ensures that KenGen remains responsive, fair, and transparent in its dealings with project-affected individuals, while providing clear channels for grievances to be resolved both internally and externally when necessary. KenGen's GCHM is provided in figure 23.

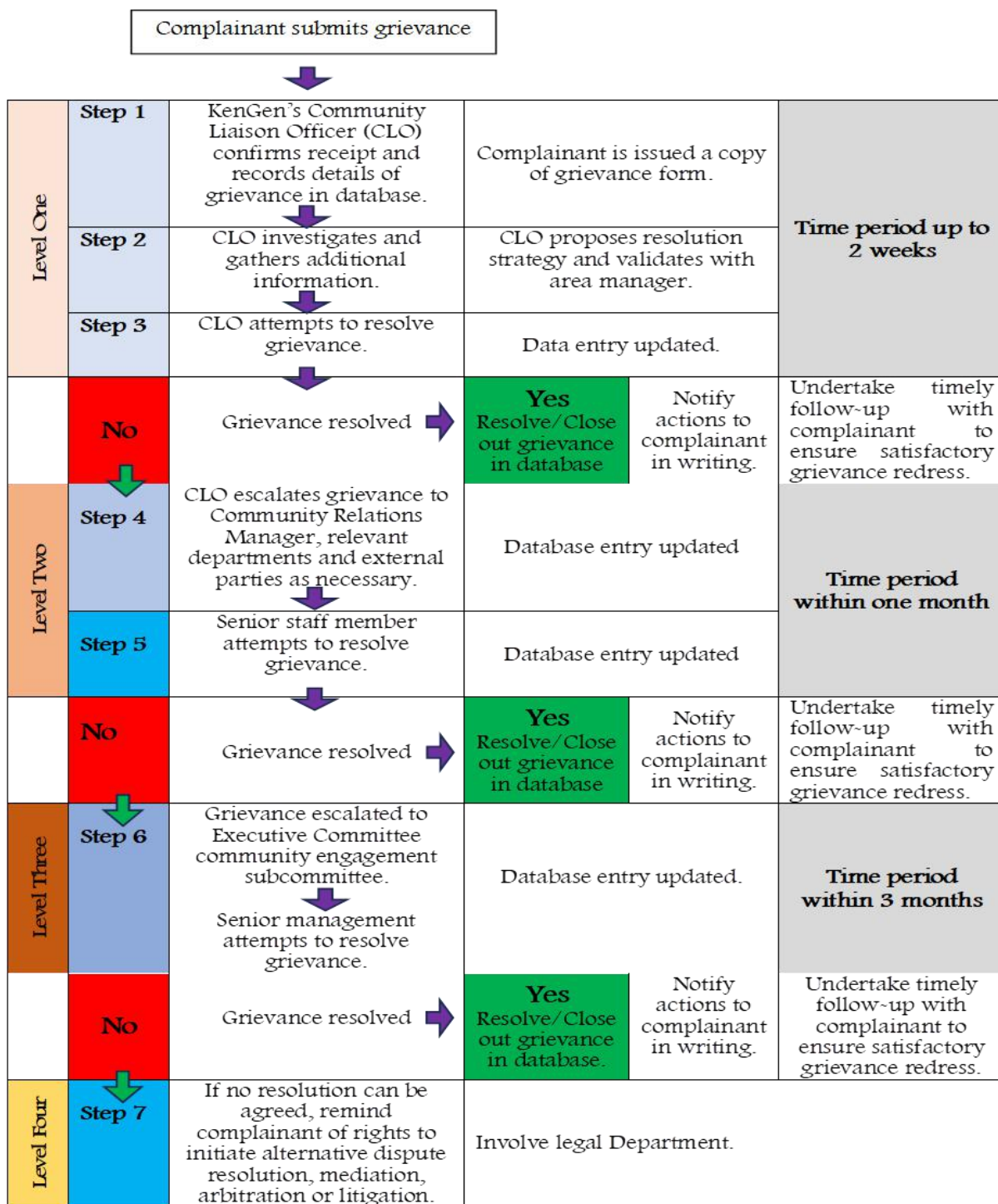


Figure 23: KenGen's Grievance and Complaints Handling Mechanism

6 CLIMATE CHANGE RISKS AND VULNERABILITY ASSESSMENT

6.1 Introduction

Emission of greenhouse gases from human activities contribute to climate change. According to part III of the second schedule to the Environmental Management and Coordination (Air Quality) Regulations 2014, Green House Gases (GHG) comprise of the following six (6) gases:

- a) Carbon dioxide (CO₂)
- b) Methane (CH₄)
- c) Nitrous oxides (N₂O)
- d) Hydrofluorocarbons (HCFCs)
- e) Perfluorocarbons (PFCs) and
- f) Sulphur hexafluoride (SF₆).

Carbon dioxide from the burning of fossil fuels is the largest single source of anthropogenic greenhouse gas emissions. The supply and use of fossil fuels accounts for about three quarters of these emissions. The global level of CO₂ (the most significant contributor to the greenhouse effect) has risen to 48% of its pre-industrial levels. In Kenya, greenhouse gas emission is constantly increasing; for instance, it increased by the highest margin of 17.92% from 2018 to 2019 (Arid Lands Information Network, 2022). Due to the continued emission of GHGs into the atmosphere, the country has experienced a general warming trend since 1960, and the trend of rising temperature is expected to continue (Voices for Just Climate Action, 2022). Arid lands Information Network, 2022 reported that areas around Rongai, Nakuru Town, Subukia, Gilgil, and Naivasha Sub-counties have been reported to exhibit relatively high temperatures as highlighted below:

- i. highest annual mean temperature of about 23.6°C,
- ii. highest mean diurnal range of temperature of about 15.77°C,
- iii. highest maximum temperature of the wettest month (about 32.90°C),
- iv. highest minimum temperature of the coldest month (about 16.1°C),
- v. highest annual temperature range (about 19.9°C),
- vi. highest mean temperature of the wettest quarter (about 24.25°C),
- vii. highest mean temperature of the driest quarter (about 23.68°C),
- viii. highest mean temperature of the warmest quarter (about 24.37°C) and
- ix. highest mean temperature of the coldest quarter (about 22.85°C).

The ever-rising temperatures has made climate change to become one of the major risks that threaten the well-being of mankind. Climate change has increased the frequency and magnitude of extreme weather events causing adverse environmental and social effects. Kenya has continued to witness extreme climatic events making it one of the most disaster-prone countries in the world (Central Bank of Kenya, 2021). Kenya's climate is strongly influenced by the Inter Tropical Convergence Zone (ITCZ), which drives rainfall in the country (World Bank Group, 2021). The rise in temperatures and distorted rainfall patterns are the key indicators of climate change witnessed in Kenya. Temperatures have increased in the past fifty (50) years in many parts of the country (Arid Lands Information Network, 2022). Since 1960, Kenya's mean annual temperature has increased by 1.0°C, at an average rate of 0.21°C per decade. The rate of increase has been most rapid in March to May (0.29°C per decade) and slowest in June to September i.e 0.19°C per decade (Nakuru County Government, 2023). The temperatures are projected to continue rising by 1.7°C by the 2050s and by approximately 3.5°C at the end of the century (World Bank Group, 2021). Impacts of temperature increase include the depletion of glaciers on Mount Kenya and sea level rise. Likewise, rainfall patterns are characterised by increased irregularity and variability with neutral to slightly decreasing trends in annual rainfall amounts over most parts of the country (Arid Lands Information Network, 2022).

Climate change is expected to increase the risk and intensity of flood events, as well as increase average annual rainfall amounts, while also furthering drought likelihoods for some areas across the country. Intense rainfall and flooding may increase the likelihood of mudslides and landslides, particularly in mountainous areas. As the incidence of extreme rainfall rises, soil erosion is also expected. As temperatures rise and droughts are prolonged, water storage capacities will likely be reduced. Kenya is highly vulnerable to seasonal variability and long-term climate change. Increasing vulnerability is expected to result in cumulative impacts across the country's social, economic and environmental systems, with a high likelihood to reverse much of the positive development progress the country has made (World Bank Group, 2021). Common effects of climate change-related hazards in Nakuru County include landslides, drought/dry spells, excess rainfall, floods, hailstones, frost/extreme cold, strong winds and bush fires (The Covenant of Mayors Sub-Saharan Africa, 2021). Climate vulnerability in the county is typically higher among social groups who experience multiple deprivations that inhibit them from managing daily risks and shocks, including but not limited to women, children, the elderly, people with disabilities, ethnic minorities, and indigenous people. These groups face deeper

climate impacts and significant barriers to coping with and adapting to such impacts (Arid Lands Information Network, 2022).

As Kenya aims to become a newly industrialized country by 2030, it will require expanding climate change resilience efforts while also increasing its domestic energy production; including through the use of renewable sources. The Government has set a target of achieving 100% of its electrical energy generation from renewable sources by 2030. The proposed drilling of forty-two (42) geothermal wells at Olkaria will contribute towards promotion of renewable energy and phaseout of thermal energy sources in Kenya thus mitigating climate change.

6.2 Climate Change Risks Relevant to the Proposed Project

The main climate change risks related to the proposed project and mitigation measures to climate proof the project are detailed in table 32.

Table 32: Climate change risks and mitigation measures relevant to the proposed project

Type of Climate Change Risk	Triggers Related to the Proposed Project	Risk Level	Potential Impacts	Proposed Mitigation Measures
Flash floods	<ul style="list-style-type: none"> • Stripping and excavation of land • Overflow or breakage of drilling fluid recirculation ponds 	Medium	<ul style="list-style-type: none"> • Loss of life and/or property • Damage to roads and well pads making them inaccessible. • Damage to water supply lines making water inaccessible at the rig site. • Loss of tourism opportunities. • Gully formation 	<ul style="list-style-type: none"> • Minimize as practicable, the area of land to be cleared. • Continue monitoring the levels of water in lake Naivasha and use the data to inform decision making. • Avoid constructing roads, well pads or water lines near steep slopes or near drainage ways. • Develop emergency evacuation procedures and designate safe areas to be used during flooding events. • Provision of adequate and suitable storm water drainage channels. • Create awareness among employees and visitors on flood safety. • Conduct flood drills at predetermined intervals. • Regular monitoring levels and integrity of the drilling fluid recirculation pond and instituting

Type of Climate Change Risk	Triggers Related to the Proposed Project	Risk Level	Potential Impacts	Proposed Mitigation Measures
				corrective actions prior to overflow or breakage.
Droughts/Dry spells	<ul style="list-style-type: none"> Atmospheric emissions of greenhouse gases from the diesel generators at the rig and vehicles. Green house gas emissions from open burning of waste. Global warming results to below average rainfall. Deforestation. Release of ozone depleting substances into the atmosphere. 	Low	<ul style="list-style-type: none"> Inadequate water for drilling of geothermal wells due to decreased water levels in Lake Naivasha. Increased human-wildlife conflicts. Increased wildlife mortality due to depletion and low quality food resources as well as water shortage. 	<ul style="list-style-type: none"> KenGen-KWS joint wildlife census to establish the impact of drought on wildlife populations within Hell's Gate National Park. Sensitize employees and communities on water conservation measures. Promoting tree growing by the communities around Olkaria Geothermal Field for resilience and sustainable livelihoods. Sensitization of communities around Olkaria geothermal field on the effects of charcoal burning. Offsetting carbon emissions by supplying water to the drilling sites via gravity instead of using diesel generators. Prohibit open burning of solid waste. Use of air conditioning systems fitted with ozone

Type of Climate Change Risk	Triggers Related to the Proposed Project	Risk Level	Potential Impacts	Proposed Mitigation Measures
				<p>friendly refrigerants like R410a.</p> <ul style="list-style-type: none"> • Inspection and maintenance of the internal combustion engines for the diesel generators at the rig sites and motor vehicles. • Regular monitoring of air emissions from the diesel generators at the rig sites to inform corrective actions where levels of emissions exceed the recommended limits. • Inspection of water supply lines and prompt fixing of leakages detected.
Soil erosion by wind and/or water.	Site stripping and excavations	Low	<ul style="list-style-type: none"> • Sedimentation of Lake Naivasha through storm water runoff. • Increase in respiratory and eye complications during strong winds. 	<ul style="list-style-type: none"> • Minimize as practicable, the area of land to be cleared and/or disturbed. • Use of directional drilling technique to minimize the number of well pads to be constructed.
Land slides	Removal of geothermal fluids from underground reservoir	Low	<p>Loss of human life and/or property</p> <p>Wildlife mortality</p> <p>Damage to the drilling rig.</p>	<ul style="list-style-type: none"> • Avoid constructing roads, well pads or water lines near steep slopes, near drainage ways or along natural erosion valleys/gullies.

Type of Climate Change Risk	Triggers Related to the Proposed Project	Risk Level	Potential Impacts	Proposed Mitigation Measures
				<ul style="list-style-type: none"> • Conduct geotechnical surveys prior to undertaking construction of well pads or roads in areas likely to be prone to landslides. • Continue with reinjection of geothermal fluids into the Olkaria reservoir. • Continue monitoring surface deformation and topographical drift using the 6 Global Navigation Satellite Systems installed at Olkaria. • Continue monitoring deformation associated with likely mass withdrawal from the geothermal reservoir using gravity monitoring methods. • Development of a landslide emergency preparedness and evacuation plan.
Bushfires/Wildfires	Fire outbreak from the rig site.	Medium	<p>Loss of human life and/or property.</p> <p>Damage to existing power lines.</p>	<ul style="list-style-type: none"> • Prohibit open burning of solid waste. • Establishment and maintenance of fire breaks around the well pads.

Type of Climate Change Risk	Triggers Related to the Proposed Project	Risk Level	Potential Impacts	Proposed Mitigation Measures
			<p>Loss of pasture and habitat for wild animals leading to dispersal to private lands.</p> <p>Wildlife mortalities.</p>	<ul style="list-style-type: none"> • Development of a fire emergency preparedness and evacuation plan. • Installation of smoke detectors. • Use of hot work permit to work system. • Designation of a smoking area. • Installation of smoke detectors. • Training of employees on fire emergency preparedness and response. • Provision of adequate fire fighting equipment.

6.3 Proposed Adaptation Measures to Climate Proof the Proposed Project

Adaptation measures to climate proof the proposed project are provided in table 33.

Table 33: Adaptation measures to climate proof the proposed project

Climate Risk	Proposed Adaptation Measure
Flooding	<ul style="list-style-type: none">• Lining of the drilling fluid recirculation pond with High-Density Polyethylene (HDPE) Geomembrane.• Creation of an overflow pond besides the main pond.
Drought/excessive heat	<ul style="list-style-type: none">• Supplement fresh water abstracted from Lake Naivasha with geothermal fluids when drilling the wells.• Harnessing of condensate from existing fumaroles e.g as it is done at Olkaria gate for watering wildlife.• Install additional water storage tanks for storing water when lake levels begin to drop.• Provide Personal Protective Equipment that can keep workers safe from heat stress.• Construct water pans, as CSR projects, for harvesting rainwater for watering domestic and wild animals.• Promote catchment conservation initiatives through tree planting.
Soil erosion (wind and water)	<ul style="list-style-type: none">• Restoration of disturbed areas at well pads and roads.• Provision of personal protective equipment including respirators.• Construction of gabions in areas likely to be prone to soil erosion.
Land slides	<ul style="list-style-type: none">• Construction of retaining walls• Site inspection after any extreme weather event.
Bushfires	<ul style="list-style-type: none">• Mobilization and suppression of unwanted fires.• Rehabilitation of ecosystems damaged by fire.

6.4 Conclusion

The proposed drilling of forty-two (42) geothermal wells is projected to take five (5) years. Within this period, it is not envisaged that temperatures will have risen significantly thus the climate change risks are considered to be low.

7 POTENTIAL SOCIAL AND ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

7.1 Positive Impacts of the Proposed Project

7.1.1 Expansion of Geothermal Energy Generation

KenGen's installed capacity for geothermal energy currently stands at 799 MWe. The proposed drilling of forty-two (42) geothermal wells at Olkaria will contribute towards injection of an approximate 200 MW of geothermal energy into the grid upon construction of power plant.

7.1.2 Mitigation of Climate Change

The proposed project aligns to the national target of abating Green House Gas (GHG) emissions by 32% by 2030 relative to the Business As Usual (BAU) scenario of 143 MtCO_{2e} as committed in the updated Nationally Determined Contribution. According to the Updated Least Cost Power Development Plan 2022 -2041 (RoK, 2022), the proposed project will contribute towards displacement of 231 MW of thermal energy (Muhoroni Gas Turbines – 56 MW, Kipevu I – 60 MW and Kipevu III – 115 MW) by the year 2031. Based on the 92% load factor and estimated grid factor of 0.2 tCO_{2e}/MWh and a project emission of 30,000 tCO_{2e}, the baseline emission will be 322,368 tCO_{2e} annually. The emission reduction will be 292,368 tCO_{2e} annually.

7.1.3 Direct Employment Opportunities

The geothermal power industry provides a wide range of employment opportunities—from exploration and drilling jobs; to high-tech manufacturing of generator, turbine, and power conditioning components; to maintenance jobs at geothermal power plants. Each of the three KenGen rigs will operate under a four-shift program with each shift comprising of thirty-four (34) workers. Thus, at any single time, the three rigs will accommodate a total of four hundred and eight (408) workers. Out of these, every shift will engage 2 unskilled casual workers (roustabouts) from the local community making a total of twenty (24) direct employment. Through the economic multiplier effect, wages and salaries earned by geothermal industry employees will generate additional income and jobs in the local and regional economy.

7.1.4 Skills and Knowledge Transfer

KenGen being a government organization, it provides an opportunity for building capacity in geothermal industry through various programmes. Some of these programmes include the

United Nations University Geothermal Training Programme, apprenticeship and attachment of university and college students. Within the period, August to November 2024, sixteen (16) students (seven female) on attachment have been engaged in the three rigs. Similarly, four interns (all male) have been engaged at the rigs for the period July to December 2024.

7.1.5 Enhancement of Local Development

Implementation of the proposed project will lead to realization of the government's Bottom-up Economic Transformation Agenda (BETA), which is geared towards economic turnaround and inclusive growth through a value chain approach. In particular, the project demonstrates the government's commitment to meet its goal of achieving Universal access to electricity while improving reliability and lowering the cost of electricity.

The Olkaria geothermal projects to some extent have improved the living standards of the Maa community through construction of access roads and the Corporate Social Responsibility (CSR) initiatives. The core CSR programmes supported by the company include education scholarships at secondary school and university level and environmental protection and improvement through social afforestation.

7.1.6 Enhancement of Business Opportunities

Business opportunities comprise of various consultancy jobs, hotel industry, supply of equipment, spare parts, food and materials, cleaning services, rig camp services, contracting jobs and provision of transportation and logistics services. Under section 157 (10) of the Public Procurement and Asset Disposal Act, 2015 every procuring entity in Kenya is required to ensure that at least thirty percent (30%) of its procurement value in every financial year is allocated to the youth, women and persons with disability. The proposed project has the potential of creating business opportunities to vulnerable groups through the 30% statutory procurement threshold.

7.1.7 Promotion of Local Tourism

Geothermal projects provide an opportunity for promoting local tourism. Various schools, universities and tertiary institutions frequent Olkaria geothermal projects for academic tours. The local community benefit from such visits since they act as tour guides whereas Kenya Wildlife Service generate revenue via the park entry fees. On average, three (3) institutions visit the power projects in a day. A total of 155,629 tourist visited the Olkaria Geothermal business area for the period between January and August 2024.

7.2 Potential Negative Environmental and Social Impacts of the Proposed Project

This section outlines potential negative environmental and social impacts of the proposed project and the associated mitigation measures.

7.2.1 Reduction of Land Cover and Soil Erosion

Given the arid nature of Olkaria Geothermal Field, land degradation resulting in low vegetation and high soil surface cover results in rapid surface runoff that can exacerbate flood events. High levels of surface soils paired with heavy rainfall events can cause significant soil erosion rates which can block existing drains, cause sediment accumulation in surface water bodies like Lake Naivasha, and in extreme cases even collate with other factors to trigger landslides. Mai Mahiu Ward, Narok Road and Longonot settlement have previously experienced landslides (Duma, 2019). Land clearance and earthworks during construction of access roads and well pads have a likelihood of reducing land cover within the park leading to habitat loss and exacerbated soil erosion incidents. During heavy rain events, the drilling fluid circulation pond can be filled with sediments resulting to overflow or sudden failure due to compromised integrity. The flood emanating from broken ponds can have devastating impacts on the downstream communities and/or critical habitats. Disturbed land surfaces result to the growth of invasive species including *Nicotiana glauca*, *Sida stenocarpus*, *Targetes minuta* and *Rusinus comin*.

Proposed Mitigation Measures

- Well siting shall take into consideration critical habitats.
- The well pads will be designed to accommodate multiple wells thus reducing project footprint.
- Surface stripping and excavation works will be confined within the site layout of the well pad and roads.
- KenGen-KWS joint baseline studies shall be undertaken for each well pad and new roads to facilitate preparation of site specific EMPs.
- So far as practicable, existing roads will be used.
- Suitable storm water drainage system shall be incorporated in the design of the new roads and well pads.
- Slope gradients shall be designed to assure stability and erosion protection measures like gabions and grassing incorporated.

- Cut slopes shall be regularly monitored to detect erosion and remediate promptly.
- Soil disturbance shall be limited to the minimum amount necessary for construction of the well pad and roads.
- Effective control of weed species within the well pads and roads will be undertaken.
- Regular monitoring of the revegetated areas will be carried out during initial vegetation establishment period to demonstrate that the objectives of the rehabilitation scheme are being achieved and that a sustainable, stable landform has been provided.
- Effective monitoring of the pond levels and provision of overflow ponds as may be deemed necessary.
- Establish flood emergency response plan which shall be periodically tested.

7.2.2 Dust Emission

Geothermal well sites are commonly located in areas dominated by volcanic soils. The soils at Olkaria are light, loose and uncompact thus are susceptible to rapid erosion by wind, natural run-off or uncontrolled drainage. During construction of the well pads and the new access roads, dust will be generated due to disturbance of soil and rock, and the handling of bulk construction materials such as crushed hard rock aggregate and murrum. Consequent environmental effects are usually localised and depend on the size of the dust particles and the strength of distributing factors and usually decrease rapidly with separation from the source. Under adverse weather conditions, however, dust can travel considerable distances, potentially resulting in its deposition in otherwise remote locations. In the immediate vicinity of the source, dust can stress vegetation through blocking stomata and reducing light availability and, depending on the type and size of dust particles, can pose a human health risk through inhalation. The project area is prone to upper respiratory ailments thus dust will likely aggravate the problem.

Proposed Mitigation Measures

- Water bowsers will be used to water unpaved well pads and road surfaces as conditions require.
- Areas involving materials handling will be sprayed with water as conditions require.
- Cement will be transported in enclosed banana trucks.
- Enforcement of defined speed limits on unpaved roads.

- Monitoring of dust emission on unpaved surfaces and implementation of corrective actions as necessary.
- Workers will be provided with appropriate personal protective equipment including aprons and particulate respirators.
- Any complaints received will be registered and trigger a review of the relevant dust management procedure/s by the project Environment Officer as a basis for development and implementation of appropriate modified practice/s.

7.2.3 Risk of Wildlife-Vehicle Collisions

The effect of roads on wildlife depends on the type of species in an area, their characteristics, their local abundance, traffic and road properties (e.g. road width and traffic speed) and the characteristics of the surrounding environment. Road orientation is important because limiting resources for animals, such as water, are often associated to geographical features (e.g. rivers, mountain chains or lakes) that form landscape gradients. These gradients result in periodic movements of animals to and from resources that may occur across different spatio-temporal scales. The movements range from individual daily movements connecting water, refuge or food to large seasonal migrations to in search of fresh pastures.

The ungulates are dependent on primary productivity and regularly move across the landscape in search of water, but may avoid roads. Conversely, movement of carnivores is less influenced by water and pasture resources. However, they may be attracted to roads since they use them for travelling and marking. In semi-arid environments, many wildlife species travel daily to and from water and fresh pastures. A study by Margarita et al (2023) found out that wild animals were more likely to follow unpaved roads in areas surrounded by more shrub coverage where movement may be hampered. The study further found out that wildlife species were more likely to take advantage of roads with low traffic volume especially in the dry season. Carnivores were over seven times more likely to follow roads and doing so for longer compared to ungulates. The proposed project has the potential of causing wildlife-vehicle collisions especially during rig move and transportation of shift crew. This can result to severe injury or death of wildlife and/or vehicle occupants. The impact is however anticipated to be low due to the low traffic that will be associated with the proposed project.

Proposed Mitigation Measures

- Wildlife mortalities shall be investigated and appropriate corrective actions implemented to prevent a repeat.
- The new roads will be designed in such a way that speed of vehicles is reduced thus minimizing the risk of accidental wildlife mortalities. For instance, narrowing the road.
- Purposeful selection of routes that address road ecology and road safety would be undertaken prior to road construction.
- Installation of appropriate wildlife warning and information signs aimed at altering driver behaviour. The signage indicate the presence of animals on the road thereby reducing the chances of collision with vehicles.
- The traffic signage should be located prior to the area where the animals are likely to be encountered. In addition, the signage should be placed so that it does not compete with other road or roadside features for the driver's attention.
- Wildlife information signs should be continually assessed for their need and relevance, and those that are no longer applicable be removed.
- Enforcement of speed limits and limiting night time driving.
- Inclusion of education on wildlife protection in the project employee induction program and toolbox talks.
- Implementation of safe driving protocols like not driving under influence of alcohol and drugs.
- Use of escort vehicle during rig move.
- Limit the number of vehicles and movements within the project area of influence where practicable.

7.2.4 Poaching

Wildlife crime has been on the rise especially in the areas outside wildlife protected areas where people resort to poaching (Office of the Auditor-General, 2018). This is driven by poverty, human-wildlife conflict and demand for wildlife products in the illegal market, amongst other factors. 90% of poaching incidents occurs at night (Office of the Auditor-General, 2018). Data on deaths and injuries resulting from human wildlife conflicts indicate a rise in the incidences.

During the construction and operation of the proposed project, there is a likelihood of increased movement of wildlife outside Hell's Gate National Park due to habitat disturbance and in search of pasture and water. This movement would increase the chances of poaching. Continued reduction in wildlife and critical habitats can undermine sustained growth in the tourism sector.

Proposed Mitigation Measures

- Park surveillance and patrols shall be undertaken by KWS rangers in liaison with Critical Infrastructure Protection Unit (CIPU) based at Olkaria.
- Basic training on park rules and regulations should be carried out for the drilling crew.
- Sensitization and awareness of the local community on wildlife conservation measures and the roles of KWS.
- Public disclosure of KWS incident reporting lines (toll free No. 0800 597 000 and mobile: +254 (0) 726610508 -WhatsApp/ +254 (0) 726 610509).
- Reduction of project footprint by adopting the multi-well pad drilling concept.

7.2.5 General Safety and Health Risks

Drilling activities are inherently dangerous and warrant detailed coverage in project specific health and safety planning. The site-specific hazards and potential risks associated with known conditions at the workplace should be identified, reviewed, and addressed in the site-specific Health and Safety Plan (HSP) and Job Safety Analysis (JSA). The safe work procedures specified in the JSAs should be consistent with the overall project HSP and the site-specific health and safety requirements. One of the most effective ways to reduce workplace hazards and injuries is through a comprehensive, proactive safety and health management system. The safety and health management system are a systematic approach to minimize the risk of injury and illness that involves identifying, assessing, and controlling risks to workers in all workplace operations. KenGen subscribes to Occupational Health and Safety Management System (ISO 45001:2018 std). The following are the potential health and safety risks associated with the proposed project. Mitigation measures have been proposed for each of the risks.

7.2.5.1 Handling of Hazardous Chemicals

The Occupational Safety and Health Administration (OSHA) defines hazardous chemical as "any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified."

OSHA defines a health hazard as a chemical that causes:

- Acute toxicity (any route of exposure)
- Skin corrosion or irritation
- Serious eye damage or eye irritation
- Respiratory or skin sensitization
- Germ cell mutagenicity
- Carcinogenicity
- Reproductive toxicity
- Specific target organ toxicity (single or repeated exposure)
- An aspiration hazard

A physical hazard is defined as a chemical that has the following characteristics:

- Explosive
- Flammable (gases, aerosols, liquids, or solids)
- An oxidizer (liquid, solid, or gas)
- Self-reactive
- Pyrophoric (liquid or solid)
- Self-heating
- An organic peroxide
- Corrosive to metal
- Gas under pressure
- Emits flammable gas in contact with water.

During drilling of the proposed geothermal wells some of the hazardous chemicals include cement, diesel, caustic soda, mica flakes, oxygen and acetylene welding set. Proper handling of hazardous chemicals is vital to prevent accidents, injuries, and even fatalities. In addition to the direct bodily harm, they can have a severe impact on the environment. Incorrect disposal or leakage/spillage can contaminate soil, water bodies and air leading to long term ecological damage.

Proposed Mitigation Measures

- A hazard communication program that evaluates potential hazards of drilling chemicals shall be established.

- Information concerning the hazardous nature of chemicals and appropriate measures to protect workers who will be exposed to them shall be promptly disclosed. The program, which shall be documented, will include information on categorization of the chemical (hazardous or not hazardous), labelling, Material Safety Data Sheets (MSDS), requisite training and methods to review and update changes in the program based on chemical usage.
- An inventory of all the hazardous chemicals in the work area shall be completed. Generally applicable measures including engineering controls, safe work practices and Personal Protective Equipment (PPE) should be considered for safe handling and use of hazardous chemicals. The PPEs will include helmets, gloves, safety boots, apron, eye protection or other protective equipment, as appropriate.
- Usage of PPEs shall be enforced and replacement done at predetermined intervals.
- Every workplace dealing with hazardous chemicals should have a comprehensive Emergency Response Plan. The Plan should outline steps to take in case of spills, leaks, or accidental exposure.
- Proper spill containment measures shall be put in place.
- Fit-for-purpose goggles or other suitable eye protection shall be used during gas welding, oxygen cutting, or brazing operations.
- Welding shall be done in enclosed areas free from combustible or flammable materials.
- Hot work permits shall be issued to workers prior to operating the oxygen and acetylene welding set.
- Suitable facilities for quick drenching or flushing of the eyes or body, or both, shall be readily accessible for emergency use where personnel can be exposed to injurious corrosive materials.

7.2.5.2 Occupational Noise Emission

The acceptable noise dose limit of 85 dB(A) is applicable for shift lengths of eight hours/day or more, 40 hours/week, or in case of occasional overtime work, provided the exposure time over one year does not exceed a total of 2000 hours (Shell International Exploration & Production B.V.1995). Noise Induced Hearing Loss (NIHL) is caused by exposure to sound levels or durations that damage the hair cells of the cochlea. Initially, the noise exposure may cause a temporary threshold shift-that is, a decrease in hearing sensitivity that typically returns to its former level within a few minutes to a few hours (National Institute for Occupational Safety and Health,

1998). Repeated exposures lead to a permanent threshold shift, which is an irreversible sensorineural hearing loss. The main sources of high noise levels (above 85 d (BA) at the drilling sites are the diesel generators as shown in table 32. There are five diesel generators at the rig sites. The maintenance team works on one diesel generator as the other four are running. The team is hence at a high risk of NIHL.

Table 34: Noise levels at drilling sites

NOISE FROM DRILLING OF WELL OW49C USING KGN1 RIG			
Time	Date	Site	Noise in dB(A)
2.10PM	16.09.19	Generator	91.9
		Cellar	62.1
		Compressor	55.4
		Supervisor's Office	64.8
2.29PM	19.09.19	Generator	90.8
		Cellar	61.1
		Compressor	54.6
		Supervisor's Office	65.1
12.55PM	08.10.19	Generator	92.4
		Cellar	62.1
		Compressor	56.1
		Supervisors Office	58.9

Proposed Mitigation Measures

- All work areas with noise levels equal to or exceeding the occupational limit of 85 d (BA) shall be categorised as hazard areas and suitable signage installed.
- Workers unable to read the warning signs shall be informed verbally about the instructions printed on signs in hazardous work areas of the facility.
- Workers exposed to noise levels above the occupational limit of 85 d (BA) shall be provided with earmuffs and be trained on their use and operation. The earmuffs shall be selected based on their noise reduction rating.
- All workers who are exposed to noise at or above 85 dBA for 8-hrs shall be informed about the potential consequences of noise exposure and the methods of preventing noise-induced hearing loss (NIHL).
- The employer shall institute a training program in occupational hearing loss prevention for all workers who are exposed to noise at or above 85 dBA for 8-hrs. The employer shall ensure worker participation in such a program. The training shall address, at a minimum, (1) the physical and psychological effects of noise and hearing loss; (2) hearing protector selection, fitting, use, and care; (3) audiometric testing; and (4) the roles and responsibilities of both employers and workers in preventing NIHL.
- Noise shall be accurately measured according to the established procedures and the measurements evaluated against the accepted criteria.
- Noise monitoring shall be undertaken using a calibrated sound level meter set to the A scale, slow response.
- Records shall be maintained as to the noise levels recorded, where they were taken, and the sources of the noise.
- Noise monitoring records shall be updated periodically to determine the trend and corrective actions to be taken.
- Employees who work in or near the high noise area or equipment may have their noise exposure determined through personnel monitoring using dosimeters. Employees monitored will have dosimeters placed on them at the beginning of their normal work shift with the microphone attached in the hearing zone. At the end of the work shift, the dosimeter will be removed and information analysed as soon as possible.
- Audiometric tests for workers exposed to high noise levels shall be conducted and corrective actions taken where abnormal results are noted. These tests shall be undertaken

by a physician, an audiologist, or an occupational hearing conservationist certified by the Directorate of Occupational Safety and Health Services.

- Periodic maintenance of noise emission sources like diesel generators and air compressors.

7.2.5.3 Community Noise Exposure

Well discharge tests have the potential of exposing the neighbouring communities and tourists to high noise levels. This can result to public nuisance, complaints, loss of sleep and disturbance to wildlife. Noise levels measured from well OW-915 during vertical discharge are presented in table 33.

Table 35: Noise levels during vertical discharge

OW-915 VERTICAL WELL DISCHARGE			
TIME	DATE	POINT	NOISE LEVELS dB(A)
1.40pm	30.09.2020	Silencer	123.3
12.56pm	02.10.2020	Silencer	122.9
11.50am	03.10.2020	Silencer	123.4
1.30pm	04.10.2020	Silencer	120.8
12.45PM	05.10.2020	Silencer	121.7
1.25PM	11.10.2020	Silencer	122.4
12.37PM	12.10.2020	Silencer	123.4

Proposed Mitigation Measures

- The duration of vertical discharge tests should be undertaken at most for 12 hours during daytime as far as practicable.
- Establish adequate buffers between the neighbouring villages/facilities and critical habitats.

- Use of improved silencer should be used when carrying out horizontal discharge tests of the wells. Figure 21 shows noise reduction from vertical discharge test of well OW-49C using the improved silencer. The noise was reduced to below 60 dB (A) at a distance of 200 metres and 40 dB(A) at a distance of about 1.2km.

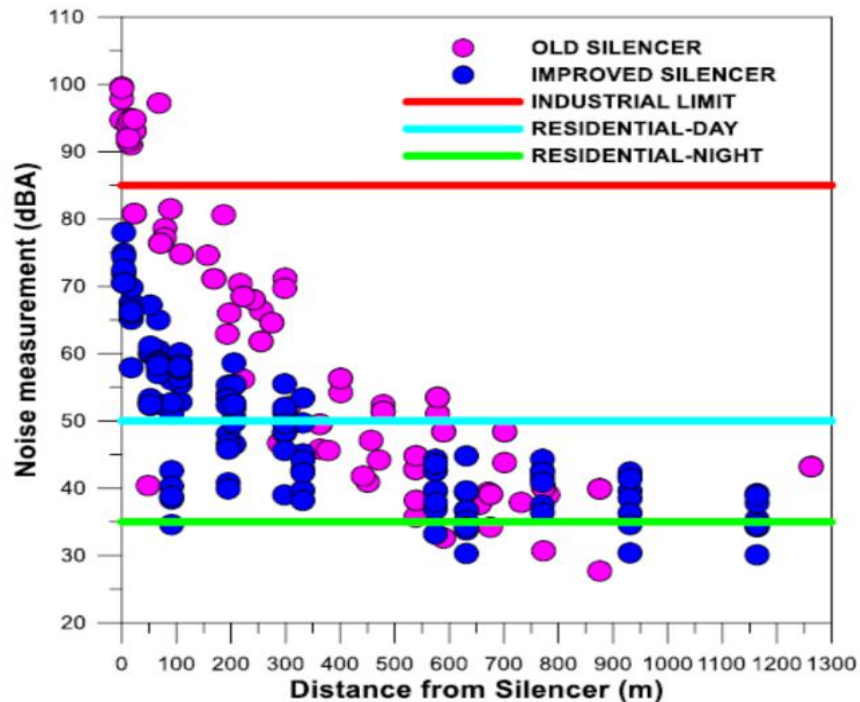


Figure 24: Use of cyclone separator/silencer to mitigate noise from well OW-49C (Rop & Ouma, 2020)

7.2.5.4 Hydrogen Sulphide and Carbon Dioxide Gas Emissions

Common geothermal systems almost always contain dissolved or free carbon dioxide (CO_2) and hydrogen sulphide (H_2S) gases. While these gases contribute to the corrosion problem, H_2S in particular limits the materials that can be used for drilling equipment and for casing to the lower strength steels, because higher strength steels will fail by sulphide stress cracking. H_2S also presents a substantial safety hazard during the drilling process. The work environment standard for harmful gases is specified as "hydrogen sulphide concentration shall not exceed 10 ppm, oxygen concentration should be 18% or more, and/or carbon dioxide concentration shall not exceed 1.5%. Tables 36 to 38 shows the effect of oxygen deficiency, high carbon dioxide and hydrogen sulphide levels at the workplace (Japan Oil, Gas and Metals National Corporation, 2021).

Table 36: Oxygen Deficiency Disease caused by Low Oxygen Level and its Corresponding Symptoms.

Severity Level	Air		Arteria blood		Symptoms
	Oxygen concentration (%)	Oxygen partial pressure (mmHg)	Saturation of oxygen (%)	Oxygen partial pressure (mmHg)	
1.	16 -12	120-90	189-85	60-45	Increased pulse/respiratory rate, decreased concentration, miscalculations, deterioration of fine muscle movement headache, tinnitus, nausea
2.	14-9	105-68	89-74	55-40	Decreased judgment ability, exaltation, mentally unstable (prone to irritability), no pain in wounds, inebriated state, headache, tinnitus, nausea, vomiting, loss of memory at that time, general weakness, increased body temperature, Cyanosis (pale face), stupor
3.	10-6	70-45	74-33	40-20	Loss of consciousness, coma, central nervous system disorder, appearance of Cheyne-Stokes breathing,

Severity Level	Air		Arteria blood		Symptoms
	Oxygen concentration (%)	Oxygen partial pressure (mmHg)	Saturation of oxygen (%)	Oxygen partial pressure (mmHg)	
					cyanosis, generalized muscle spasm
4.	Below 6	Below 45	Below 33	Below 20	Syncope in an instant, coma, slow breathing followed by respiratory arrest and finally cardiac arrest

Note: Cyanosis symptoms are also observed as the lips and nails turning dark purple.

As in the case of poisonous gas poisoning, humans die of brain oxygen deprivation 10 minutes after respiratory arrest and 3-5 minutes after cardiac arrest. This shall be primarily considered when treating the victims.

Table 37: Carbon Dioxide Concentration in Air and its Corresponding Symptoms

Percentage (%) Carbon dioxide concentration in air	Symptoms
0.5	Allowable concentration for occupational health management
1-2	Discomfort occurs
3-4	Symptoms such as increased respiratory rate, increased pulse and blood pressure, headache, dizziness, nausea, etc. appear due to respiratory system stimulation

Percentage (%) Carbon dioxide concentration in air	Symptoms
6-7	Respiratory distress
7-10	Unconsciousness within a few minutes, die of cyanosis
20	Paralyzed in a few seconds and the heart stops

Table 38: Hydrogen Sulphide Poisoning

Concentration (ppm)	Effect by Body Part
0.0047-0.025	Smell: Odour threshold
0.3	Clearly senses odour, do not feel pain after acclimating.
3-5	Moderately strong odour that is unpleasant.
5-10	Odour is extremely unpleasant.
10	Allowable concentration for 8 hours shift. Eye: Lower limit which causes the irritation to the eye's mucous membrane.
20	Respiratory system: Lower limit which causes irritation to the lungs. Eye irritation after 6 hours of exposure.
20-30	Tolerable but after acclimating to this level, one becomes insensible to the

Concentration (ppm)	Effect by Body Part	
	higher concentration of odour (olfactory fatigue).	
50-150	Few hours of exposure results in mild poisoning symptoms.	Conjunctivitis (“gas eye”), itchy eyes, eye pain, feeling of sand in the eyes, feeling dazzling, hyperaemia and swelling, corneal opacification, corneal destruction and peeling, visual field distortion and blurring, light enhancing pain
100-150	Olfactory nerve paralysis appears after 2-15 minutes of exposure, leading to the false sense that the unpleasant odor is rather alleviated.	
100-200	Continuous exposure of 8 – 48 hours leads to bronchitis, pneumonia, suffocation death due to pulmonary edema.	
150-200	Upper limit concentration to feel odour. When the concentration exceeds this level, odour cannot be felt due to olfactory fatigue.	
200	Burning pain to the eye’s mucous membrane, 30 minutes is the tolerable limit.	
170-300	Burning pain in the airway mucosa Exposure less than 1 hour is the upper limit for avoiding serious symptoms	
350-400	1-hour exposure can be life threatening.	
400-700	Exposure of 30-60 minutes can be life threatening.	

Concentration (ppm)	Effect by Body Part	
700	Cranial nerve: Experiencing an excessive breathing for a short time, followed by immediate respiratory paralysis.	
800-900	Loss of consciousness, respiratory arrest and death.	
1000-1500	Immediate syncope, convulsions, death from respiratory Paralysis.	
5000	Immediate death	

Acute hydrogen sulphide poisoning may cause serious prognostic symptoms, such as nervous system complications, cardiovascular system complications and pneumonia, and may also cause other long-term symptoms, including headache, fever, chills, difficulty walking, dementia, post encephalitic complication, etc.

Proposed Mitigation Measures

- An appropriate gas detector system comprising at least two sensors with the capability of continuous measuring both H₂S and CO₂ shall be installed at the site and functioning at all times while the rig is operating.
- Gas detectors shall be maintained in accordance with the Original Equipment Manufacturers (OEM) documentation, and shall activate both audible and visual alarms where maximum occupational limits are exceeded.
- A gas hazard abatement plan shall be prepared and all rig crew and support personnel shall be made familiar with its application.
- Gas hazard escape equipment shall be provided at appropriate locations and available for use at all times when the rig is operational.
- The derrick or mast shall have an auxiliary means of escape installed prior to personnel working on elevated fixed platforms in and on the derrick or mast. The auxiliary escape route should use a specially rigged and securely anchored escape line attached to the

derrick or mast to provide a readily available and convenient means of escape from the elevated fixed platform. The escape line route shall be kept clear of obstructions.

- Escape equipment shall not be used except during an emergency, maintenance or training purposes. Personnel shall be trained in the proper procedure(s) for escaping the derrick or mast.
- All rig and support personnel shall be trained and competent in the use of emergency life support apparatus (ELSA) or equivalent escape equipment. At least one self-contained breathing apparatus (SCBA) shall be onsite, and at least two of the rig crew on every shift shall be trained and competent in its use.
- Approved self-contained or supplied-air breathing equipment shall be used for those atmospheres where tests indicate toxic or hazardous gases are present in quantities immediately dangerous to life or health (IDLH) or oxygen content is less than necessary to sustain life.
- All work areas prone to hydrogen sulphide and carbon dioxide gas emissions shall be identified and suitable signage installed. The information on the signage shall be written in Maa, Swahili and English languages.
- Workers and visitors to the rig site shall be advised of the potential dangers of being exposed to high hydrogen sulphide gas levels.
- A windsock shall be installed at the well pad to show the direction where the wind is blowing to and workers advised to evacuate to the side where the wind is blowing from with respect to the hydrogen sulphide emission source.
- H₂S monitoring shall be undertaken at predetermined intervals using a calibrated gas meter and records maintained as to the H₂S levels recorded, where they were taken, and the time.
- Where the maximum occupational limit of H₂S (10 ppm) is exceeded, staff shall be evacuated, appropriate corrective actions undertaken and allowed to return only after the site has been confirmed to be safe.
- Air from the rig utility system shall not be used as the source for breathing air supply.
- When working at workplaces where harmful gases could be generated and may exceed the work environment standards, gas diffusion fan shall be provided at the workplace, and shall be operated, as necessary.
- Workers who suffer acute hydrogen sulphide gas poisoning shall be treated by a medical specialist. Even if the victim appears to have completely recovered, heavy exposure may

result in fatal pulmonary edema after 1 to 2 days from the event. Victims shall hence be required to take enough rest, regardless of the severity of the injuries, or they may suffer long-term effects.

- Where confined space conditions exist or have the potential to exist e.g. mud tanks, a confined space entry or other permit system should be activated. The system should include the following:
 - a) posting procedures should be at least 2 staff,
 - b) evaluation of permit space conditions (e.g. internal atmospheric testing, internal configuration, etc.),
 - c) procedures for safe entry,
 - d) equipment required (e.g. respiratory protection),
 - e) assignment of entrants, attendants and entry supervisors,
 - f) emergency/rescue procedures,
 - g) multi-employer coordination,
 - h) permit cancellation procedures and
 - i) review practices.
- An induction programme for new rig employees shall be carried out regardless of prior experience to ensure awareness of current standards and practices. In addition to emphasising the responsibilities employees have for their own safety, they shall be instructed on work procedures, safe practices and any emergency responsibility associated with their position and the use of personal protective equipment.

7.2.5.5 Well Blowouts

A blowout (i.e., loss of well control) can be caused by the uncontrolled flow of reservoir fluids into the wellbore and may result in an uncontrolled release of formation fluids and gases into the environment (National Ground Water Association, 2008). Blowout can occur during drilling and work-over phases (where it is of particular concern) or during production phases. A blowout may consist of steam, water, gas, or a mixture of these. It can result to injuries and fatalities.

Proposed Mitigation Measures

- Blowout prevention measures should focus on maintaining wellbore hydrostatic pressure by effectively estimating formation fluid pressures and the strength of subsurface formations. This

can be achieved with techniques such as proper prewell planning and technical reviews (i.e., audits of the well control equipment and personnel competency, independent review of well design and control procedures), drilling fluid logging, and using sufficient hydrostatic head of weighted drilling fluid or completion fluid to balance the pressures in the wellbore.

- Well Contingency plans should be prepared for well operations and should include identification of provisions for well capping in the event of uncontrolled blowout (providing indication of the tools, equipment, and intervention time required) and identification of spill recovery measures.
- A dedicated blowout risk analysis and emergency plan should be prepared, detailing the measures in place to prevent a blowout, the provisions for well control in a blowout scenario (including capping tools and oil spill recovery means), and indicating the time necessary for the intervention. The risk analysis should include a failure mode and effect analysis as well as a reliability analysis of the technical systems in place to control a blowout, as well as reliability analysis of the systems.
- Use of a blowout preventer (BOP) to seal, control, and prevent the uncontrolled release of fluids from a well during drilling operations.
- Provisions should be made for prompt medical attention in case of serious injury to include, but not limited to, transportation of the injured person to a medical treatment facility.
- Each shift should have at least an individual trained in first aid including cardiopulmonary resuscitation (CPR) techniques.
- A first aid kit shall be maintained and available at the worksite. The kit should contain appropriate materials and should be inspected at frequent intervals and replenished as necessary.
- Air compressors may be required for backup BOP accumulator pump thus they should be inspected at least once in a period of twenty-four months by a government approved inspector.
- Pre-job, or toolbox meetings shall be undertaken daily for the purpose of discussing health and safety concerns specific to a particular job.

7.2.5.6 Fire Risk

Fire risk is likely to arise as a result of storage and use of flammable materials at the drilling site. It can result to loss of life and/or property. Spread of fire within the national park has the potential of damaging the habitat, injuring wildlife and even causing fatalities. The effect will be worst felt during the dry season.

Proposed Mitigation Measures

- Fire audits shall be undertaken at the rig sites at least once in a year.
- Fire extinguishing equipment shall be available, suitably located, readily accessible, and plainly labelled as to their type and method of operation.
- Fire extinguishing equipment shall be accessible and free of obstructions during operations.
- Drilling crew members shall be familiar with the location of fire extinguishing equipment, emergency assembly point and shall be trained in the use of such equipment, application, and associated hazards.
- Discarded oily rags and combustible waste should be stored in metallic containers with the covers kept in place.
- Smoking shall be permitted only in designated areas.
- Fire drills shall be conducted at the respective rig sites (N370, KGN 1 or KGN 2) at least once in a year.
- Fire marshals shall be designated and trained at predetermined intervals.
- Fire extinguishing equipment shall be periodically inspected and maintained in operating condition. A record of the most recent equipment inspection shall be maintained.
- Fire emergency response plan shall be prepared and tested periodically.
- The rig health and safety committee should meet (preferably weekly i.e. during shift change) and minutes documented.
- Establishment and maintenance of fire breaks around the well pads.
- Workplace inspections shall be undertaken by the health and safety committee members at least once in a month.
- Implementation of the hot work permit to work system.
- Installation of smoke detectors.

7.2.5.7 Falling Objects

Objects falling from height as well as accidental collapse of the rig are a potential source of injuries and fatalities.

Proposed Mitigation Measures

- A risk assessment should be performed to determine the appropriate safe location and distance from the centre of a derrick or mast to minimize the potential of the derrick or mast striking workers or equipment in the fall zone.
- Lifting and rigging devices in use shall be designed to handle expected load capacity. A risk assessment shall be performed before using these devices.
- When personnel are climbing or working at heights, tools shall be secured, or the relevant risk be mitigated).
- Load-bearing, hydraulic-levelling jacks shall have a safety lock device, double valves, or equivalent.
- In well servicing operations, personnel shall be out of the derrick/mast, or cellar, or both, and stand clear when a downhole assembly is being unseated or when initial pull on the tubing or rods is made.
- Tools, parts, and other materials shall not be kept in the derrick or mast above the rig floor unless they are in use and measures are taken to prevent them from falling.
- All lifting equipment shall undergo statutory inspection by an approved government inspector.
- Rods, tubulars, drill pipe, and drill collars racked or hung on the derrick should be secured to prevent them from falling across the derrick or mast.
- Safety clamps (e.g. wedding band, dog collar) shall be removed from drill collars, flush joint pipe, or similar equipment before they become an overhead hazard.

7.2.6 Geothermal Fluids Withdrawal and Discharge

Geothermal fluids comprise of drilling fluid and brine. Brine from the Olkaria reservoir has been found to be slightly alkaline with elevated levels of TDS, Sulphides, Chloride, Arsenic and Boron (5 Capitals, 2015). The temperatures are usually as high as 85°C. On the other hand, drilling fluid contains a mixture of chemicals used for drilling. Discharge of hot geothermal fluids into environment has the potential of causing pollution of surface water bodies, damage to vegetation and injuries to wild animals or people.

Heavy metals become harmful when their rate of accumulation is faster than rate at which they can be discharged. Such high concentrations of metallic elements interfere with plant roots. When such plants are consumed, the metals find their way into the food chain. Metallic elements can be taken in by animals through ingestion, inhalation or skin absorption. The effect to human

beings includes cardiovascular, bone diseases, nervous system disorders as well as kidney problems.

The removal of geothermal fluid from underground reservoirs, may cause the rock formations above it to compact, leading to subsidence of the land surface. While this is rare in vapor-dominated fields, it can happen in liquid dominated fields if reinjection is not practiced to maintain reservoir pressures. The geothermal system at Olkaria consists of a two-phase reservoir. The wells produce 75% water and 25% steam. Separation of steam is done using cyclone separators from where dry steam is piped to the powerhouse and separated water injected back into the reservoir. With continuation of the existing reinjection program, land subsidence is not envisaged.

Proposed Mitigation Measures

- Drilling fluid and geothermal brine should be contained in ponds lined with High-Density Polyethylene (HDPE) Geomembrane.
- All ponds used for containment of geothermal fluids should be fenced to prevent access by wildlife and unauthorized persons.
- The drilling fluid should be recirculated in order to save on chemical usage.
- Installation of safety signage written in Maa, Swahili & English languages. The signage should be installed at strategic points.
- Physicochemical analysis of the chemistry of the geothermal fluids to inform operational controls to be put in place.
- Depending with the quantities of geothermal fluids extracted, overflow ponds shall be provided as necessary.
- Pond levels shall be monitored to prevent accidental overflow.
- In case of accidents/incidents, a systematic and methodical investigation shall be carried out to identify the root causes and prevent future accidents.
- Installation of measures to prevent natural surface drainage from entering the pit or breaching during heavy storms (e.g. careful siting, berms).
- Continue with implementation of the reinjection program within the Olkaria Geothermal Field.
- Continue monitoring surface deformation and topographical drift using the 6 Global Navigation Satellite Systems installed at Olkaria.

- Continue monitoring deformation associated with likely mass withdrawal from the geothermal reservoir using gravity monitoring methods.
- Development of a landslide/land subsidence emergency preparedness and evacuation plan.
- Conduct geotechnical surveys at the well pads prior to continuing with well drilling in case of encountering challenges below ground surface.

7.2.7 Risk of Pollution of Lake Naivasha and Underground Water Resources

The risk of contamination of surface and underground aquifers by geothermal fluids has been demonstrated by various studies. Results of monitoring of surface and ground water quality during drilling of three deep geothermal exploration wells in Meshkinshahr geothermal project, NW- Iran revealed contamination (Noorollahi & Sahzabi, 2005). The geothermal project drilling sites were located almost at the onset of the Khyav River and at higher elevation than the river base. In this study, the concentration of TDS, Ca, K, Mg, pH, Fe, Cu, SO₄, NO₃ and Si of samples of river water collected downstream increased during drilling of the exploration wells and reduced upon finalizing drilling. To find out the pathways for the contamination to the river, three possibilities were considered i) flow from faults and fractures associated with drill sites to the river, ii) pollution from discharges of cold shallow recourses, which were polluted by drilling fluids, and iii) pollution by discharges from deep hot geothermal reservoirs which discharged through hot springs along the river canal. Chemical pollutants tend to persist for an extended period, which gives enough time for contamination of deeper aquifers.

The risk of pollution of Lake Naivasha waters through underground seepage and infiltration of effluent is minimal since Lake Naivasha is typically a source lake. It does not receive ground water from any other source. As a closed basin lake, Naivasha owes its freshness to underground outflows estimated at about 50 Mean Million Cubic Metres (MCM) according to many studies. Source lakes discharge water into ground and are often fresh in nature. Southerly flow towards Lake Magadi is exclusively through a deep regional aquifer system while northerly flow towards Elementaita and Nakuru is in flow towards Lake Baringo and is through a deep aquifer as well (Wakhungu, 2017). There are no water boreholes that have been drilled in the vicinity of the proposed project sites thus the risk of contamination by seepage of geothermal fluids through faults and fractures is very minimal.

Proposed Mitigation Measures

- i. Production casing strings (9.625 inch) will be incorporated in the design of the proposed wells to prevent ingress or loss of fluid into or from the well, and “communication” or leakage of fluids between different aquifers. The casings are set depending on the geological aspect of the reservoir ranging from 750 to 1200 metres.
- ii. Incidences of accidental effluent discharge, with the potential of polluting Lake Naivasha, should be investigated promptly and effective operational controls instituted.

7.2.8 Pressure on Fresh Water from Lake Naivasha

Changes in Lake Naivasha water level is attributed mostly to the amount of water used, rainfall, evaporation and underground seepage. The lake level reduction may also be related to deforestation in the catchment area which has led to the reduced water quantities in rivers that feed the lake (Njiru et al, 2017). An adequate supply of water is required while undertaking all drilling operations. The supply rate shall be adequate for all quenching, drilling (including drilling without returns of circulation) and cementing operations. Typically, 800 – 1000 litres per minute of water would be required for quenching which takes a period of not less than 12 hours (African Union, 2016). At Olkaria, approximately 140,000 cubic meters (140 million litres) is required for drilling of a single geothermal well to a total depth of 3,000 m. KenGen abstracts water from Lake Naivasha for commercial and domestic uses at Olkaria by virtue of water abstraction permit Ref. WRMA/20/NSA/2GD/22/S which expires on 24th November 2027 (Refer to appendix 12). The maximum permitted water abstraction limit is 248,000M³ per month. The amount of water abstracted for use at Olkaria during the period January to September 2024 is shown in figure 25.

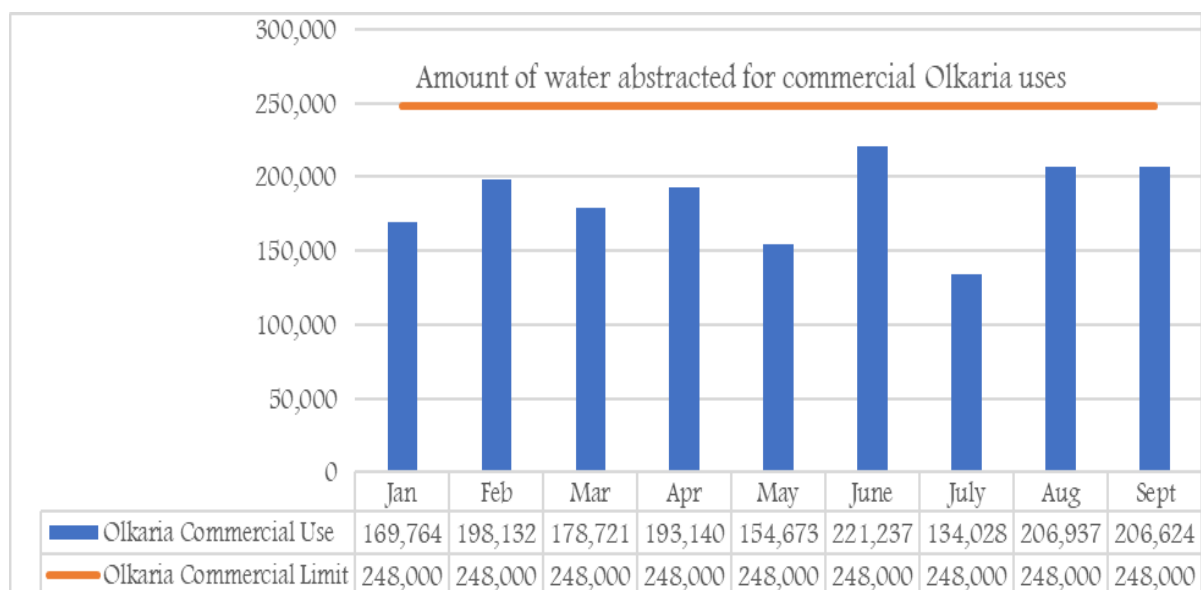


Figure 25: Monthly Water Consumption for Olkaria Commercial Uses

The quantities of water abstracted when drilling of geothermal wells was ongoing using the three KenGen rigs did not exceed the maximum recommended limit for the entire period under consideration. The highest water consumption was 221,237 M³ in June 2024. KenGen intends to utilize the three available rigs to drill the proposed geothermal wells thus increased pressure on Lake Naivasha, as a result of the proposed project, is not envisaged within the proposed project's implementation time line of five years.

Proposed Mitigation Measures

- Identify and promote water conservation measures including supplementing drilling water with geothermal fluids and promptly addressing leakages.
- Promote education and awareness among employees about the essential role of water and its intrinsic value. This will facilitate better informed decision making and more sustainable water consumption patterns.
- Continue monitoring the quantities of water abstracted from Lake Naivasha and used for drilling of the proposed geothermal wells.
- Continue monitoring lake levels to inform appropriate water resource management measures.
- Ensure periodic calibration of the water flow meters for the water supplied to the rig sites.
- Promote catchment conservation initiatives through tree planting.

7.2.9 Waste Generation

Drilling of geothermal wells generates waste. Lack of proper waste management measures can result to public nuisance, environmental pollution, and aesthetic degradation and health effects. The types of waste generated at Olkaria drilling sites are provided in table 39.

Table 39: Types of Waste Generated at Olkaria Rigs and the Current Management Practise

Index	Type of Waste	Existing Management Measure
1.	Used oil	<ul style="list-style-type: none">• Drained in metallic drums which are transferred to the designated temporary storage area at Mitsubishi yard.• Sold to NEMA licensed waste handlers.
2.	Domestic sewage	Disposed in pit latrine dug at the site.
3.	Empty plastic drums for the drilling detergent.	Reused at the drilling detergent manufacturing plant operated by KenGen behind the Runda Staff Quarters.
4.	Empty metallic drums, scrap metals and plastic casing protectors.	<ul style="list-style-type: none">• Accumulated and temporary stored at the designated scrap metal yard.• Sold to scrap metal dealers licensed by NEMA and Scrap Metal Council.
5.	Food waste	<ul style="list-style-type: none">• Disposed in waste bins provided at the site.• Offsite disposal through NEMA licensed handlers.
6.	Oily rags	<ul style="list-style-type: none">• Segregated and disposed in waste bins provided at the site.• Disposed through NEMA licensed incinerator operators.
7.	Drilling cuttings	Accumulated in the drilling fluid recirculation ponds and disposed in burrow pits within the geothermal field.

Index	Type of Waste	Existing Management Measure
8.	Gunny bags for drilling materials	Accumulated and disposed through NEMA licensed handlers.
9.	Used oil filters from the diesel generators.	Accumulated in containers and disposed via NEMA licensed incinerator operators.

Proposed Mitigation Measures

- Animal proof waste cages shall be provided at the drilling site for temporary accumulation of waste.
- Adopt the 5Rs (Refuse, Reduce, Reuse, Repurpose and Recycle) approach in waste management.
- Ensure proper waste segregation and containment at the source. Waste segregation is an environmental best management practice designed to reduce costs through storing incompatible wastes separately, including separating hazardous from non-hazardous wastes, or regulated from non-regulated wastes.
- Contract scrap metal dealers who are licensed by NEMA and Scrap Metal Council to buy metallic drums, scrap metals and plastic casing protectors.
- Contract a NEMA licensed incinerator operator to collect and incinerate oily rags and oil filters.
- No burning of solid waste shall be undertaken at the site.
- Contract NEMA licensed waste transporters for the used oil and non-hazardous waste to dispose the waste at county approved sites.
- Dully filled waste tracking sheets shall be maintained at the site. Waste tracking refers to a system by which the handling, movement, treatment, and disposal of wastes are monitored by the waste generator.
- Backfill the pit latrine upon completion of drilling.
- Empty plastic drums shall be reused at the drilling detergent manufacturing plant operated by KenGen.
- Create awareness and education amongst workers on laid down waste management measures.

- Single use plastic bottles shall be discouraged via use of water dispensers with reusable water bottles.
- The various waste streams generated should be documented and related records filed. Generators should develop a Waste Disposition Report (WDR). The WDR is a summary of the types and quantities of wastes, the point(s) of generation/consolidation and the specific disposal method(s) utilized. All hazardous and many non-hazardous wastes which are treated/disposed should be included.
- Regular inspections of stored hazardous wastes (oily rags and used oil) should be performed and corrective actions taken as appropriate.

7.2.10 Air Emissions from Internal Combustion Engines

Air emissions refers to the gases and particles which are put into the air or emitted by various sources. Such pollutants include carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM), and sulphur dioxide (SO₂). The emission sources include internal combustion engines and open burning of solid waste. Air emissions have the potential of causing climate change, public nuisance, acid rain and health related complications. The three KenGen rigs are powered by the diesel generators shown in table 40.

Table 40: Generators that Power KenGen Rigs

Index	Location	Genset kVA			Make
1.	KGN-1	Prime (50Hz)	Power	1714 kVA	Caterpillar
2.	KGN-2	Prime (50Hz)	Power	1714 kVA	Caterpillar
3.	N370	Prime (50Hz)	Power	Torque converter	National Oilwell Varco

Flue gas emission testing for the above generators was carried out on 27th and 28th February 2024 (Eurolab Services Ltd, 2024). The results are shown in table 41.

Table 41: Flu Gas Emissions

Pollutant	Units	KGN-1 Genset 2	KGN-2	N370	EMC Regulatory Limit- Small combustion facilities
Sulphur Dioxide, SO ₂	mg/Nm ³	BDL	BDL Below Detection Limit (BDL)	1.91	Use 1.5% Sulphur fuel
Nitrogen Oxides, NO _x	mg/Nm ³	1274.50	1440.49	747.57	1460
Carbon Monoxide, CO	mg/Nm ³	336.18	343.30	241.94	N/A

The results indicate that the average concentrations of the parameters measured were within the standards stipulated under the Environmental Management and Coordination (Air Quality) regulations, 2014. Sulphur dioxide concentration for KGN-1-Genset 2 and KGN-2 was below the detection limit of the method used (Eurolab Services Ltd, 2024).

The rig containers are served with air conditioners fitted with R22 and R410a refrigerants. Leakage of R22 into the atmosphere has the potential of destroying the ozone layer.

Proposed Mitigation Measures

- Monitoring of stack emissions from the diesel generators shall be undertaken periodically.

- Analysis of fuel quality shall be undertaken during delivery to the drilling site.
- Regular maintenance of internal combustion engines.
- Fuelling of company vehicles at accredited fuelling stations.
- Usage of R22 refrigerant in the air conditioning system shall be phased out.

7.2.11 Risks of Conflicts with the Neighbours

Conflicts are often related to disputes over the use of natural resources, including land and water by owners, farmers or pastoralists. Conflicts between pastoralists and other land users around land ownership have been reported. Climate change, particularly desertification, has exacerbated this form of conflicts. The presence of large infrastructure projects is an important driver, increasing hostilities related to land ownership and restrictions of pastoral mobility (World Bank, 2020). The Maa community has attachment to their indigenous land, ancestral territory and its resources (World Bank, 2016). Part of the proposed site for the project borders two Maasai villages, Olomayiana Kubwa and Narasha as well as Orpower 4 geothermal concession area. The community has an arrangement with KWS where they migrate with their livestock through the national park in search of greener pastures outside the park. Potential accidents involving livestock are likely to spark conflicts. In the recent past, conflicts involving sharing of economic and employment opportunities have been witnessed at Olkaria. Besides community related conflicts, encroachment on Orpower 4 concession area can result to legal battles brought about by resource use conflicts.

Proposed Mitigation Measures

- Undertake continuous engagement of the neighbouring Maa community to provide information on progress of the project. The established stakeholder engagement structures should be used.
- Vehicular traffic should be controlled during migration of domestic livestock through the National Park.
- Implement the grievance and complain handling mechanism (GCHM) that will promptly resolve potential conflicts. The GCHM should be disclosed to the neighbouring community.

- Establish an adequate buffer between geothermal concession areas owned by Orpowa 4 and KenGen Plc in liaison with the Ministry of Energy.
- A portion of the unskilled employment opportunities arising from proposed drilling of geothermal wells should be allocated to the local community.
- Raise awareness among the local community on the available government procurement opportunities related to the proposed project. These should target the youths, women and people living with disabilities.

7.2.12 Risk of Spread of Communicable Diseases

A communicable disease is one that spreads from one person or animal to another or from a surface to a person. They are the result of pathogens such as viruses and bacteria. They can transmit through contact with bodily fluids, insect bites, contaminated surfaces, water and foods or through the air. The potential for transmission of communicable diseases is influenced by a complex interplay of host, agent and the environment. Each of the KenGen rigs will be operated in four shifts with each shift containing thirty-four (34) workers. Examples of communicable diseases that are likely to spread due to the proposed project include HIV/AIDS, other Sexually Transmitted Diseases, typhoid, cholera, mpox etc. The diseases are likely to spread to both the workers and the neighbouring community.

Proposed Mitigation Measures

- Enhance education and awareness in prevention and control of communicable diseases among the workers and the local community members.
- Provide psychosocial support to the affected workers in order to avoid or reduce stress.
- Improve access to potable water for drinking and washing hands at the rig sites.
- The shift workers shall be housed at the camping facilities to minimize movement that can create risk of transmission of communicable diseases.
- Arrange for mobile Voluntary Counselling and Testing of the workers and the neighbouring communities.

- The camping facilities shall be maintained in proper hygienic condition. These shall include regular cleaning, disinfection, fumigation and washing of beddings.
- Provision and equipping of condom dispensers at the workplaces and neighbouring communities to prevent the spread of HIV and other Sexually Transmitted Diseases.

7.2.13 Preservation of Archaeological and Cultural Assets

The study of archaeological and other historical resources is important to (a) fulfil an innate curiosity about the past, since the origins and development, lifestyles, economy and industry of previous generations can be traced and understood through archaeological remains; (b) contribute to the sense of tradition and culture; and (c) promote a sense of national identity.

Archaeology is a vital component of recreation, since many people enjoy visiting archaeological sites and studying archaeological remains. It contributes to education. Archaeological and other historical remains are a fragile and finite resource that needs to be carefully managed and conserved.

The majority of the objects of archaeological, palaeontological, historical, cultural or scientific interest are smaller and often hidden below ground, surviving as features such as pits, postholes, gullies and ditches cut into the subsoil. Very often the evidence is in the form of artefacts, like coins, pottery sherds, stone tools, and metal objects. There are no archaeological or cultural assets within the proposed project sites thus no negative impacts are envisaged. The cultural assets are located at the Maasai Cultural Centre which falls outside Hell's Gate National Park.

Proposed Mitigation Measures

- An archaeological watching brief will be carried out during the relevant stages of development. These stages will involve earth moving, topsoil stripping, and the digging of foundations and services. The watching brief will enable any archaeological evidence encountered to be recorded and removed if appropriate.
- Where unexpected archaeological remains are found within the project site, KWS and National Museums of Kenya will be informed.

8 PROJECT ALTERNATIVES FOR THE PROPOSED DRILLING OF FORTY-TWO GEOTHERMAL WELLS IN HELL’S GATE NATIONAL PARK

When conducting an Environmental and Social Impact Assessment (ESIA) study for the proposed drilling of forty-two geothermal wells’ project in Hell's Gate National Park, consideration of project alternatives is necessary. These alternatives provide different options for achieving the project's objectives while minimizing negative environmental and social impacts. Below are potential project alternatives for the proposed drilling of forty-two geothermal wells:

8.1 No Project Alternative

This alternative involves not proceeding with the geothermal drilling project as discussed in table 42.

Table 42: Alternative of not proceeding with the geothermal drilling project

Advantages	Disadvantages
<ul style="list-style-type: none">• No disruption to the ecosystem within Hell's Gate National Park	<ul style="list-style-type: none">• Missed opportunity to harness clean geothermal energy, which is vital for Kenya's growing energy needs
<ul style="list-style-type: none">• Avoids potential negative impacts on wildlife, vegetation, and local communities	<ul style="list-style-type: none">• Continued reliance on fossil fuels or less sustainable energy sources that contributes to climate change.
<ul style="list-style-type: none">• Preserves the Park’s aesthetic and ecological value	<ul style="list-style-type: none">• Limits Kenya’s progress toward meeting climate goals and growing energy demands

8.2 Well Drilling Design

The drilling design considered both vertical and directional wells. In the past geothermal wells were mostly vertical and the same usually also applies to the first wells (exploration wells) in fields where development is just starting. Recently, directional wells have become popular in many geothermal fields in the world including the Greater Olkaria Field. The principal benefits are that fewer drill-pads and less surface piping are needed. This translates into reduced

environmental impacts and costs associated with well pad preparation and piping. Directional drilling also enables reaching drilling targets that are not easily accessible by vertical wells. KenGen will use both designs in the proposed project. More emphasis will be on drilling directional wells.

8.3 Well Pad Preparation Design

The design of the well pads put into consideration the environmental impacts associated with well pad preparation. Thus, each pad will have multiple cellars to minimize on the number of well pads prepared. Three categories of well pads are listed below:

- i. Well pad measuring 180m by 104m for three cellars.
- ii. 220m by 104m for four cellars.
- iii. 150m by 104m for two sites lying back-to-back.
- iv. 110m by 94m for one cellar.

This will go along way to minimize the area of vegetation that will be cleared, and amount of dust generated.

8.4 Alternative Locations for Geothermal Wells

This entails exploring drilling of the geothermal wells outside Hell's Gate National Park in less ecologically sensitive areas within the geothermal-rich Rift Valley as discussed in table 43.

Table 43: Alternative location for geothermal wells

Advantages	Disadvantages
<ul style="list-style-type: none"> Reduces the impact on wildlife habitats and biodiversity in the national park. 	<ul style="list-style-type: none"> Other locations may have lower geothermal potential or higher costs due to infrastructure requirements
<ul style="list-style-type: none"> Avoids potential conflicts with conservation efforts and tourist activities 	<ul style="list-style-type: none"> Land access and acquisition issues could arise, potentially affecting local communities

Advantages	Disadvantages
<ul style="list-style-type: none"> Allows for energy generation without impacting an ecologically sensitive area 	<ul style="list-style-type: none"> Transportation and access to alternative locations might be more challenging

8.5 Drilling Geothermal Wells in Phases

It involves implementing the geothermal wells drilling process in phases, starting with a small number and expanding based on environmental monitoring results as discussed in table 44.

Table 44: Drilling of geothermal wells in Phases

Advantages	Disadvantages
<ul style="list-style-type: none"> Allows for adaptive management of environmental impacts, with ongoing assessments and mitigations at each phase 	<ul style="list-style-type: none"> Phased drilling may delay the full realization of energy generation capacity
<ul style="list-style-type: none"> If significant negative impacts are identified, further drilling can be restructured 	<ul style="list-style-type: none"> Additional administrative and regulatory approvals may be required at each phase, potentially causing delays
<ul style="list-style-type: none"> Spread-out investment and drilling to reduce financial and ecological risks 	

8.6 Alternative Renewable Energy Sources

It involves developing alternative renewable energy sources as shown in table 45.

Table 45: Alternative renewable energy sources

Advantages	Disadvantages
<ul style="list-style-type: none"> Consider alternative renewable energy projects outside the geothermal wells, 	<ul style="list-style-type: none"> Solar and wind power generation are less reliable than geothermal energy due to the vagaries of weather

Advantages	Disadvantages
such as solar or wind energy, outside Hell's Gate National Park	
<ul style="list-style-type: none"> Solar or wind energy has a much lower ecological footprint compared to geothermal drilling 	<ul style="list-style-type: none"> Hell's Gate's unique geothermal potential may go untapped, and Kenya would miss out on utilizing a proven clean energy source
<ul style="list-style-type: none"> It could preserve the natural beauty and ecological balance of the national park 	<ul style="list-style-type: none"> Land requirements for large-scale solar or wind farms could also have ecological impacts if not well-sited
<ul style="list-style-type: none"> Lower water usage compared to geothermal drilling, which typically requires substantial water for cooling and operation 	

8.7 Enhanced Conservation and Mitigation Measures

Proceed with the project but implement enhanced environmental mitigation measures, such as habitat restoration, mapping wildlife routes, and offset programs as discussed in table 46.

Table 46: Conservation and mitigation measures

Advantages	Disadvantages
<ul style="list-style-type: none"> Balances geothermal energy development with conservation, reducing long-term impacts on the ecosystem 	<ul style="list-style-type: none"> Implementation of mitigation and conservation measures can be costly

Advantages	Disadvantages
<ul style="list-style-type: none"> Increased monitoring can ensure early detection of environmental changes and allow for adjustments 	<ul style="list-style-type: none"> Even with mitigation, some irreversible environmental impacts may occur
<ul style="list-style-type: none"> Offsetting measures, such as habitat restoration, can benefit the local environment 	

8.8 Conclusion:

Each alternative has its trade-offs between environmental protection, energy generation, and economic viability. The choice of a suitable alternative should prioritize both the project's energy objectives and environmental conservation goals, especially given the sensitive nature of Hell's Gate National Park as a protected area and a significant tourist destination.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

ESMP for the proposed drilling of 42 geothermal wells is shown in table 47.

Table 47: ESMP for the proposed drilling of 42 geothermal wells

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Loss of vegetation and Soil Erosion	➤ Loss of life and damage to property due to floods or landslides.	Well siting shall take into consideration critical habitats.	Internal costs	Prior to well pad construction	Olkaria Well Siting Committee - KenGen
	➤ Growth of invasive species	KenGen-KWS joint baseline studies shall be undertaken for each well pad and new roads to facilitate preparation of site specific EMPs.	1,000,000 per site	Prior to well pad and road construction	Olkaria Well Siting Committee - KenGen
	➤ Sedimentation of Lake Naivasha	So far as practicable, identification of existing roads that	Not applicable	Prior to construction of new roads.	Olkaria Well Siting Committee - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		can connect to the new sites shall be done.			
		Suitable storm water drainage system shall be incorporated in the design of the new roads and well pads.	10,000,000	During construction of well pads and new roads.	Olkaria Civil Infrastructure Division ~ KenGen
		Slope gradients shall be designed to assure stability and erosion protection measures like gabions and grassing incorporated.	10,000,000	During construction of well pads and new roads.	Olkaria Civil Infrastructure Division ~ KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Cut slopes shall be regularly monitored to detect erosion and remediate promptly.	Cost of remediation to determined after monitoring.	During and after drilling of the proposed geothermal wells.	Olkaria Civil Infrastructure Division - KenGen
		Soil disturbance shall be limited to the minimum amount necessary for construction of the well pad and roads.	Not applicable	During construction of the new roads and well pads.	Olkaria Civil Infrastructure Division - KenGen
		Effective control of weed species within the well pads and roads will be undertaken.	2,000,000 per annum	During and after drilling of the proposed geothermal wells.	Olkaria Civil Infrastructure Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Regular monitoring of the revegetated areas to determine survival rate.	Internal costs	During construction of well pads and new roads as well as drilling of geothermal wells.	Olkaria Civil Infrastructure Division - KenGen
		Effective monitoring of the pond levels and provision of overflow ponds as may be deemed necessary.	Internal costs.	During drilling and well discharge tests.	Olkaria Civil Infrastructure Division - KenGen
		Establish flood emergency response plan which shall be periodically tested.	Internal costs	Prior to construction of the new roads and well pads.	Olkaria Quality and Safety Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Dust Emission	<ul style="list-style-type: none"> ➤ Human ailments ➤ Public nuisance 	Water bowsers will be used to water unpaved well pads and road surfaces as conditions require.	5,000,000	During construction of new roads and well pads.	Olkaria Civil Infrastructure Division - KenGen
		Areas involving materials handling will be sprayed with water as conditions require.	1,000,000	During drilling of the proposed geothermal wells.	Olkaria Drilling and Logistics Division -KenGen
		Cement will be transported in enclosed banana trucks.	Not applicable	Prior to and during drilling of the proposed geothermal wells.	Olkaria Drilling and Logistics Division -KenGen
		Enforcement of defined speed limits on unpaved roads.	Not applicable	During and after construction of new roads.	Olkaria Quality and Safety Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Monitoring of dust emission on unpaved surfaces and implementation of effective controls as necessary.	Internal costs	During and after construction of new roads.	Olkaria Quality and Safety Division - KenGen
		Workers will be provided with appropriate personal protective equipment including aprons and particulate respirators.	500,000	During construction of the new roads and well pads.	Olkaria Quality and Safety Division - KenGen
		Any complaints received will be registered and trigger a review of the relevant dust	Internal costs	During and after construction of the new roads and well pads.	<ul style="list-style-type: none"> ➤ Olkaria Quality and Safety Division - KenGen ➤ Olkaria Sustainable Development

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		management procedure/s.			Division ~ KenGen
Risk of Wildlife-Vehicle Collisions	Wildlife/human injuries and mortality	Wildlife mortalities shall be investigated and appropriate corrective actions implemented to prevent a repeat.	Internal costs	Throughout the project cycle	<ul style="list-style-type: none"> ➤ Olkaria Quality and Safety Division ~ KenGen ➤ Olkaria Sustainable Development Division ~ KenGen
		The new roads will be designed in such a way that speed of vehicles is reduced thus minimizing the risk of accidental wildlife mortalities. For instance, narrowing the road.	To be included in cost for road construction.	During road design	Olkaria Civil Infrastructure Division ~ KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Purposeful selection of routes that address road ecology and road safety would be undertaken prior to road construction.	Internal costs	Prior to road design	Olkaria Well Siting Committee - KenGen
		Installation of appropriate wildlife warning and information signs aimed at altering driver behaviour.	10,000 per signage	During road construction.	Olkaria Quality and Safety Division - KenGen
		The traffic signage should be located prior to the area where the animals are likely to be encountered.	Not applicable	During road construction.	Olkaria Quality and Safety Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Wildlife information signs should be continually assessed for their need and relevance, and those that are no longer applicable be removed.	Internal costs	Throughout project cycle	Olkaria Quality and Safety Division ~ KenGen
		Enforcement of speed limits and limiting night time driving.	Internal costs	Throughout project cycle	Olkaria Quality and Safety Division ~ KenGen
		Inclusion of education on wildlife protection in the project employee induction program and toolbox talks.	Internal costs	Throughout project cycle	Olkaria Sustainable Development Division ~ KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Implementation of safe driving protocols like not driving under influence of alcohol and drugs.	Internal costs	Throughout project cycle	Olkaria Quality and Safety Division - KenGen
		Use of escort vehicle during rig move.	Internal costs	During rig move	Olkaria Drilling and Logistics Division- KenGen.
		Limit the number of vehicles and movements within the project area of influence where practicable.	Not applicable	Throughout project cycle	Olkaria Drilling and Logistics Division- KenGen.
Poaching	➤ Reduced tourism opportunity	Park surveillance and patrols shall be undertaken by KWS rangers in liaison with Critical	300,000 per month	Throughout project cycle	Olkaria Security and Investigations Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
	➤ Reduction in animal population	Infrastructure Protection Unit (CIPU) based at Olkaria.			
		Basic training on park rules and regulations should be carried out for the drilling crew.	Internal costs	Throughout project cycle	Olkaria Sustainable Development Division - KenGen
		Sensitization and awareness of the local community on wildlife conservation measures and the roles of KWS.	Internal costs	Throughout project cycle	Olkaria Sustainable Development Division - KenGen
		Public disclosure of KWS incident reporting lines.	Not applicable	Throughout project cycle	Olkaria Sustainable

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
					Development Division - KenGen
		Reduction of project footprint by adopting the multi-well pad drilling concept.	Not applicable	During well siting	Olkaria Well Siting Committee - KenGen
Handling of Hazardous Chemicals	<ul style="list-style-type: none"> ➤ Injuries ➤ Loss of life ➤ Soil and water pollution 	A hazard communication program that evaluates potential hazards of drilling chemicals shall be established.	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Information concerning the hazardous nature of chemicals and appropriate measures to protect	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		workers who will be exposed to them shall be promptly disclosed.			
		An inventory of all the hazardous chemicals in the work area shall be completed and PPEs provided.	15,000,000/annum for PPE	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Usage of PPEs shall be enforced and replacement done at predetermined intervals.	15,000,000/annum for PPE	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Every workplace dealing with hazardous chemicals should have a	Not applicable	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		comprehensive Emergency Response Plan.			
		Proper spill containment measures shall be put in place.	200,000 per rig site	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Fit-for-purpose goggles or other suitable eye protection shall be used during gas welding, oxygen cutting, or brazing operations.	1,000,000	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Welding shall be done in enclosed areas free from combustible or	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		flammable materials.			
		Hot work permits shall be issued to workers prior to operating the oxygen and acetylene welding set.	Internal cost	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Suitable facilities for quick drenching or flushing of the eyes or body, or both, shall be readily accessible for emergency use.	100,000/rig	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
Occupational Noise Emission	<ul style="list-style-type: none"> ➤ Hearing impairment ➤ Public nuisance 	All work areas with noise levels equal to or exceeding the occupational limit	150,000/rig for the signage.	During geothermal well drilling	Olkaria Quality & Safety Division- KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		of 85 d(BA) shall be categorised as hazard areas and suitable signages installed.			
		Workers unable to read the warning signs shall be informed verbally about the instructions printed on signs in hazardous work areas of the facility.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen
		Workers exposed to noise levels above the occupational limit of 85 d(BA) shall be provided with earmuffs and	5,000,000/annum	During geothermal well drilling and testing.	Olkaria Quality & Safety Division-KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		be trained on their use and operation.			
		All workers who are exposed to noise at or above 85 dBA for 8-hrs shall be informed about the potential consequences of noise exposure and the methods of preventing noise-induced hearing loss	Internal costs	During geothermal well drilling and testing	Olkaria Quality & Safety Division-KenGen
		The employer shall institute a training program in occupational hearing loss prevention for all workers who are	Internal costs	During geothermal well drilling and testing	Olkaria Quality & Safety Division-KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		exposed to noise at or above 85 dBA for 8-hrs.			
		Noise shall be accurately measured according to the established procedures and the measurements evaluated against the accepted criteria.	Internal costs	During geothermal well drilling and testing	Olkaria Sustainable Development Division - KenGen
		Noise monitoring shall be undertaken using a calibrated sound level meter set to the A scale, slow response.	100,000/annum for calibration	During geothermal well drilling and testing	Olkaria Sustainable Development Division - KenGen
		Records shall be maintained as to the	Internal costs	During geothermal well	Olkaria Sustainable

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		noise levels recorded, where they were taken, and the sources of the noise.		drilling and testing	Development Division - KenGen
		Noise monitoring records shall be updated periodically to determine the trend and corrective actions to be taken.	Internal costs	During geothermal well drilling and testing	Olkaria Sustainable Development Division - KenGen
		Employees who work in or near the high noise area or equipment may have their noise exposure determined through personnel	2,000,000/annum	During geothermal well drilling and testing	Olkaria Quality & Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		monitoring using dosimeters.			
		Audiometric tests for workers exposed to high noise levels shall be conducted and corrective actions taken where abnormal results are noted.	10,000/person	During geothermal well drilling and testing	Olkaria Quality & Safety Division
		Periodic maintenance of noise emission sources like diesel generators and air compressors.	Internal costs	During geothermal well drilling.	Olkaria Drilling and Logistics Division, KenGen
Community Noise Emissions	<ul style="list-style-type: none"> ➤ Public nuisance ➤ complaints, loss of sleep and 	The duration of vertical discharge tests should be undertaken at most	Not applicable	During geothermal well testing.	Olkaria Reservoir & Steamfield Division- KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
	disturbance to wildlife	for 12 hours during daytime as far as practicable.			
		Establish adequate buffers between the neighboring villages/facilities and critical habitats.	Internal costs	During well siting	Olkaria Well Siting Committee - KenGen
		Use of improved silencer when carrying out horizontal discharge tests of the wells.	Internal costs for mobilization of existing silencer	During well discharge tests	Olkaria Reservoir & Steamfield Division- KenGen
Hydrogen Sulphide and Carbon Dioxide Gas Emissions	<ul style="list-style-type: none"> ➤ Human fatalities ➤ Deterioration of human health 	An appropriate gas detector system comprising at least two sensors with the capability of continuous	1,000,000/rig	Prior to commencement of drilling of the wells	Olkaria Drilling and Logistics Division, KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		measuring both H ₂ S and CO ₂ shall be installed at the rig site.			
		Gas detectors shall be maintained in accordance with the Original Equipment Manufacturer's (OEM) documentation, and shall activate both audible and visual alarms where maximum occupational limits are exceeded.	Internal costs	During geothermal well drilling	Olkaria Quality and Safety Division
		A gas hazard abatement plan shall be prepared and all rig crew and	Internal costs	During geothermal well drilling	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		support personnel shall be made familiar with its application.			
		Gas hazard escape equipment shall be provided at appropriate locations and available for use at all times when the rig is operational.	1,000,000 per rig	During geothermal well drilling	Olkaria Quality and Safety Division
		The derrick or mast shall have an auxiliary means of escape installed prior to personnel working on elevated fixed platforms in	Internal costs	During rigging-up	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		and on the derrick or mast.			
		Escape equipment shall not be used except during an emergency, maintenance or training purposes.	Not applicable	During geothermal well drilling	Olkaria Quality and Safety Division
		Personnel shall be trained in the proper procedure(s) for escaping the derrick or mast.	Internal costs	During geothermal well drilling	Olkaria Quality and Safety Division
		All rig and support personnel shall be trained and competent in the use of emergency life support	Internal costs	During geothermal well drilling	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		apparatus (ELSA) or equivalent escape equipment.			
		At least one self-contained breathing apparatus (SCBA) shall be onsite, and at least two of the rig crew on every shift shall be trained and competent in its use.	500,000/rig site	During geothermal well drilling	Olkaria Quality and Safety Division
		Approved self-contained or supplied-air breathing equipment shall be used for those atmospheres where tests indicate toxic or hazardous gases	Internal costs	During geothermal well drilling	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		are present in quantities immediately dangerous to life or health (IDLH) or oxygen content is less than necessary to sustain life.			
		All work areas prone to hydrogen sulphide and carbon dioxide gas emissions shall be identified and suitable signages installed. The information on the signages shall be written in Maa, Swahili and English languages.	100,000/rig site	During geothermal well drilling	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Workers and visitors to the rig site shall be advised of the potential dangers of being exposed to high hydrogen sulphide gas levels.			
		A windsock shall be installed at the well pad to guide on the safe direction for evacuation.	50,000	During geothermal well drilling	Olkaria Quality and Safety Division
		H ₂ S monitoring shall be undertaken at predetermined intervals using a calibrated gas meter and records maintained as to the H ₂ S levels recorded,			

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		where they were taken, and the time.			
		Where the maximum occupational limit of H ₂ S (10 ppm) is exceeded, staff shall be evacuated, appropriate corrective actions undertaken and allowed to return only after the site has been confirmed to be safe.	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division
		Air from the rig utility system shall not be used as the source for breathing air supply.	Not applicable	During emergency evacuation	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Areas prone to H ₂ S or CO ₂ gases should be provided with gas diffusion fan which shall be operated, as necessary.	100,000/rig	During geothermal well drilling	Olkaria Quality and Safety Division
		Workers who suffer acute hydrogen sulphide gas poisoning shall be treated by a medical specialist.	Variable	During geothermal well drilling	Olkaria Quality and Safety Division
		Where confined space conditions exist or have the potential to exist e.g. mud tanks, a confined space entry or other	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		permit system should be activated			
		An induction programme for new rig employees shall be carried out regardless of prior experience to ensure awareness of current standards and practices.	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division
Well Blowouts	Injuries Human fatalities	Blowout prevention measures should focus on maintaining wellbore hydrostatic pressure by effectively estimating formation fluid pressures and the	Already incorporated in the rig	During geothermal well drilling and testing	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		strength of subsurface formations.			
		Well Contingency plans should be prepared for well operations and should include identification of provisions for well capping in the event of uncontrolled blowout	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division
		A dedicated blowout risk analysis and emergency plan should be prepared, detailing the measures in place to prevent a blowout, the provisions for	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		well control in a blowout scenario (including capping tools and oil spill recovery means), and indicating the time necessary for the intervention.			
		The risk analysis should include a failure mode and effect analysis as well as a reliability analysis of the technical systems in place to control a blowout, as well as reliability analysis of the systems.	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Use of a blowout preventer (BOP) to seal, control, and prevent the uncontrolled release of fluids from a well during drilling operations.	Already included in the rigs	➤ During geothermal well drilling and testing	Olkaria Quality and Safety Division
		Provisions should be made for prompt medical attention in case of serious injury to include, but not limited to, transportation of the injured person to a medical treatment facility.	Internal costs	During geothermal well drilling and testing	Olkaria Quality and Safety Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Each shift should have at least an individual trained in first aid including cardiopulmonary resuscitation (CPR) techniques	3,000,000/annum for first aid training	During geothermal well drilling and testing	Olkaria Quality and Safety Division
		A first aid kit shall be maintained and available at the worksite. The kit should contain appropriate materials and should be inspected at frequent intervals and replenished as necessary.	80,000 per site	<ul style="list-style-type: none"> ➤ During construction of well pads and roads ➤ During geothermal well drilling and testing. 	<ul style="list-style-type: none"> ➤ Olkaria Civil Infrastructure Division - KenGen ➤ Olkaria Drilling & Logistics Division- KenGen ➤ Olkaria Steamfield & Reservoir Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Air compressors should be inspected at least once in a period of twenty-four months by a government approved inspector.	200,000/site	During geothermal well drilling	Olkaria Quality & Safety Division- KenGen
		Pre-job, or toolbox meetings shall be undertaken daily for the purpose of discussing health and safety concerns specific to a particular job.	Internal costs	<ul style="list-style-type: none"> ➤ During construction of well pad and roads. ➤ During geothermal well drilling. 	<ul style="list-style-type: none"> ➤ Olkaria Drilling & Logistics Division- KenGen ➤ Olkaria Steamfield & Reservoir Division ~ KenGen
Fire Risk	➤ Loss of life and/or property	Fire audits shall be undertaken at the	100,000/site	During geothermal well drilling	Olkaria Quality & Safety Division- KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
	<ul style="list-style-type: none"> ➤ Habitat destruction ➤ Wildlife injuries/fatalities 	rig sites at least once in a year.			
		Fire extinguishing equipment shall be available, suitably located, readily accessible, and plainly labelled as to their type and method of operation.	3,000,000/rig site	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen
		Fire extinguishing equipment shall be accessible and free of obstructions during operations.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen
		Drilling crew members shall be familiar with the location of fire	1,000,000 for training	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		extinguishing equipment, emergency assembly point and shall be trained in the use of such equipment, application, and associated hazards.			
		Discarded oily rags and combustible waste should be stored in metallic containers with the covers kept in place.	100,000/rig site	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		Smoking shall be permitted only in designated areas.	200,000/rig site for the mobile smoking room	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Fire drills shall be conducted at the respective rig sites (N370, KGN 1 or KGN 2) at least once in a year	Internal costs	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		Fire marshals shall be designated and trained at predetermined intervals	2,000,000/year	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		Fire extinguishing equipment shall be periodically inspected and maintained in operating condition.	500,000/year	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Fire emergency response plan shall be prepared and tested periodically.	Internal costs	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		The rig health and safety committee should meet (preferably weekly i.e. during shift change) and minutes documented.	Internal costs	During geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		Establishment and maintenance of fire breaks around the well pads.	100,000/well pad	Prior to commencement of geothermal well drilling.	Olkaria Quality & Safety Division-KenGen.
		Workplace inspections shall be undertaken by the health and safety	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		committee members at least once in a month.			
		Implementation of the hot work permit to work system.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.
		Installation of smoke detectors.	100,000/site	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.
Falling Objects	Injuries/fatalities	A risk assessment should be performed to determine the appropriate safe location and distance from the centre of a derrick or mast to minimize the potential of the derrick or mast	Internal costs	Prior to rigging up	Olkaria Drilling and Logistics Division

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		striking workers or equipment in the fall zone.			
		Lifting and rigging devices in use shall be designed to handle expected load capacity. A risk assessment shall be performed before using these devices.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.
		When personnel are climbing or working at heights, tools shall be secured, or the relevant risk be mitigated).	Internal costs	During, rigging up, geothermal well drilling and rigging down.	Olkaria Quality & Safety Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Load-bearing, hydraulic-levelling jacks shall have a safety lock device, double valves, or equivalent.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.
		Tools, parts, and other materials shall not be kept in the derrick or mast above the rig floor unless they are in use and measures are taken to prevent them from falling.	Internal costs	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.
		All lifting equipment shall undergo statutory inspection by an approved	500,000 per annum	During geothermal well drilling	Olkaria Quality & Safety Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		government inspector.			
		Rods, tubulars, drill pipe, and drill collars racked or hung on the derrick should be secured to prevent them from falling across the derrick or mast.	Internal costs	During geothermal well drilling	Olkaria Drilling & Logistics Division-KenGen.
		Safety clamps (e.g. wedding band, dog collar) shall be removed from drill collars, flush joint pipe, or similar equipment before they become an overhead hazard.	Internal costs	During geothermal well drilling	Olkaria Drilling & Logistics Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Hot Geothermal Fluids Withdrawal and Discharge	<ul style="list-style-type: none"> ➤ Soil and water pollution ➤ Wildlife or human Injuries/fatalities ➤ Damage to vegetation 	Drilling fluid and geothermal brine should be contained in ponds lined with High-Density Polyethylene (HDPE) Geomembrane	300,000/pond	During well drilling and testing.	Olkaria Civil & Infrastructure Division-KenGen.
		All ponds used for containment of geothermal fluids should be fenced to prevent access by wildlife and unauthorized persons.	250,000/site	During geothermal well drilling and testing	Olkaria Civil & Infrastructure Division-KenGen
		The drilling fluid should be recirculated in	Internal costs	During geothermal well drilling	Olkaria Drilling & Logistics Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		order to save on chemical usage.			
		Installation of safety signage written in Maa, Swahili & English languages. The signage should be installed at strategic points.	200,000/rig site	During geothermal well drilling and testing	Olkaria Civil & Infrastructure Division-KenGen
		Physicochemical analysis of the chemistry of the geothermal fluids to inform operational controls to be put in place.	100,000/site	During geothermal well drilling and testing	Olkaria Sustainable Development Division-KenGen
		Depending with the quantities of geothermal fluids extracted, overflow	Internal costs	During geothermal well	Olkaria Civil & Infrastructure Division-KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		ponds shall be provided as necessary.		drilling and testing	
		Pond levels shall be monitored to prevent accidental overflow.	Internal costs	During geothermal well drilling and testing	Olkaria Civil & Infrastructure Division-KenGen
		In case of accidents/incidents, a systematic and methodical investigation shall be carried out to identify the root causes and prevent future accidents.	Internal costs	During geothermal well drilling and testing	Olkaria Quality & Safety Division-KenGen
		Implementation of measures to prevent natural surface drainage from	Internal costs	During geothermal well	Olkaria Civil & Infrastructure Division-KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		entering the pit or breaching during heavy storms (e.g. careful siting, berms).		drilling and testing	
		Continue with implementation of the reinjection program within the Olkaria Geothermal Field.	Internal costs	During geothermal well drilling and testing	Olkaria Steam field & Reservoir Division-KenGen
		Continue monitoring surface deformation and topographical drift using the 6 Global Navigation Satellite Systems installed at Olkaria	Internal costs	During geothermal well drilling and testing	Olkaria Resource Development Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Continue monitoring deformation associated with likely mass withdrawal from the geothermal reservoir using gravity monitoring methods	Internal costs	During geothermal well drilling and testing	Olkaria Resource Development Division-KenGen.
		Development of a landslide/land subsidence emergency preparedness and evacuation plan.	Internal costs	During geothermal well drilling and testing	Olkaria Quality & Safety Division-KenGen
		Conduct geotechnical surveys at the well pads where challenges are	Internal costs	During geothermal well drilling	Olkaria Resource Development Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		encountered below ground surface.			
		Production casing strings (9.625 inch) will be incorporated in the design of the proposed wells to prevent ingress or loss of fluid into or from the well, and “communication” or leakage of fluids between different aquifers	Included in project cost	During geothermal well drilling	Olkaria Drilling & logistics Division-KenGen.
		Incidences of accidental effluent discharge, with the potential of polluting Lake Naivasha, should be investigated	Internal costs	During geothermal well drilling and testing	Olkaria Sustainable Development Division-KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		promptly and effective operational controls instituted.			
Pressure on Fresh water from lake Naivasha	Reduced water quantities	Identify and promote water conservation measures including supplementing drilling water with geothermal fluids and promptly addressing leakages.	Internal costs	During geothermal well drilling and testing	Olkaria Drilling and Logistics Division - KenGen
		Promote education and awareness among employees about the essential role of water and its intrinsic value.	Internal Costs	During geothermal well drilling	Olkaria Sustainable Development Division -KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Continue monitoring the quantities of water abstracted from lake Naivasha and used for drilling of the geothermal wells.	Internal costs	During geothermal well drilling and testing	Olkaria Drilling and Logistics Division - KenGen
		Continue monitoring lake levels to inform appropriate water resource management measures.	Internal costs	During geothermal well drilling and testing	Olkaria Sustainable Development Division - KenGen
		Ensure periodic calibration of the water flow meters for the water supplied to the rig sites.	Internal costs	During geothermal well drilling and testing.	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Promote catchment conservation initiatives through tree planting.	10,000,000 per annum	During geothermal well drilling and testing.	Olkaria Sustainable Development Division - KenGen
Waste Generation	<ul style="list-style-type: none"> ➤ Soil and water pollution ➤ Public health deterioration ➤ Aesthetic degradation ➤ Wildlife fatalities 	Animal proof waste cages shall be provided at the drilling site for temporary accumulation of waste.	100,000 per rig site	Prior to undertaking drilling of geothermal wells.	Olkaria Drilling and Logistics Division - KenGen
		Adopt the 5Rs (Refuse, Reduce, Reuse, Repurpose and Recycle) approach in waste management.	Internal costs	Throughout project cycle	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Ensure proper waste segregation and containment at the source.	Internal costs	Throughout project cycle	Olkaria Drilling and Logistics Division - KenGen
		Contract scrap metal dealers who are licensed by NEMA and Scrap Metal Council to buy metallic drums, scrap metals and plastic casing protectors.	Internal costs	Throughout project cycle	Olkaria Supply Chain Division - KenGen
		Contract a NEMA licensed incinerator operator to collect and incinerate oily rags and oil filters.	1,000,000/annum	During drilling of the geothermal wells	Olkaria Sustainable Development Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		No burning of solid waste shall be undertaken at the site.	Not applicable	During drilling of the geothermal wells.	Olkaria Drilling and Logistics Division - KenGen
		Contract NEMA licensed waste transporters for the used oil and non-hazardous waste to dispose the waste at county approved sites	600,000 per annum	During drilling of the geothermal wells.	Olkaria Sustainable Development Division - KenGen
		Dully filled waste tracking sheets shall be maintained at the site.	Internal costs	During drilling and testing of the geothermal wells.	Olkaria Sustainable Development Division - KenGen
		Backfill the pit latrine upon	Internal costs	After rigging down and demobilization	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		completion of drilling.			
		Empty plastic drums shall be reused at the drilling detergent manufacturing plant operated by KenGen.	Not applicable	During drilling of the geothermal wells	Olkaria Drilling and Logistics Division - KenGen
		Create awareness and education amongst workers on laid down waste management measures.	Internal costs	During drilling of the geothermal wells	Olkaria Sustainable Development Division - KenGen
		Single use plastic bottles shall be discouraged via use of water dispensers	Internal costs	Throughout the project cycle	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		with reusable water bottles.			
		The various waste streams generated should be documented and related records filed.	Internal costs	During drilling of the geothermal wells	Olkaria Sustainable Development Division ~ KenGen
		Regular inspections of stored hazardous wastes (oily rags and used oil) should be performed to enhance effectiveness of operational controls.	Internal costs	During drilling of the geothermal wells	Olkaria Sustainable Development Division ~ KenGen
	Climate change	Monitoring of stack emissions from the diesel generators	5,000,000 per annum	During drilling of the	Olkaria Sustainable

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Air Emissions from Internal Combustion Engines	public nuisance, acid rain and health related complications	shall be undertaken periodically.		geothermal wells	Development Division - KenGen
		Analysis of fuel quality during delivery to the drilling site.	Internal costs	During drilling of the geothermal wells	Olkaria Supply Chain Division - KenGen
		Regular servicing and maintenance of internal combustion engines.	Internal costs	During drilling of the geothermal wells	Olkaria Drilling and Logistics Division - KenGen
		Fuelling of company vehicles at accredited fuelling stations.	Internal costs	Throughout project cycle	Olkaria Transport Division. KenGen
		Usage of R22 refrigerant in the air conditioning system shall be phased out.	Internal costs	Prior to commencement of drilling of the geothermal wells	Olkaria Administration Division, KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Risks of Conflicts with the Neighbours	Wildlife fatalities	Undertake continuous engagement of the neighbouring local community to provide information on progress of the project.	4,000,000 per annum	Throughout project cycle	Olkaria Community Relations Division - KenGen.
	Legal battles				
	Erosion of reputational image				
		Vehicular traffic should be controlled during migration of livestock through the National Park.	Internal costs	Throughout project cycle	Olkaria Transport Division. KenGen
		Implement the grievance and complain handling mechanism (GCHM) that will promptly resolve potential conflicts. The GCHM should	Internal costs	Throughout project cycle	Olkaria Community Relations Division - KenGen.

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		be disclosed to the neighbouring community			
		Establish an adequate buffer between geothermal concession areas owned by Orpower 4 and KenGen Plc in liaison with the Ministry of Energy.	Internal costs	During well siting	Olkaria Well Siting Committee - KenGen
		A portion of the unskilled employment opportunities should be allocated to the local community.	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Raise awareness among the local community on the available government procurement opportunities related to the proposed project.	Internal costs	Throughout the project phase	Olkaria Supply Chain Division ~ KenGen
Risk of Spread of Communicable Diseases	<ul style="list-style-type: none"> ➤ Stigma ➤ Health deterioration ➤ Fatalities 	Enhance education and awareness in prevention and control of communicable diseases among the workers and the local community members	3,000,000 per annum	Throughout the project cycle	Olkaria Human Resources Division ~ KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Provide psychosocial support to the affected workers in order to avoid or reduce stress.	Internal costs	Throughout the project cycle	Olkaria Human Resources Division - KenGen
		Improve access to potable water at the rig sites.	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		The shift workers shall be housed at the camping facilities to minimize movement that can create risk of transmission of communicable diseases.	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
		Arrange for mobile Voluntary Counselling and Testing of the workers and the neighbouring communities.	2,000,000 per annum	During geothermal well drilling	Olkaria Human Resources Division - KenGen
		The camping facilities shall be maintained in proper hygienic condition.	Internal costs	During geothermal well drilling	Olkaria Drilling and Logistics Division - KenGen
		Provision and equipping of condom dispensers at the workplaces and neighbouring communities to prevent the spread of STDs	Internal costs	During geothermal well drilling	Olkaria Human Resources Division - KenGen

Environmental/Social Aspect	Potential Impacts	Proposed Mitigation Measures	Estimated Budget (Ksh.)	Time Frame	Responsibility
Loss of Archaeological and cultural assets	No negative effect is envisaged	Where unexpected archaeological remains are found within the project site, KWS and National Museums of Kenya will be informed.	Internal costs	During well pad and road construction	Olkaria Sustainable Development ~ KenGen

10 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

The Environmental and Social Monitoring Plan for the proposed drilling of 42 geothermal wells is shown in table 48.

Table 48: Environmental and Social Monitoring Plan for the proposed drilling of 42 geothermal wells.

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
1.	Compliance with EIA license conditions	EMCA, 1999	Monthly	Site inspections/Auditing	Site inspection/audit reports
2.	Compliance with water abstraction permit conditions	Water Act, 2016	Monthly	Meter readings	Water consumption reports
3.	Employment creation	<ul style="list-style-type: none"> • Employment Act, 2007 • The Constitution of Kenya, 2010 	Monthly	Physical counts	Recruitment records for casual employees
4.	Workplace registration	Occupational Safety & Health Act (OSHA), 2007	Quarterly	Workplace inspections	Workplace inspection reports

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
5.	Ambient and occupational levels of noise emission	Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009	Monthly	Measurement of noise levels using a hand held sound level meter at identified receptor points.	Noise measurement reports
6.	Calibration status of the sound level meters and H ₂ S gas analyzers.	<ul style="list-style-type: none"> ➤ Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009 ➤ The Factories and Other Places of Work (Hazardous Materials) Rules, 2007 	Annually	Verification of calibration certificates	Equipment calibration certificates and calibration schedules.
7.	Dust emission	➤ OSHA, 2007	Daily during road and well	➤ Visual inspection of project site	Dust emission report

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
		<ul style="list-style-type: none"> ➤ Public Health Act, Cap 242 ➤ Environmental Management and Coordination (Air Quality) Regulations, 2014 	pad construction	<ul style="list-style-type: none"> ➤ Measurement of particulate matter ➤ Complaints from the public or workers 	
8.	Air emissions from internal combustion engines.	<ul style="list-style-type: none"> ➤ Climate Change Act No. 11 of 2016 ➤ OSHA, 2007 ➤ Environmental Management and Coordination (Air Quality) Regulations, 2014 ➤ Traffic Act, Cap 403 	Annually	<ul style="list-style-type: none"> ➤ Stack emission measurements by a calibrated gas analyzer. ➤ Motor vehicle inspection 	<ul style="list-style-type: none"> ➤ Stack emission reports ➤ Vehicle inspection reports
9.	Hydrogen sulphide gas emissions	<ul style="list-style-type: none"> ➤ OSHA, 2007 ➤ The Factories and Other Places of Work (Hazardous 	Daily	H ₂ S gas measurement using a calibrated gas analyzer	H ₂ S measurement reports

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
		Materials) Rules, 2007 ➤ Environmental Management and Coordination (Air Quality) Regulations, 2014			
10.	Solid waste generated and disposal	➤ Environmental Management and Coordination (Waste Management) Regulations, 2006 ➤ Sustainable Waste Management Act, 2022	Monthly	➤ Weighing of quantities generated ➤ Inspection of temporary solid waste containment areas. ➤ Verification of dully filled waste tracking sheets.	➤ Solid waste reports ➤ Dully filled waste tracking sheets
11.	Wildlife populations	Wildlife Management and Conservation Act, 2013	Annually	Joint KWS-KenGen Wildlife census	Wildlife census reports

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
12.	Water quality	<ul style="list-style-type: none"> ➤ Water Act, 2016 ➤ Water Rules, 2021 ➤ Environmental Management Coordination (Water Quality) Regulations , 2006 	Quarterly	Sampling and Laboratory analysis	Water quality reports
13.	Effluent quality (geothermal fluid)	<ul style="list-style-type: none"> ➤ Water Act, 2016 ➤ Water Rules, 2021 ➤ Environmental Management and Coordination (Water Quality) Regulations , 2006 	Quarterly	Sampling and Laboratory analysis	Effluent quality reports for each drilled well
14.	Incidents and accidents involving workers, members of	<ul style="list-style-type: none"> ➤ The Wildlife Conservation and 	Monthly	Investigation of incidents and accidents.	Incident and accidents investigation reports

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
	the public or animals (domestic and wild)	Management Act, 2013 ➤ OSHA,2007			
15.	Control of invasive species of vegetation	The Wildlife Conservation and Management Act, 2013	Quarterly	Visual observation of disturbed sites	Invasive species reports
16.	Landscaping and revegetation of disturbed sites	➤ EMCA, 1999 ➤ The Wildlife Conservation and Management Act, 2013	Quarterly	Visual observation of rehabilitated sites	Site rehabilitation reports
17.	Tree planting	➤ EMCA, 1999 ➤ Forest Act, 2016 ➤ Climate Change Act, 2016	Quarterly	Visual observation of planted trees	Quarterly reports
18.	Statutory trainings (first aid, fire fighting and Occupational	OSHA, 2007	Quarterly	Verification of training records	Training reports

INDEX	MONITORING ITEM	RELEVANT STANDARD/LAW	MONITORING FREQUENCY	MONITORING MEANS	MONITORING INDICATOR
	Health and Safety Committee trainings)				
19.	Induction of new employees	OSHA, 2007	Daily	Verification of induction records	Induction reports
20.	Statutory equipment inspection (cranes, chain blocks, lifting tackles and fire fighting equipment)	OSHA, 2007	Semi annually	Verification of equipment inspection certificates	Equipment inspection reports
21.	Occupational Health and Safety (OHS) Committee meetings	OSHA, 2007	Quarterly	Verification of minutes of meetings conducted	OSH Committee reports
22.	Site inspections for compliance	OSHA, 2007	weekly	Verification of site inspection reports	Site inspection reports
23.	Sensitization campaigns targeting behaviour change	HIV and AIDS Prevention and Control Act (Cap 14 of 2006)	Quarterly	Verification of awareness records.	Sensitization/awareness reports

11 CONCLUSIONS AND RECOMMENDATIONS

Despite the effects of climate change on the planet, it is not envisaged that there will be restrictions on the amount of water abstracted for drilling of the proposed geothermal wells as per the water allocation plan for Lake Naivasha. This is justified by the fact that the lake level has been rising from September 2023 to September 2024 (1888.726 to 1891.109 masl) which way above the amber alert limit (between 1885.3 and 1884.6 masl) where water abstraction permit holders are only allowed to draw up to 75% of their industrial water use. In terms of water consumption, the status quo will remain since KenGen will utilize the three existing rigs.

The physicochemical results for Lake Naivasha water showed that all the parameters analysed, except *E.coli* and nitrates, were within the maximum recommended limits for sources of domestic water. Each of the rigs incorporates a water treatment plant that will purify the water to be used for domestic purposes during drilling of the 42 geothermal wells.

Respiratory diseases (tuberculosis, coughing, running nose, asthma etc.) tops the list of prevalent diseases within the project area. This could be attributed to exposure to dust and smoke since majority of the households cook with firewood. Shrubs and grasslands predominantly colonize the study area. Bare areas are characterized by rock outcrops, lava flow and scattered vegetation. Built-up areas comprise sites occupied by anthropogenic activities such as geothermal infrastructure including well pads, roads, steam pipes, transmission line masts and power plants. Other human activities noted include clearing of vegetation, restoration of habitats, livestock incursion, charcoal burning, bushfires and tourism. The area around project sites OW738 and 734 drains into sensitive ecological areas such as the vulture cliff located southeast of the site and have *Osyris lanceolate* (a shrub) listed as an endangered plant species under the Wildlife Conservation and Management Act of 2013. Majority of wildlife was observed in area OW734 and included buffalos, Maasai giraffe, eland, African hare, zebras, dikdiks and Aardvark. Other species identified in isolated areas included hyenas in gullies and Klipspringers on rocks. Several species of birds were also sighted including sunbirds, starlings and weaver birds. Reptiles observed included blue-headed agama. Insects comprised dung beetles, butterflies and dragonflies.

Four (4) public barazas, nine (9) one-on-one meetings and one key stakeholders meeting were carried out. All the public barazas and the key stakeholders meeting were well attended. Nine (9) questionnaires were also filled by the key stakeholders and returned for consideration. The

stakeholders were in support of the proposed project subject to KenGen adhering to the Environmental and Social Management Plan. KenGen has a Grievance and Complaint Handling Mechanism (GCHM) designed to provide an effective platform for the company to resolve complaints from individuals affected by its projects. The GCHM will be used throughout the project implementation duration.

The proposed project has the potential of resulting to the following benefits:

- i. Mitigation of climate change when the wells are finalized and connected to a 200 MW geothermal power plant.

Based on the 92% load factor and estimated grid factor of 0.2 tCO₂e/MWh and a project emission of 30,000 tCO₂e, emission reduction of the power plant will be 292,368 tCO₂e annually.

- ii. Creation of direct employment opportunities

KenGen rigs will operate under a four-shift program with each shift comprising of thirty-four (34) workers. Out of these, every shift will engage 2 unskilled casual workers (roustabouts) from the local community making a total of twenty (24) direct employment. Through the economic multiplier effect, wages and salaries earned by the drilling crew will generate additional income and jobs in the local and regional economy.

- iii. Promotion of skills and knowledge transfer

The project will provide a learning opportunity for students on attachment and interns under the Government of Kenya (GoK) performance contract.

- iv. Enhancement of Local Development

Implementation of the proposed project will lead to realization of the government's Bottom-up Economic Transformation Agenda (BETA), which is geared towards economic turnaround and inclusive growth through a value chain approach. Corporate Social Responsibility projects sponsored by the project proponent will enhance local development.

- v. Enhanced business opportunities

Business opportunities will comprise of various consultancy jobs, hotel industry, supply of equipment, spare parts, food and materials, cleaning services, rig camp services, contracted jobs and provision of transportation and logistics services.

vi. Promotion of tourism

Various schools, universities and colleges are likely to visit the project for academic reasons during geothermal well drilling phase.

The potential negative environmental and social impacts are associated with the following risks:

- i. Destruction of land cover and soil erosion
- ii. Dust emission
- iii. Wildlife-vehicle collisions
- iv. Poaching of wildlife
- v. Geothermal fluid withdrawal and discharge
- vi. Pressure on Lake Naivasha
- vii. Waste generation and disposal
- viii. Air emissions
- ix. Conflicts with neighbours
- x. Spread of communicable diseases
- xi. General safety and health risks.

The ESIA team has endeavoured to propose suitable and adequate mitigation measures for the identified negative environmental and social impacts. The measures will be taken into consideration when implementing KenGen's Integrated Management System based on the 3 ISO standards thereby promoting environmentally sustainable development of the proposed project. KenGen has undertaken drilling of geothermal wells both locally and internationally using internal capacity thus there is no doubt that the ESMP will be implemented.

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13 APPENDICES

Appendix 1: Geothermal Resource License

1010

RM



REPUBLIC OF KENYA
MINISTRY OF ENERGY

Telegrams: "MINPOWER"
Telephone: +254-20-310112
Fax: +254-20-228314/240910
Email: ps@energymin.go.ke
When replying please quote

OFFICE OF THE
PERMANENT SECRETARY
NYAYO HOUSE
P. O. Box 30582
NAIROBI

Ref. No. ME/CONF/2/6/1B
and date

September 19, 2008

Mr. Edward W. Njoroge, EBS
Managing Director
KenGen
Stima Plaza B, Parklands
NAIROBI

Dear

Eddie

RE: GRANT OF OLKARIA II GEOTHERMAL RESOURCES LICENCE
NO. 1/2008 TO KENGEN

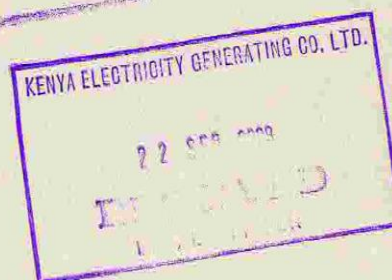
Please refer to your letter Ref. LO/033ME2/BK/lk dated July 31 2008 on the
above captioned subject.

Attached hereto please find one (1) copy of a geothermal license for Olkaria II
geothermal field for your perusal and record.

Yours

Patrick M. Nyoike

PATRICK M. NYOIKE, CBS
PERMANENT SECRETARY



THE REPUBLIC OF KENYA



MINISTRY OF ENERGY

THE GEOTHERMAL RESOURCES ACT, 1982
(Act No.12 of 1982)

AND

THE GEOTHERMAL RESOURCES REGULATIONS, 1990
Geothermal Resources Licence No.1/2008

This Geothermal Resources Licence is granted this ^{19th} day of September, 2008 by the Minister for Energy to Kenya Electricity Generating Company (KenGen), Stima Plaza, Kolobot Road, Parklands of P.O. Box 47936, 00100 Nairobi, Kenya (the "Licensee") pursuant to the Geothermal Resources Act, 1992 (the "Act") and the Geothermal Resources Regulations, 1990 (the "Regulations").

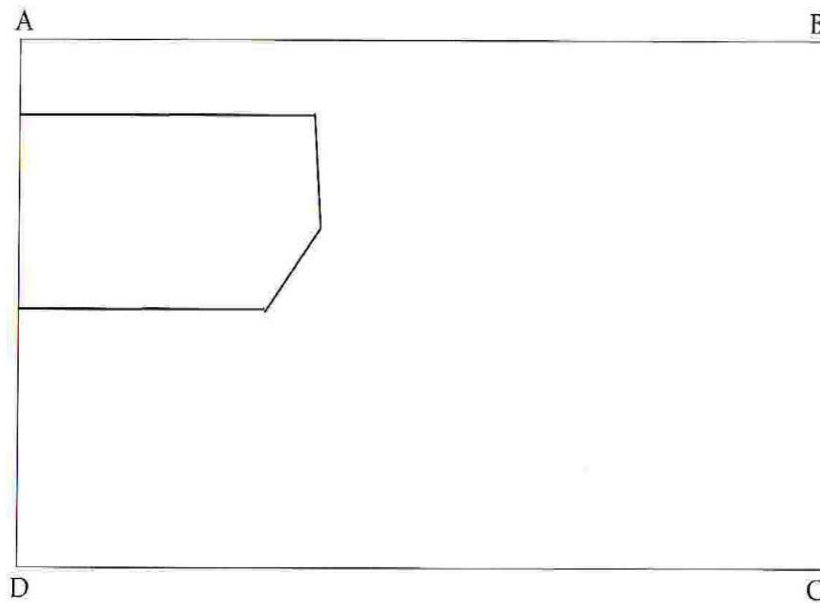
1. The Licensee is hereby granted the following exclusive rights:

- (a) The right and privilege to enter and explore, drill for, extract, produce, utilise and dispose of geothermal steam and associated geothermal resources in or under the land described in Appendix I and shown on the map set forth in Appendix II hereof (the "Licence Area").
- (b) The right to construct or erect and to use, operate and maintain within the Licence Area, together with ingress and egress there upon all wells, pumps, pipes, pipelines, buildings, plants, sumps, brine pits, reservoirs, tanks, waterworks, pumping stations, roads, electric power generating plant, transmission lines, industrial facilities, electric, telegraph or telephone lines or cables and such other works and structures and to use so much of the surface of the land within the Licence Area as may be necessary or convenient for the production, utilisation and processing of geothermal resources or for the full

APPENDIX I

DELINEATION OF LICENCE AREA

The license shall be all those certain lands more particularly described below:



The UTM co-ordinates and respective area are

	Northing	Easting
A	9910000	192000
B	9910000	210000
C	9898000	192000
D	9898000	192000
Area=204 km ² Approx. or 20,400Ha Approx.		

Appendix 2: Excerpt of sublease Agreement and KWS Letter granting site access

Dated this 16th Day of November 2022

KENYA WILDLIFE SERVICE
("Sub-Lessor")

TO

KENYA ELECTRICITY GENERATING COMPANY PLC (KenGen PLC)
("Sub-Lessee")

SUB LEASE

-In respect of-

TITLE NUMBER

IR 105419/1 (LR NO. 12881/5)

(Comprising Aggregate of Approximately 1,580.29 acres (639.52 Hectares) within Hells Gate
National Park

Drawn by: -

ESTHER ANDISI-LEGAL OFFICER
KENYA WILDLIFE SERVICE
P.O BOX 40241-00100
NAIROBI

Form LRA 62 (adopted with modifications as Approved by the Chief Lands Registrar) (r.76(1) & 87(3))

THE REPUBLIC OF KENYA
THE LAND REGISTRATION ACT
THE LAND REGISTRATION (GENERAL) REGULATIONS, 2017

Date Received	Presentation Book No.....	Official Fees Paid Kshs.
------------------------	------------------------------	-----------------------------

SUB- LEASE
TITLE NUMBER: IR 105419/1 (LR NO. 12881/5)

Date of Lease	<u>16th</u> day of <u>November</u> 2022
Sub- lessor	<u>KENYA WILDLIFE SERVICE</u> a body corporate established under Wildlife Conservation and Management Act No. 47 of 2013 having its principal offices in Langata, and of Post Office Box Number 40241-00100 Nairobi in Republic of Kenya (hereinafter referred to the "Sub lessor" which expression shall where the context so admits include the Sub-lessor's successors in title and assigns) of the one part.
Sub-lessee	<u>KENYA ELECTRICITY GENERATING COMPANY PLC (KenGen PLC)</u> a limited liability Company incorporated under the Companies Act (repealed CAP 486) of the Laws of Kenya, having its registered offices at Stima Plaza, Kolobot Road and of Post Office Box 47936-00100 Nairobi (hereinafter called the "Sub-lessee" which expression shall where the context so admits include the Sub-lessee's successors in title and assigns) of the other part.
Park	That piece or parcel of land known as Hells Gate National Park, situate south of Lake Naivasha in Nakuru County containing by measurement Two Five One Nought decimal Nought (2510.0)) hectares or thereabouts also known as Land Reference Number 12881/5 which said piece of Land is subdivision of the premises comprised in a Grant registered in the Land Titles Registry at Nairobi as Number I.R. 105419/1 which the dimensions abuttals and boundaries thereof delineated on the Plan annexed to the said Grant and more particularly on Land Survey Plan Number 274042 deposited in the Survey Records Office at Nairobi and thereon bordered red which land is held by the Sub-lessor as lessee from the Government of Kenya under the provisions of the said Grant subject to the annual rent of

Sub lease: KWS-KenGen (PLC)

Page 2 of 41

KT

FIRST SCHEDULE

The Demised Land

ALL THAT part forming a portion of the Park comprising approximately Six Three Nine decimal Five Two (639.52) hectares (1,580.29 acres) or thereabouts known as Land Reference Number 12881/5 which said piece of land with the dimensions abutments and boundaries thereof delineated on the Plan annexed more particularly on Land Survey Plan Number 274042 deposited in the survey Records Office at Nairobi and thereon bordered red on the Plan annexed to the Certificate of Title known as IR 105419/1.

INCLUDING:

- a. All the Furniture and Equipment Inventory;
- b. all additions and improvements to the Demised Land;
- c. all the Sub-lessor's fixtures and fittings of every kind which shall from time to time be in or upon the Demised Land whether originally affixed or fastened to or upon the Demised Land or otherwise except any such fixture installed by the Sub-lessee that can be removed from the Demised Land without defacing the same; and
- d. any Pipes wholly in or on the Demised Land that exclusively serve the Demised Land.

BROKEN DOWN AS FOLLOWS:

- | | |
|--------------------------------|------------------------------------|
| a. Area 1 (OW-734 & 738) | - 9.80 Acres (3.96 Hectares) |
| b. Area 2 (OW-905, 905A & 919) | - 14.70 Acres (5.94 Hectares) |
| c. Area 3 | - 184.58 Acres (74.70 Hectares) |
| d. Area 4 | - 1,371.21 Acres (554.92 Hectares) |



REF: KWS/LANDS/148/Vol.11/2024 (5.1)

9th May, 2024

Eng. Peter Njenga
The Managing Director & CEO
Kenya Electricity Generating Company PLC
P.O Box 47936-00100
NAIROBI

Dear CEO,

RE: ACCESS TO THE SITES FOR THE ADDITIONAL SUB-LEASED LAND AT HELL'S GATE NATIONAL PARK

We refer to your letter Ref: CS/PROP/KWS – Sublease Land/fkk/moo dated 28th February 2024 on the above subject.

On 10th March 2023, a joint meeting between Kenya Electricity Generating Company PLC and Kenya Wildlife Service was held at the Geothermal Plaza in Lake Naivasha, with respect to the Sub-lease of additional Land **(1580.29 Acres)** which is part of the Hell's Gate National Park which culminated to a joint survey which was successfully executed.

The draft cadastral plans from the exercise are now ready for submission to the Director of Surveys' for Authentication as per the provisions of Survey Regulations of 1994.

We hereby write to grant access to the said additional areas subject to terms and conditions in the sublease agreement.

Thank you for your continued support.

Yours Sincerely,

Dr. Erustus Kanga EBS, HSC.
DIRECTOR GENERAL

Appendix 3: Approved TOR and Letter from NEMA with conditions for approval

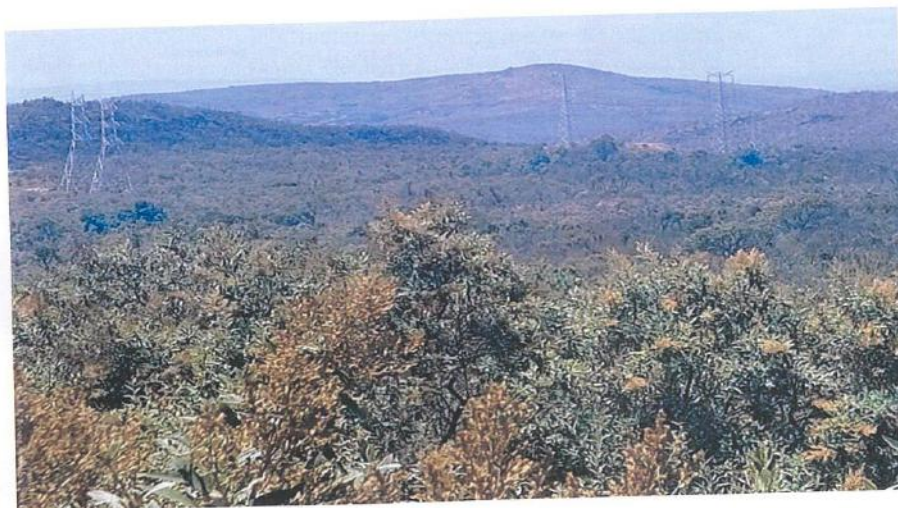
TOP 808



KenGen

KENYA ELECTRICITY GENERATING COMPANY PLC

TERMS OF REFERENCE
FOR
CONDUCTING ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR
THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR
105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK IN
NAIVASHA SUB-COUNTY, NAKURU COUNTY.



PROJECT PROPONENT:

KENYA ELECTRICITY GENERATING COMPANY PLC

PREPARED BY:

PHILIP BARASA

LEAD EIA/AUDIT EXPERT & ESIA STUDY TEAM LEADER
NEMA REG. No. 1857

6th OCTOBER 2024



Approved
J. Mwakali
H. K. TA
15/10/24

808 205

Name and Address of ESIA Team Leader

Philip Barasa,
P.O BOX 103532 -00101
Nairobi, Kenya
Mobile: +254 724 455061

Signed:



EIA/EA Lead Expert
NEMA Reg. No: 1857

06/10/2024

Date

Name and Address of Project Proponent

Kenya Electricity Generating Company PLC,
Stima Plaza, Phase III
Kolobot Road, Parklands
P.O BOX 47936 -00100
Nairobi, Kenya
Tel : +254 20 3666000
Mobile : 0711036000/0732116000

Signed:



Joshua Were
Sustainable Development Manager

07/10/2024

Date

LIST OF ABBREVIATIONS

BETA	Bottom-up Economic Transformation Agenda
BSc.	Bachelor of Science
CBO	Community Benefit Organization
COP	Conference of Parties
DOHSS	Directorate of Occupational Health and Safety Services
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act, 1999
EPRA	Energy and Petroleum Regulatory Authority
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDC	Geothermal Development Company
GHG	Green House Gases
GIS	Geographic Information System
HV	High Voltage
ILO	International Labour Organization
IR	Index Register
ISO	International Organization for Standardization
KenGen	Kenya Electricity Generating Company PLC
KETRACO	Kenya Electricity Transmission Company PLC
KMFRI	Kenya Marine and Fisheries Research Institute
KPLC	Kenya Power and Lighting Company PLC
KV	Kilo Volts
KWS	Kenya Wildlife Service
LR	Land Registration
LNRA	Lake Naivasha Riparian Association
Ltd	Limited
Msc	Master of Science
MW	Megawatt of Electricity
NEMA	National Environment Management Authority
NAIVAWASCO	Naivasha Water and Sanitation Company
NGAO	National Government Administration Office
OSH	Occupational Safety and Health
PLC	Public Limited Company
RAP	Resettlement Action Plan
SDG	Sustainable Development Goals
ToRs	Terms of Reference
WRA	Water Resources Authority
WWF	World Wildlife Fund

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1.0. Introduction

Kenya Electricity Generating Company PLC (KenGen) is the leading electric power generating company in Kenya. The company produces about 61% of electricity consumed in the country using various sources. The sources are hydro, thermal, wind and geothermal. Olkaria is one of the business areas of KenGen where geothermal steam is used to generate electric power. KenGen is in possession of a geothermal resource license No. 1/2008 for Olkaria Geothermal Field dated 19th September 2008 and valid for thirty (30) years. The license was issued by the Ministry of Energy. The Olkaria geothermal licensed area measures 204 km² (20,400 Ha). Hell's gate national park, measuring 2510 Ha, falls within the geothermal licensed area where energy generation is undertaken by KenGen and Orpower 4 Inc. KenGen has developed an ambitious strategy to increase its geothermal power generation capacity. As part of this strategy, the Company has installed 799MW of geothermal energy at Olkaria and Eburru Geothermal Fields.

KenGen is certified and conforms to ISO 9001:2015 (Quality Management System), ISO 14001:2015 (Environmental Management System) and ISO 45001:2018 (Occupational Health and Safety Management System). In order to further its strategy of increasing geothermal power generation capacity, the company proposes to drill forty-two (42) geothermal wells on a piece of land IR 105419/1 (LR NO.12881/5), located within Hell's Gate National Park. The piece of land measures approximately 1580.29 acres (639.52 Ha) and has been leased from Kenya Wildlife Service (KWS) vide a sublease agreement dated 16th November 2024. The lease period is fifty (50) years from commencement date (renewable). The right to access the piece of land was granted by KWS on 16th May 2024. Drilling of the wells will be undertaken using rigs owned and operated by KenGen. Among the sub-lease covenants include the requirement for KenGen to comply with the provisions of Environmental Management and Coordination Act (EMCA), 1999 and the Wildlife Conservation and Management Act, 2013.

The proposed drilling of forty two (42) of geothermal wells falls under the high-risk project category pursuant to Legal Notice No. 31, legislative Supplement No. 16, which amended the second schedule of EMCA 1999. In accordance with section 58 of EMCA 1999, a proponent intending to implement a high risk project is required to undertake an Environmental and Social Impact Assessment (ESIA) study and obtain a license from National Environment Management Authority (NEMA). Against this background, these Terms of Reference (ToR) have been prepared for review and approval by NEMA prior to carrying out the ESIA study. The ToRs have been prepared, in consultation with the project proponent, as provided for by Regulation 11 (1) of the Environmental (Impact Assessment and Audit) Regulations, 2003. Preparation of the ToRs was preceded by the scoping exercise conducted by the proponent.

2.0. The Project Proponent

The project proponent is Kenya Electricity Generating Company PLC (KenGen) and the registered office and contact addresses are:

Kenya Electricity Generating Company PLC
Stima Plaza, Phase III,
Kolobot Road, Parklands

P.O. Box 47936 – 00100 Nairobi, Kenya
Mobile: 0711036000/0732116000
Web : www.kengen.co.ke
E-mail : pr@kengen.co.ke

3.0. Description and Objective of the Proposed Project

The proposed project entails drilling of forty two (42) geothermal wells using KenGen rigs. The objective of the proposed project is to enhance geothermal power generation at Olkaria Geothermal Field in line with the company's Good-to-Great (G2G) strategy.

4.0. Project Justification

The proposed drilling of forty two (42) geothermal wells at Olkaria will contribute towards promotion of renewable energy and phaseout of thermal energy sources in Kenya. Increased integration of renewable energy sources such as hydropower, wind, solar PV, and geothermal accelerates the global goal of “towards net zero emissions”. The proposed project aligns to the national target of abating Green House Gas (GHG) emissions by 32% by 2030 relative to the Business As Usual (BAU) scenario of 143 MtCO_{2e} as committed in the updated Nationally Determined Contribution. The Government has set a target of achieving 100% of its electrical energy generation from renewable sources by 2030. This is in line with the Kenya Energy Transition Investment Plan launched at the United Nations Climate Change Conference (COP 28) in 2023. Implementation of the proposed project will lead to realization of the government's Bottom-up Economic Transformation Agenda (BETA), which is geared towards economic turnaround and inclusive growth through a value chain approach. In particular, the project demonstrates the government's commitment to meet its goal of achieving Universal access to electricity while improving reliability and lowering the cost of electricity.

5.0. Project Activities

The activities associated with the proposed project will be as follows:

- i. The geothermal well drilling targets will be established by the proponent's multidisciplinary well siting committee.
- ii. Environmental baseline study will be undertaken for the respective drilling targets and sub-Environmental Management Plans prepared jointly by KenGen and KWS teams. The sub-EMPs will be tailored to each well pad preparation and drilling operations thus ensuring that appropriate measures are taken to avoid or minimize potential environmental and social impacts.
- iii. Design and construction of the new road network that will connect the well pads.
- iv. Design of the well pad and construction using earth moving equipment. It would entail surface stripping and excavation works. The well pads will be designed to accommodate multiple wells thus reducing the project's footprint and impacts on biodiversity.
- v. Construction of the cellars where the rig will be anchored. This would involve masonry works.

- vi. Construction of water supply network from existing pipelines to the well pad. KenGen is in possession of a water abstraction permit issued by Water Resources Authority. Water for industrial and domestic usage is abstracted from Lake Naivasha.
- vii. Fencing of the well pads and drilling fluid recirculation ponds using chain link. This will control access to the site and ensure safety of the wild animals.
- viii. Lining of the drilling fluid recirculation ponds with High Density Polyethylene (HDPE) geomembrane to prevent contact with the soil and percolation.
- ix. Rig move from one well pad to the other using 4 No. cranes, 2 No. forklifts, 4 No. flatbed trailers, 2 No. low loaders, 2 No. abnormal load trailers and 2 No. escort vehicles.
- x. Setting up of the containerised camp facilities.
- xi. Supply of consumables including fuel for the generators, casing and accessories, cement and additives (silica, retarders, accelerators, friction reducers, mica, fluid loss control agents and slurry weight reducing agents), drilling mud (bentonitic clay and polymers) and drilling detergent.
- xii. Rigging up at the well pad i.e placing and assembling the various parts of the rig in readiness for drilling. Associated accessories like diesel generators, air compressors, mud tanks and mud pumps will also be installed.
- xiii. Drilling of the geothermal wells to a target depth of 3,000 metres. This is expected to take approximately 80 days. Geothermal wells in Olkaria are of regular casing program design with a 95/8" production casing and 7" liner. The wells have surface, anchor and production casings running from surface to respective depths.
- xiv. Cementing of the casings. The cement plays two important functions: to give the casing mechanical support under its sometimes-intense thermal cycling between production and shut-in, and to protect the outside of the casing from corrosion by in-situ fluids.
- xv. Rigging down and demobilization of the rig.
- xvi. Well completion test will be done after drilling the well. The test is carried out to establish production potential and characteristics of wells and reservoir properties.
- xvii. Removal of the drilling wellhead and installation of the permanent wellhead which shall be preceded with quenching (pumping water into the already drilled well) to ensure the well is in a fully controlled condition.

Site preparation works and mobilisation activities will proceed during daylight hours only, however production drilling activity will be undertaken seven days per week, 24 hours per day.

6.0. Site Layout

Site layout for a typical well pad under drilling operations is shown in figure 1.

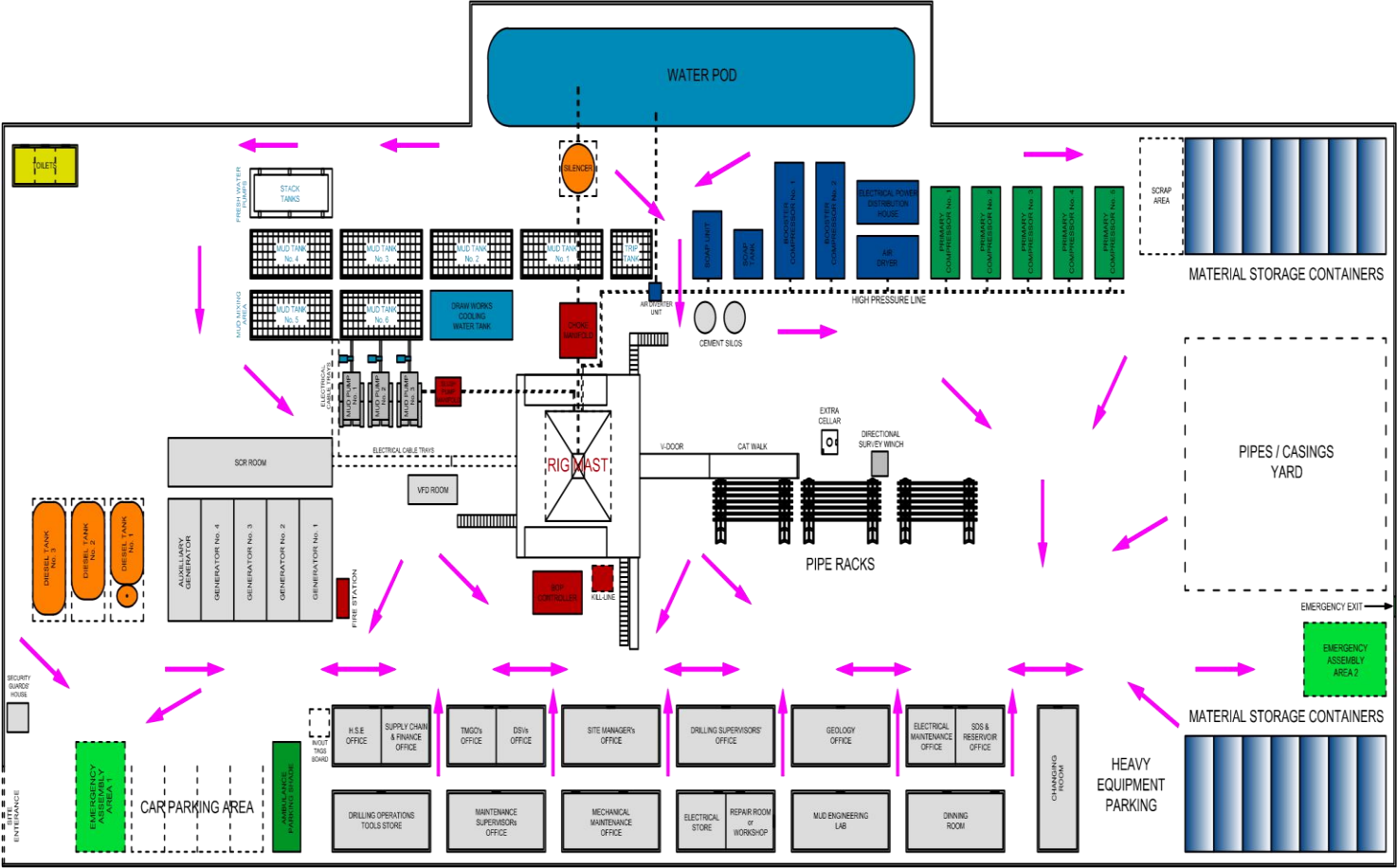


Figure 1: Site layout for a typical well pad under drilling operations

7.0. Inputs and Equipment

The inputs used in drilling a typical geothermal well to a depth of 3000 m (3 km) are shown in table 1.

Table 1: Inputs used to drill a typical geothermal well

Category	Input	Unit	Quantities
Mud and mud materials	Drilling Bentonite	ton	47.50
	Starch	ton	0.60
	Caustic Soda	ton	0.90
Lost circulation materials	Mica-Flakes	ton	0.85
	Drilling detergent	210 litre drum	200
Cement and cement additives	Blended Cement	ton	130.5
	Neat Cement	ton	161.8
	Wyoming (2% BWOC)	ton	2.61
	Mica Flakes (3% BWOC)	ton	3.5
	Fluid Loss (0.3% BWOC)	ton	0.09
	Friction Reducer (0.3% BWOC)	ton	0.09
	Retarder (0.3% BWOC)	ton	0.09
	Mica Flakes (2% BWOC)	ton	0.42
Generator and air compressors fuel	Diesel	litres	466,480.00
Others	Drilling water	M ³	140,000.00
	Corrosion Inhibitor	drums	1
	Pipelax	drums	4

Drilling of the geothermal wells will be undertaken using a rotary drilling rig and its accessories which include diesel generators, mud tanks and air compressors.

The equipment that will be used for construction of the well pads, water supply line and access roads are provided in table 2.

Table 2: Equipment for construction of well pads, water supply line and access roads

Index	Type of Equipment	No. Required
1.	Logistic vehicles	2
2.	Bulldozers	2
3.	Tippers	8
4.	Graders	2
5.	Excavators	2
6.	Shovels	2
7.	Water bowsers	2
8.	Rollers	2

8.0. Geothermal Well Drilling Process

- i. Drilling Method: An appropriate drilling technology (e.g., rotary drilling, directional drilling) is selected based on geological conditions.
- ii. Drilling Operations: Begin drilling, continuously monitoring parameters like pressure and temperature, and managing cuttings and fluids.
- iii. Drilling starts with 26-inch surface hole to 60m then 20-inch casing run in hole cemented in place to hold loose top formation. 17 ½ inch intermediate section is drilled to 300m then 13 3/8-inch casing cemented. The production section 12 ¼ inch is drilled to between 750-1200m then 9 5/8-inch casing cemented in place to seal off all underground cold influx. Lastly the main hole 8 ½ inch is drilled to 3000m and 7-inch liners run in hole to total depth. The top sections are drilled using water-based mud while production and main holes drilled using aerated water and foam.

9.0. Scope of the Environmental and Social Impact Assessment (ESIA) Study

The broad scope of the assignment will be to carry out Environmental and Social Impact Assessment (ESIA) study for the proposed drilling of geothermal wells. The study will cover identification of environmental, social and economic aspects and prediction of the positive and negative impacts associated with the proposed project. The ESIA study will also help to develop mitigation measures in the form of Environmental and Social Management Plan (ESMP) as well as monitoring plans for the successful implementation of ESMP. The ESIA study will be structured to meet the requirements of existing legal frameworks.

The ESIA study report will endeavour to provide the following information as provided for by regulation 18(1) of the Environmental (Impact Assessment and Audit) Regulations, 2003:

- a) the proposed location of the project;

- b) a concise description of the national and international environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- c) the objectives of the project;
- d) the technology, procedures and processes to be used in the implementation of the project;
- e) the materials to be used in the construction and implementation of the project;
- f) the products, by-products and waste generated by the project;
- g) a description of the potentially affected environment;
- h) the environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- i) alternative technologies and processes available and reasons for preferring the chosen technology and processes;
- j) analysis of alternatives including project site, design and technologies and reasons for preferring the proposed site, design and technologies;
- k) an environmental management plan proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment; including the cost, time frame and responsibility to implement the measures;
- l) provision of an action plan for the prevention and management of foreseeable accidents and hazardous activities in the cause of carrying out activities or major industrial and other development projects;
- m) the measures to prevent health hazards and to ensure security in the working environment for the employees and for the management of emergencies;
- n) an identification of gaps in knowledge and uncertainties which were encountered in compiling the information;
- o) an economic and social analysis of the project;
- p) an indication of whether the environment of any other state is likely to be affected and the available alternatives and mitigating measures; and
- q) such other matters as NEMA may require.

10.0. Responsibilities of the ESIA Team

The ESIA team, under the leadership of a registered and licensed Lead EIA/Audit Expert, will ensure that a thorough and comprehensive ESIA study is carried out by executing the following tasks:

Task 1: Description of the Proposed Project

The ESIA team will provide:

- a) a comprehensive description of the proposed project and the surrounding environment specifying any information necessary to identify and assess the environmental and social effects of the project;
- b) detailed project objectives and information regarding; nature, location/existing setting and general layout;
- c) Description of the geothermal well drilling process;
- d) Activities to be undertaken during construction, operation and decommissioning phases of the project;

- e) detailed description of raw material inputs, technology and processes to be used as well as products, by-products and waste to be generated;
- f) areas to be reserved for construction and areas to be preserved in their existing state as well as activities and features which will introduce risks or generate impact (negative and positive) on the environment will be highlighted;
- g) outline plans for waste disposal as well as plans for providing utilities and other services;
- h) Details of work force to be employed;
- i) Alternative technologies.

Task 2: Description of the Environment/Baseline Data Collection

Baseline data on the project's area of influence and its surroundings shall be established through field survey, review of relevant literature/authenticated documents and sample collection and laboratory analysis of soil and vegetation. The following shall form part of the baseline data.

Geological, Geophysical and Geo-hydrological Aspects

The ESIA team will:

- a) Describe the geography and physiography of the project area.
- b) Critically review the geology and soil characteristics around the project area.
- c) Determine the impact of the proposed project on the geological environment including possibility of land subsidence and micro earthquakes.

Flora and Fauna of the Project's Area of Influence:

The ESIA will collect baseline information on the existing biodiversity and determine how it will be affected by construction and operation activities.

Socio-economic Aspects

Socio-economic aspects to be considered will include the following:

- a) Land uses;
- b) Demographic profile;
- c) Economic activities around the project site;
- d) Identification of cultural and aesthetic sites;
- e) Existing public infrastructure and social services i.e. education, health, communication and transport network, etc.
- f) Prevalent diseases.

Task 3: Carry out Public Consultations

The ESIA team will carry out adequate public participation to ensure that all relevant concerns and opinions regarding the proposed project are integrated into the project decision making process and are adequately addressed in the ESIA study report. This shall be achieved by presenting the findings of the ESIA study to the identified stakeholders and soliciting comments from them with regards to the proposed drilling of geothermal wells in Hell's Gate

National Park. Four public meetings and a key stakeholders' workshop will be conducted to fulfil this requirement. Table 3 provides details of stakeholders who will be consulted during the workshop that will be chaired by the Deputy County Commissioner, Naivasha Sub-county.

Table 3: Details of Stakeholders to be Consulted

Stakeholder	Contact Person
1. Orpower 4 Incl Ltd	Managing Director & CEO
2. Energy and Petroleum Regulatory Authority (EPRA)	South Rift Region – Head of the Region
3. National Environment Management Authority (NEMA)	Sub-county Environment Officer, Naivasha
4. Oserian Development Company Ltd	Managing Director & CEO
5. National Government Administration Office (NGAO), Hells' Gate location	Area Chief, Olkaria Location
6. NGAO, Olkaria Sub-location	Area Asst. Chief, Olkaria Sub-location
7. Kenya Police	OCS, Olkaria Police Post
8. Imarisha Naivasha Trust	MD & CEO
9. Lake Naivasha Riparian Association (LNRA)	General Manager
10. WWF –Naivasha	Project Coordinator
11. Elsamere Conservation Centre	Project Manager
12. Nature Kenya	Project Officer, Naivasha
13. Kenya Marine and Fisheries Research Institute (KMFRI)	Regional Manager –Naivasha
14. Lake Naivasha Water Resource Users Association (LANAWRUA)	Chairperson
15. KWS –Hell's Gate & Mt. Longonot National Parks	Senior Warden
16. Wildlife Research and Training Institute - Naivasha	MD and CEO
17. Kedong Ranch Company Ltd	Manager
18. Water Resources Authority (WRA)	Sub-Regional Manager –Nakuru-Naivasha Region
19. Directorate of Occupational Health & Safety Services (DOHSS)	Occupational Health and Safety Officer, Naivasha Sub-County
20. Naivasha Sub-County Environment Office	Environment Officer, Naivasha Sub-County
21. Naivasha Sub-County Public Health Office	Public Health Officer, Naivasha Sub-County
22. Naivasha Sub-County Veterinary Office	Veterinary Officer, Naivasha Sub-County
23. Naivasha Sub-County Livestock Office	Livestock Officer, Naivasha Sub-County
24. Naivasha Sub-County Public Works & Infrastructure Office	Public Works & Infrastructure Officer, Naivasha Sub-County

Stakeholder	Contact Person
25. Naivasha Sub-County Land & Settlement Office	Land & Settlement Officer, Naivasha Sub-County
26. Nakuru County Assembly	Member of County Assembly – Olkaria Ward
27. Olkaria RAP land Community Dispensary	Nurse-in-Charge, Olkaria RAP land Community Dispensary
28. Community Based Organization (CBO) - Kamere	Chairman
29. Geothermal Development Company (GDC)	The Environment Manager, GDC
30. Lake Naivasha Tourism Group	Chairperson
31. Lake Naivasha Growers Group (LNGG)	Chairperson
32. National Government Administration Office (NGAO)	Subcounty Commissioner, Naivasha
33. NGAO	Assistant Subcounty Commissioner,
34. Naivasha Water and Sanitation Company (NAIVAWASCO)	MD & CEO
35. Naivasha Professional Association	Chairperson
36. Akiira Geothermal Company Ltd	MD & CEO
37. Kenya Power PLC	Regional Manager
38. Kenya Electricity Transmission Company Limited	MD & CEO

Key informant Interviews (KII) will be conducted with the following stakeholders; KWS, Oserian Development Company Ltd, Orpower IV Inc., Elsamere Conservation Centre, RAPland dispensary, Water Resources Authority- Naivasha and Naivasha Subcounty Public Health Officer.

The public meetings/barazas will be held at RAPland, Kamere, Narasha and Olomayiana Kubwa villages. The meetings will be chaired by the area Chief-Olkaria Location. Notices for the public meetings and stakeholders' workshop will be sent out prior to the planned meeting dates.

Stakeholder comments will be analysed and included in the ESIA report. Upon submission of the ESIA study report to NEMA, the final ESIA report will be disclosed to the public for a period of 30 days to facilitate submission of comments. Notices to invite comments will be done by way of a radio, newspaper and the Kenya Gazette.

Task 4: Legislative and Regulatory Framework.

A description will be given of the pertinent acts of parliament, regulations, standards, treaties, protocols, conventions, agreements and institutional framework governing environmental management, health and safety. Consideration will be given to the national and international legislations. Among those to be considered include the following.

i. Legal Framework

- a) The Constitution of Kenya, 2010
- b) Environmental Management and Coordination Act, 1999
- c) Environmental (Impact Assessment and Audit) Regulations of 2003
- d) The Environmental Management and Co-ordination (Waste Management) Regulations 2006
- e) The Environmental Management and Co-ordination (Water Quality) Regulation, 2006
- f) The Environmental Management and Co-ordination (Noise and Excessive Vibrations Pollution Control) Regulations, 2009
- g) The Environmental Management and Co-ordination (Air Quality) Regulation, 2014
- h) Occupational Safety and Health Act, 2007
- i) The Factories and Other Places of Work (Fire Risk Reduction) Rules, 2007
- j) The Factories and Other Places of Work (Hazardous Substances) Rules, 2007
- k) The Factories and Other Places of Work (Noise Prevention and Control) Rules, 2005 – Legal Notice No.25
- l) The Factories (Building Operations and Works of Engineering Construction) Rules, 1984
- m) The Work Injury Benefits Act, 2007
- n) The Water Act, 2016 and its regulations
- o) Public Health Act, Cap 242
- p) The Wildlife Management and Conservation Act, No. 47 of 2013
- q) The Energy Act, 2019
- r) Occupiers Liability Act (Cap 34)
- s) Climate Change Act, 2016
- t) Physical and Land Use Planning Act, 2019
- u) Sustainable Waste Management Act, 2022 and
- v) The HIV and AIDS Prevention and Control Act (Cap 14 of 2006)

ii. International Conventions

- a) The 1985 Vienna Convention for the Protection of the Ozone Layer
- b) The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer
- c) The United Nations Framework Convention on Climate Change, 1992 and its Protocols
- d) The 1971 Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat
- e) The Convention on Biological Diversity
- f) Paris Agreement
- g) International Labour Organization (ILO);
- h) Sustainable Development Goals (SDGs).

iii. Policies

- a. Kenya Vision 2030;
- b. Fourth Medium Term Plan (2023-2027);
- c. Sessional Paper No. 10 of 2014 on the National Environment Policy;
- d. Sessional Paper No. 1 of 2017 on National Land Policy;
- e. The National Climate Change Response Strategy (NCCRS), 2010;

- f. Least Cost Power Development Plan 2022-2041.

Task 5: Determination of Potential Impacts of the Proposed Project

The ESIA team shall identify all possible positive and negative impacts arising from all aspects of the proposed project during construction, operation and decommissioning phases. Potential impacts will be drawn from case studies of similar drilling projects at Olkaria geothermal field and other fields worldwide. Each negative impact shall be described in detail. The assessment shall include short term and long-term impacts of the proposed project as well as cumulative impacts. The issues to be considered when identifying potential impacts will include those provided under the second schedule to the Environmental (Impact Assessment and Audit) Regulations, 2003. They are as detailed below.

1. Ecological Considerations
 - a) Biological diversity including effect of proposal on the number, diversity and breeding habits of wild animals.
 - b) Sustainable use;
 - i. effect of proposal on soil fertility;
 - ii. breeding populations of wild animals;
 - iii. natural regeneration of vegetation and sustainable yield;
 - iv. wetland resource degradation or wise use of wetlands.
 - c) Ecosystem maintenance including
 - a. effect of proposal on food chains;
 - b. nutrient cycles;
 - c. aquifer recharge, water run-off rates, soil erosion;
 - d. a real extent of habitats;
 - e. fragile ecosystems.
2. Social considerations including
 - i. economic impacts;
 - ii. social cohesion or disruption;
 - iii. effect on human health;
 - iv. immigration or emigration;
 - v. communication - roads opened up, closed, rerouted;
 - vi. effects on culture and objects of culture value.
3. Landscape
 - i. views opened up or closed;
 - ii. visual impacts (features, removal of vegetation);
 - iii. compatibility with surrounding area;
 - iv. amenity opened up or closed, e.g. recreation possibilities.
4. Land uses
 - i. Effects of proposal on current land uses and land use potentials in the project area;
 - ii. possibility of multiple use;
 - iii. effects of proposal on surrounding land uses and land use potentials.
5. Water
 - a) water sources (quantity and quality);
 - i. rivers;

- ii. springs;
- iii. lakes (natural and man-made);
- iv. underground water;
- b) drainage patterns/drainage systems.

11.0. Potential Environmental Impacts

The potential environmental and social impacts associated with the proposed modular geothermal power plants include:

- a) positive impacts:**
 - i. generation of additional renewable geothermal energy;
 - ii. creation of employment opportunities;
 - iii. enhancement of business opportunities;
 - iv. displacement of carbon emissions from existing thermal power plants;
 - v. skills and knowledge transfer.

- b) negative impacts:**

A summary of potential environmental and social impacts and corresponding mitigation measures are presented in the table 4.

Table 4: Potential Negative Environmental and Social Impacts

Index	Project Activity	Potential Environmental and Social Impacts/Aspects	Measures to be Put in Place
1.	Land clearance and earthworks during access roads and well pad construction.	Loss of native vegetation	<ul style="list-style-type: none"> i. Well siting shall take into consideration sensitive sites. ii. The well pads will be designed to accommodate multiple wells thus reducing project footprint. iii. Surface stripping and excavation works will be confined within the site layout of the well pad and roads. iv. KenGen-KWS joint baseline studies shall be undertaken for each well pad and new road to facilitate preparation of sub-EMPs. v. So far as practicable, existing roads will be used.
2.	Land clearance and earthworks during access roads and well pad construction.	Soil erosion	<ul style="list-style-type: none"> i. Slope gradients shall be designed to assure stability and erosion protection measures like gabions and grassing incorporated. ii. Cut slopes shall be regularly monitored to detect erosion and remediate promptly. iii. Soil disturbance shall be limited to the minimum amount necessary for construction of the well pad and roads.
3.	Land clearance, earthworks and transportation of materials.	Dust	<ul style="list-style-type: none"> i. Application of water sprays using water bowsers. ii. Cement will be transported using portable trailer silos. iii. Enforcement of speed limits.
4.	Rig Move and transportation of materials and drilling crew.	Road Traffic Accidents (RTA)	<ul style="list-style-type: none"> i. Implementation of Traffic Management Plan including strict enforcement of speed limits and limiting night time driving. ii. Inclusion of education on wildlife protection in the project employee induction program and toolbox talks. iii. Implementation of safe driving protocols. iv. Use of escort vehicle during rig move.
5.	Earthworks, drilling of geothermal wells and demobilization.	Solid waste disposal	<ul style="list-style-type: none"> i. Waste segregation and provision of animal proof waste containment cages. ii. NEMA licensed waste handlers will be contracted.

Index	Project Activity	Potential Environmental and Social Impacts/Aspects	Measures to be Put in Place
			iii. Disposal of waste at licensed/approved sites and maintaining dully signed waste tracking sheets.
6.	Drilling of geothermal wells.	Domestic sewage disposal	i. Provision of portable toilets for use by drilling crew. ii. Exhausting of sewage and disposal at approved sites using NEMA licensed firms.
7.	Transportation of consumables and drilling of geothermal wells	Air emissions from the internal combustion engines (vehicles and power generators).	i. Periodic maintenance and servicing of the engines. ii. Quality checks of fuel supplied at the rigs. iii. Fuelling of vehicles at accredited pumping stations.
8.	Geothermal well drilling & discharge tests.	Hydrogen Sulphide gas emissions.	i. Gas emission will be monitored ii. A contingency plan regarding high levels of H ₂ S will be implemented.
9.	Geothermal well drilling & discharge tests.	Release of hot geothermal fluids to the environment.	i. Use of blowout preventers in the rig assembly. ii. Physicochemical analysis of brine. iii. Temporary containment in fenced ponds and iv. reinjection into the reservoir.
10.	Earth works, drilling of geothermal wells and discharge tests.	Noise emission	i. Limit duration of vertical discharge test as far as practicable. ii. Use of silencers iii. Limit civil work activities to daytime (0800 to 1700 hrs), to the extent feasible. iv. Preventive and condition based maintenance of air compressors and internal combustion engines.
11.	Drilling of geothermal wells	Spillage of oil/fuel from the power generators and fuel/oil storage tanks.	i. Storage of fuel and oil in well secured and managed areas with impervious floors and bunding walls. ii. Implementation of oil/fuel spill contingency plans.
12.	Drilling of geothermal wells	Drill cuttings and drilling fluid.	i. Fluids and solids would be tested to determine the chemical composition and identify any materials that may be hazardous.

Index	Project Activity	Potential Environmental and Social Impacts/Aspects	Measures to be Put in Place
			ii. Any drill cuttings that exceed the toxicity threshold for hazardous waste would be treated as hazardous waste and disposed via NEMA licensed handlers.
13.	Drilling of geothermal wells	Influx of workers at the project site resulting to spread of contagious diseases.	i. Unskilled labour will be sourced from the local community. ii. Education of the drilling crew on mode of spread and prevention of contagious diseases.
14.	Drilling of geothermal wells	Pressure on water abstracted from Lake Naivasha.	i. Use of brine to supplement water used for drilling the wells. ii. Monitoring of quantities of water and brine used for drilling of the geothermal wells. iii. Water leakages will be monitored and corrective actions taken as appropriate.

Further prediction of the potential environmental and social impacts will be done upon collection of baseline data and undertaking public participation exercise.

12.0. Mitigation and Management of Negative Impacts.

Recommendations will be made for feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels. This will culminate into an Environmental and Social Management Plan (ESMP) for avoiding or reducing (e.g. restoration and rehabilitation), as far as possible, any adverse impacts due to the proposed project. A monitoring plan will also be developed taking care of the following:

- a) The activity to be monitored and the parameters chosen to effectively carry out the exercise
- b) The methodology to be employed and the frequency of monitoring and
- c) The sites to be monitored.

13.0. Preparation of ESIA Study Report

The ESIA team will be required to prepare the ESIA study report which will focus on key findings, conclusions and recommended actions, supported by summaries of the data collected and citations of any references used in interpreting those data.

14.0. Methodology

Standard ESIA techniques will be used including site reconnaissance, literature review, desktop review, mapping of the site using Geographic Information System (GIS), data and information collection, data analysis and stakeholder consultations, in order to fulfil the ToRs.

15.0. Study Team

A multidisciplinary team whose details are indicated in table 5 has been appointed to conduct the ESIA study for the proposed drilling of geothermal wells:

Table 5: ESIA Team Composition

Index	Name	Qualifications	NEMA Reg. No.
1.	Philip Barasa	MSc. Geothermal Energy Technology; BSc. Environmental Science.	Lead Expert No. 1857
2.	Elizabeth Mwangi-Gachau	Master of Environmental Studies; BSc. Environmental Studies; Postgraduate Diploma in Environmental Science.	Lead Expert No. 2399
3.	Douglas Gichangi	MSc. Geo-Information Science & Earth Observation with specialization in Natural Resources Management; BSc. Environmental Conservation & Natural Resource Management.	Lead Expert Reg. No.8118
4.	Rolex Rangángá	BSc. Environmental Studies	Associate Expert No. 10545
5.	Peninah Mbuthi	Masters in Education Management, Bachelor of Arts in Sociology, Postgraduate diploma in education	Not Registered
6.	Preston Mulunda	BSc. Mechanical and Industrial Engineering - Production option.	Not Registered
7.	Alex Ndwiga	Bachelor of Applied Science Geoinformatics	Not Registered
8.	Ruth Cheruiyot	BSc. Environmental Health	Associate Expert No. 9010

The CVs for the above experts are attached.

The roles of the ESIA study team are detailed in table 6.

Table 6: Roles of the ESIA Team

No.	Name	Position	Task
1.	Philip Barasa	Lead EIA/Audit/Geothermal Expert	<ul style="list-style-type: none"> • Team Lead that will oversee and coordinate the ESIA study. • Climate risk and vulnerability assessment. • Impact Prediction • Preparation of ESMP. • Report compilation and submission to NEMA.
2.	Elizabeth Mwangi-Gachau	Environmental Expert	<ul style="list-style-type: none"> • Legal, regulatory and institutional Framework. • Climate risk and vulnerability assessment • Mitigation Measures. • Project Alternatives
3.	Douglas Gichangi	Biodiversity Expert	<ul style="list-style-type: none"> • Baseline data collection • Biodiversity impact assessment
4.	Ruth Cheruiyot	Environmental Health Expert	<ul style="list-style-type: none"> • Baseline data collection including sampling of vegetation, water and soil. • Noise and air quality assessment. • Climatic data analysis.
5.	Rolex Rang'ang'a	Environmental Expert	<ul style="list-style-type: none"> • Baseline data collection. • Stakeholder Engagement (Recording the deliberations).
6.	Kelly Tamakaro	Social Expert	<ul style="list-style-type: none"> • Stakeholder mapping and community mobilization. • Facilitate public barazas and key stakeholders meeting. • Collect Socio-economic baseline data.

No.	Name	Position	Task
7.	Peninah Mbuthi	Social Expert	<ul style="list-style-type: none"> • Social Impact Assessment • Analyse stakeholder feedback.
8.	Preston Mulunda	Geothermal Drilling Expert	<ul style="list-style-type: none"> • Project Description including project objectives, types and quantities of materials to be used, construction of well pads and roads and drilling process. • Hazard identification and risk analysis. • Occupational Health and Safety Management Plan for drilling operations.
9.	Alex Ndwiga	GIS Expert	<ul style="list-style-type: none"> • Baseline data collection and presentation in form of maps. • Acquisition of satellite imagery for impact analysis.

16.0. Expected Outputs

Ten hard copies and an electronic copy of the ESIA study report will be prepared and submitted to NEMA for review and approval. The report will include an appendix with items such as layout drawings, land ownership documents, site plans, approved ToRs, PIN certificate for KenGen and lead expert's license. The soft copy of the report will be submitted electronically via NEMA website.

17.0. Proposed Work plan for the ESIA Study

The proposed work plan is shown in table 7.

Table 7: Workplan for the ESIA Study

ITEM DESCRIPTION	DURATION (No. of days)
Preparation, submission and approval of terms of reference by NEMA	10
Baseline data collection	15
Public participation	20
Desktop ESIA study report preparation	15
Presentation of draft ESIA report to KenGen Management	1
Preparation of final ESIA study report, printing, binding, endorsement and submission to NEMA	3
Public participation and consultations including; <ul style="list-style-type: none">• Preparation of public notice by NEMA• Submission of public notice to government printers for incorporation in Kenya gazette• Submission of public notice to print media for incorporation in the newspaper with wider local circulation• Advertising in local newspaper and Kenya Gazette for 2 successive weeks• Receipt of comments from the public and key stakeholders• Response to the public and/or stakeholders comments by the ESIA team in form of a report and submission of the report to NEMA as an addendum to the ESIA study report where necessary.	40
Review of the ESIA study report & decision making by NEMA (Issuance of EIA license)	50
TOTAL No. of days to complete ESIA study Report & receive approval from NEMA	150

NB: Some activities will run concurrently.

18.0. Conclusion and Recommendations

The scoping exercise has established that the proposed project will lead to accelerated power generation that will enable KenGen to meet the growing demand for electricity. The screening exercise classified the project as high risk and the proponent shall be committed to putting in place several measures to mitigate the potential negative environmental, social, safety and health risks and impacts associated with the proposed project throughout its life cycle. It is recommended that in addition to this commitment, the proponent will focus on implementing the measures to be discussed and highlighted in the ESMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects. It is expected that the potential positive impacts arising from the proposed development shall be enhanced for maximum benefit. These measures will go a long way in ensuring the best possible environmental compliance and performance standards.

REFERENCES

- KenGen internal Reports domiciled at Olkaria Geothermal Field.
- Various statutory laws and regulations under www.kenyalaw.org.

Lead Experts License



EAE23060026

FORM 7

(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING
LICENSE**

License No : NEMA/EIA/ERPL/20302

Application Reference No: NEMA/EIA/EL/26964

M/S **PHILIP JUMA BARASA**
(individual or firm) of address
P.O. Box 103235 - 00101 NAIROBI

is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
General

registration number **1857**

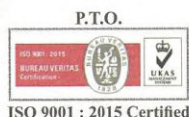
in accordance with the provision of the Environmental Management and Coordination
Act Cap 387.

Issued Date: 1/9/2024

Expiry Date: 12/31/2024

Signature.....

(Seal)
Director General
The National Environment Management Authority





NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

Mobile Lines: 0724 253 398, 0723 363 010, 0735 013 046
Telkom Wireless: 020-2183718, 020-2101370
Incident Lines: 0786 101 100, 0741 101 100

P.O. Box 67839 - 00200
Popo Road, Nairobi, Kenya
Email: info@nema.go.ke
Website: www.nema.go.ke



REF: NEMA/TOR/5/2/808

DATE: 15th October, 2024

Managing Director,
Kenya Electricity Generating Company PLC
P.O. BOX 47936-00100,
NAIROBI.

RE: TERMS OF REFERENCE (TOR) FOR ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R NO 12881/5) WITHIN HELL'S GATE NATIONAL PARK IN NAIVASHA SUB-COUNTY, NAKURU COUNTY.

We acknowledge the receipt of your TOR for the above proposed project.

Pursuant to the Environmental Management and Coordination Act, 1999, the Environmental (Impact Assessment and Audit) Regulations 2003 and Legal notice 31 & 32 of 2019, your terms of reference for the Environmental Impact Assessment (EIA) for the **PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R NO 12881/5) WITHIN HELL'S GATE NATIONAL PARK IN NAIVASHA SUB-COUNTY, NAKURU COUNTY** has been approved with the following conditions:

1. You shall undertake a detailed Climate Change Risks and Vulnerability Assessment for the project to inform the appropriate adaptation and mitigation measures to climate proof the project in line with provisions of Climate Change Act, 2016.
2. You shall undertake inclusive and detailed Public Participation with the Project Affected Persons (PAPs) in full compliance to Regulations 17 of the EIA/EA Regulations 2003 and provide evidence of Published Notices for the meeting dully signed minutes and attendance lists of least three consultation meetings.
3. You shall undertake detailed Baseline Environmental and Social Conditions on Water Quality, Biodiversity, Air Quality and Geophysical conditions and baseline livelihoods of the local community within the proposed project footprint area.

You shall submit ten (10) copies of the EIA study report duly signed by all participating experts and the proponent accompanied by the above specialized assessment reports upon payment of the applicable EIA processing and monitoring fees being 0.1% of the total project cost, a soft copy of the summarised ESMP in **WORD** format for preparation of public notice and one electronic copy of the report prepared by the team of experts to the Authority.

You are advised to comply accordingly.

A handwritten signature in blue ink, appearing to read 'J. Makau', with a long horizontal flourish extending to the right.

JOSEPH MAKAU

FOR: DIRECTOR GENERAL

Appendix 4: EIA Expert's Practicing Licenses



nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

EAE 23060026

FORM 7

(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING
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License No : NEMA/EIA/ERPL/20302

Application Reference No: NEMA/EIA/EL/26964

M/S **PHILIP JUMA BARASA**
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General

registration number **1857**

in accordance with the provision of the Environmental Management and Coordination
Act Cap 387.

Issued Date: 1/9/2024

Expiry Date: 12/31/2024

Signature.....

(Seal)

Director General

The National Environment Management Authority

P.T.O.



ISO 9001 : 2015 Certified





FORM 7



EAE 23062405

(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING
LICENSE**

License No : NEMA/EIA/ERPL/22032

Application Reference No: NEMA/EIA/EL/29210

M/S Elizabeth Mwangi-Gachau
(individual or firm) of address
P.O. Box 1999 - 20117 Naivasha.

is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
General
registration number **2399**

in accordance with the provision of the Environmental Management and Coordination
Act Cap 387.

Issued Date: 8/23/2024

Expiry Date: 12/31/2024

Signature.....

(Seal)

Director General
The National Environment Management Authority

P.T.O.



ISO 9001 : 2015 Certified





nema
Mazingira Yetu | Uhai Wetu | Wajibu Wetu

EAE 23061254

FORM 7

(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING
LICENSE**

License No : NEMA/EIA/ERPL/21608

Application Reference No: NEMA/EIA/EL/28576

M/S **Douglas Mutuota Gichangi**

(individual or firm) of address

P.O. Box 785 - Naivasha.

is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
General

registration number **8118**

in accordance with the provision of the Environmental Management and Coordination
Act Cap 387.

Issued Date: 5/2/2024

Expiry Date: 12/31/2024

Signature.....

(Seal)

Director General

The National Environment Management Authority

P.T.O.



ISO 9001 : 2015 Certified





FORM 7



EAE 23062507

(r.15(2))

**NATIONAL ENVIRONMENT MANAGEMENT
AUTHORITY(NEMA)
THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING
LICENSE**

License No : NEMA/EIA/ERPL/22144

Application Reference No: NEMA/EIA/EL/28591

M/S RUTH CHERUIYOT

(individual or firm) of address
P.O. BOX 785- 20117 Naivasha

is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Associate Expert**
registration number **9010**

in accordance with the provision of the Environmental Management and Coordination
Act Cap 387.

Issued Date: 10/1/2024

Expiry Date: 12/31/2024

Signature.....

(Seal)

Director General

The National Environment Management Authority

P.T.O.

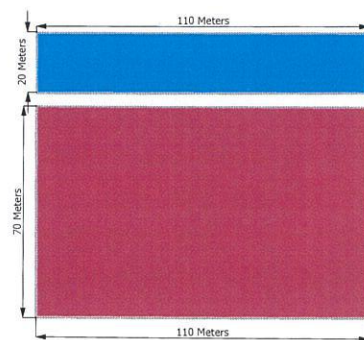


ISO 9001 : 2015 Certified

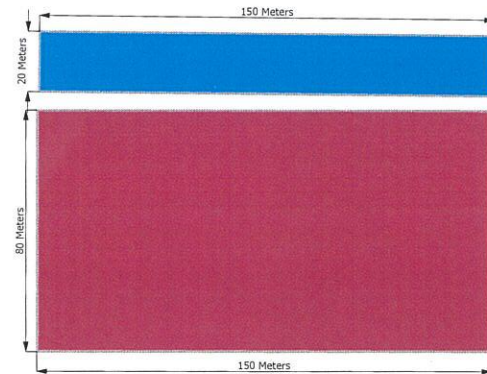


Appendix 5: Drawing of Multiple Well Pad

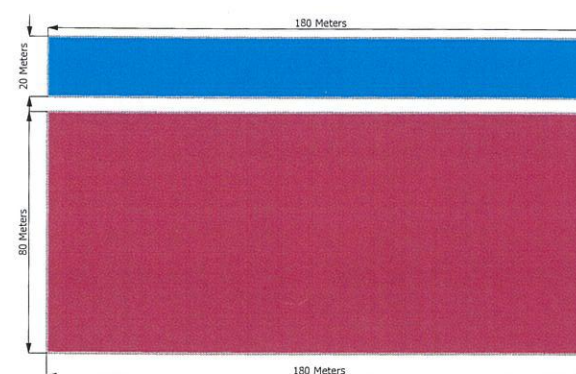
One well Wellpad



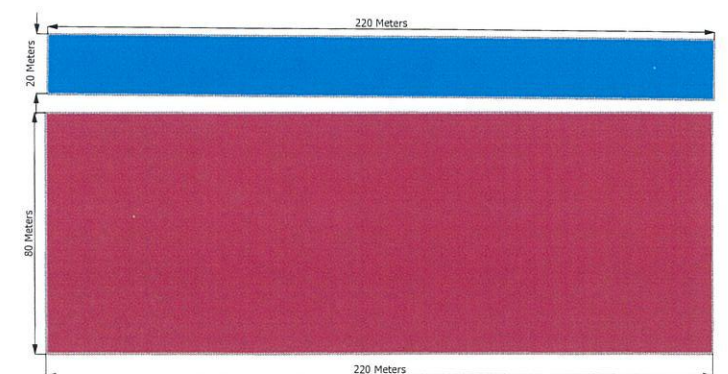
Two well Wellpad



Three well Wellpad



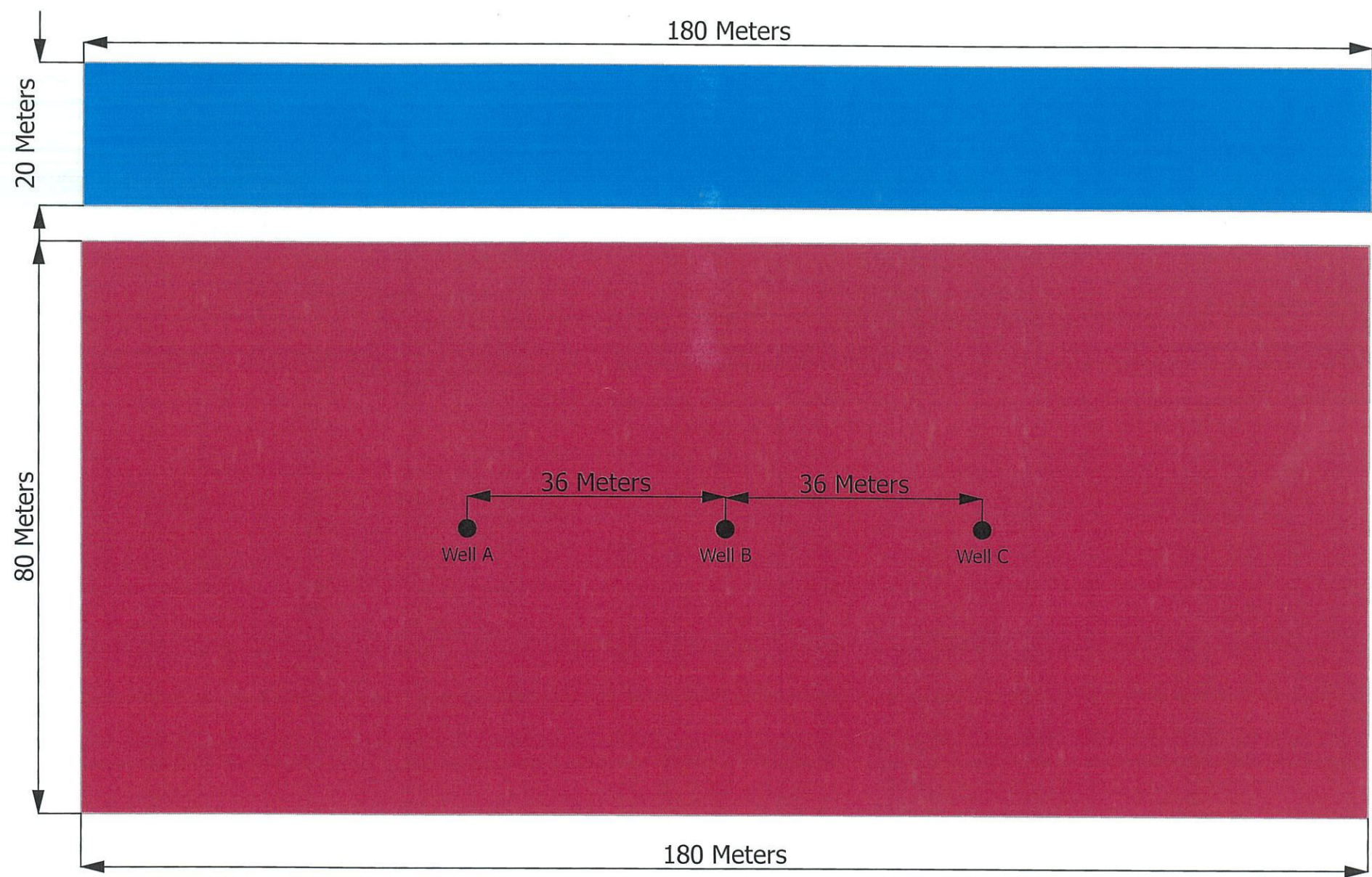
Four well Wellpad



NB:
The Distance between the Wellpad
and Pond = 4 Meters
Blue = Pond
Red= Wellpad

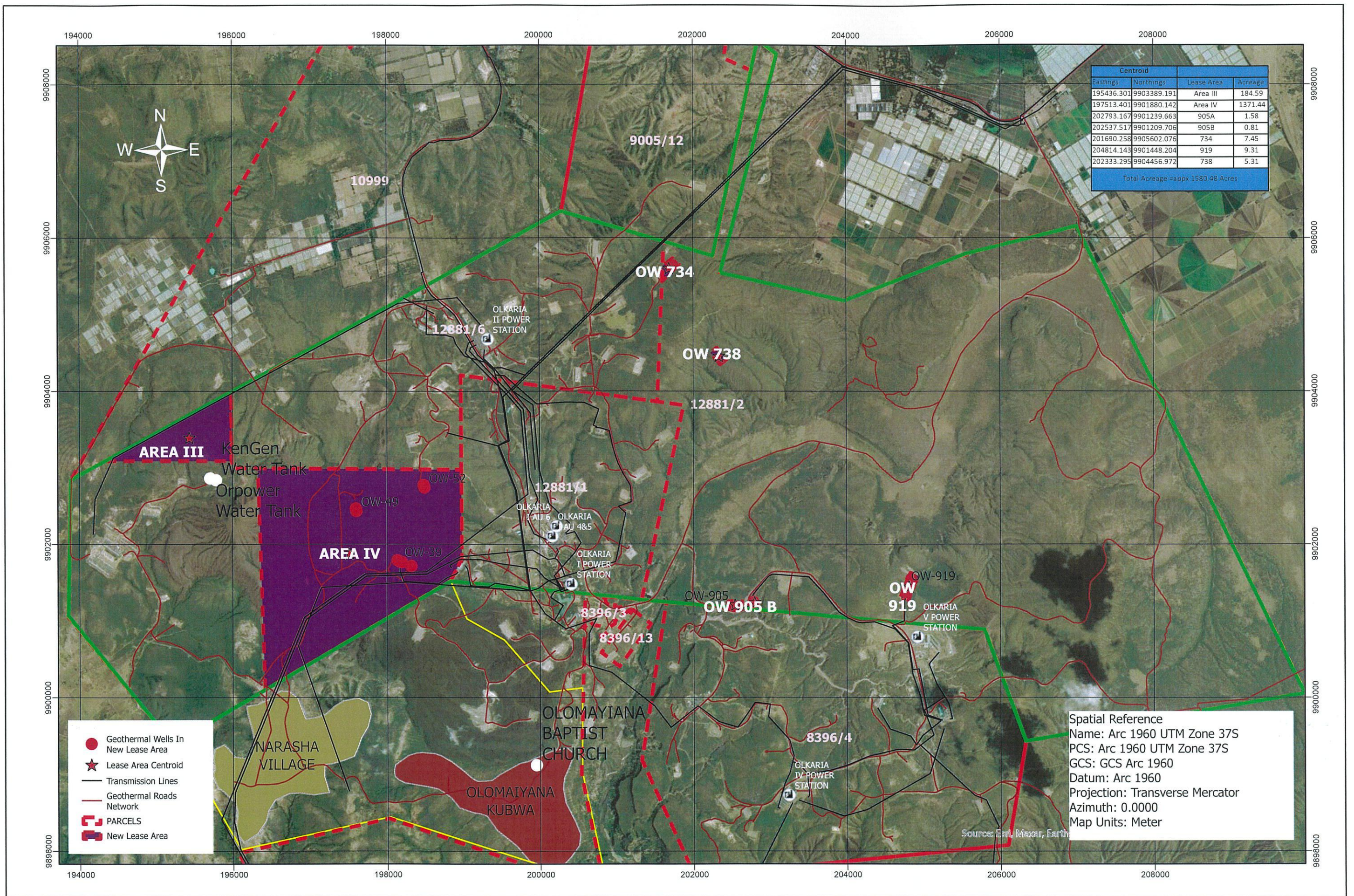
Appendix 6: Rig Site Lay-Out Plan

Three Wellpad Layout



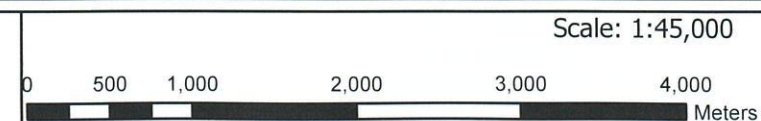
NB:
The Distance between the Wellpad and Pond = 4 Meters
Blue =Pond
Red= Wellpad

Appendix 7: Site Location Map



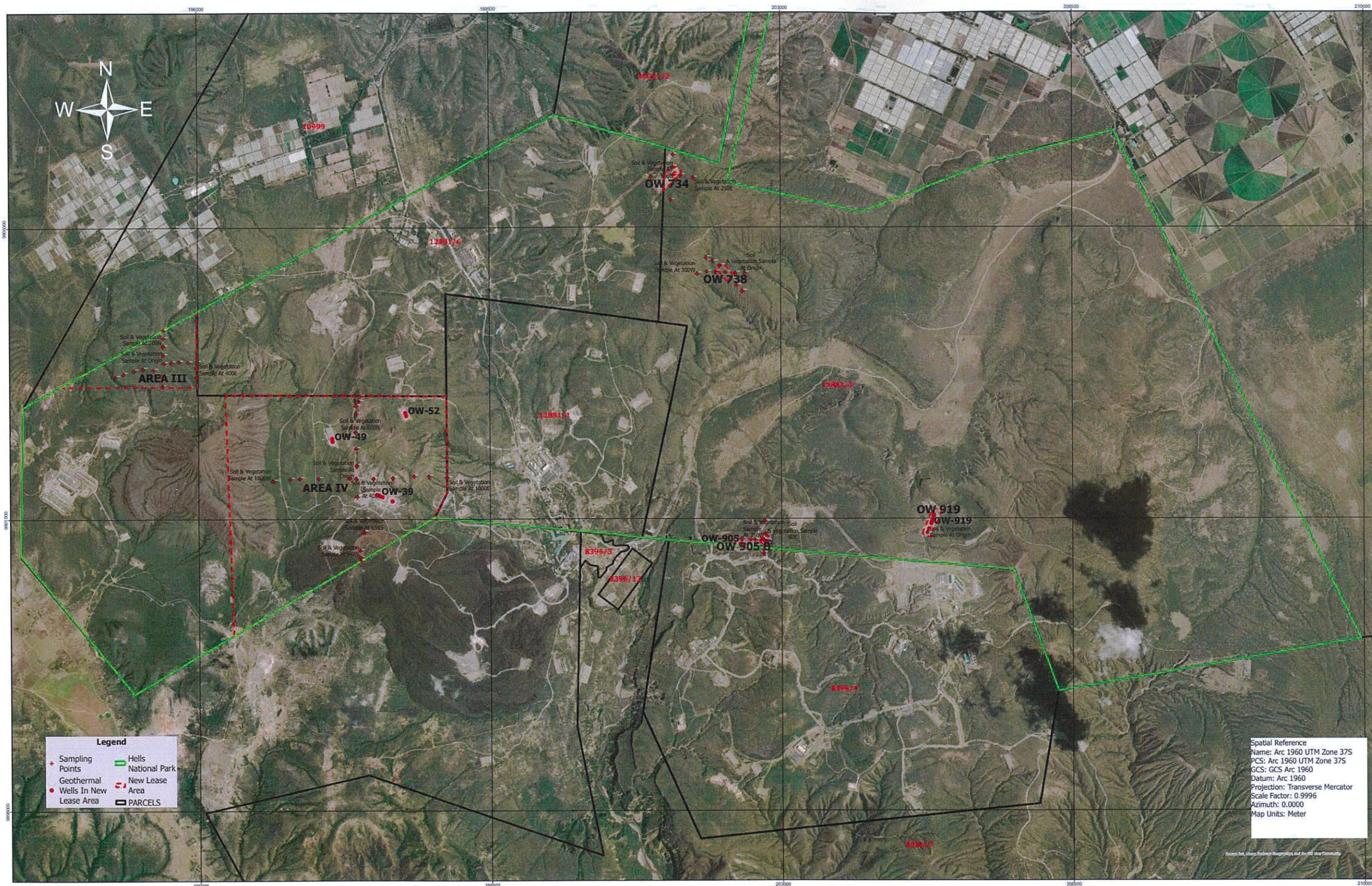
Geothermal Resource Development

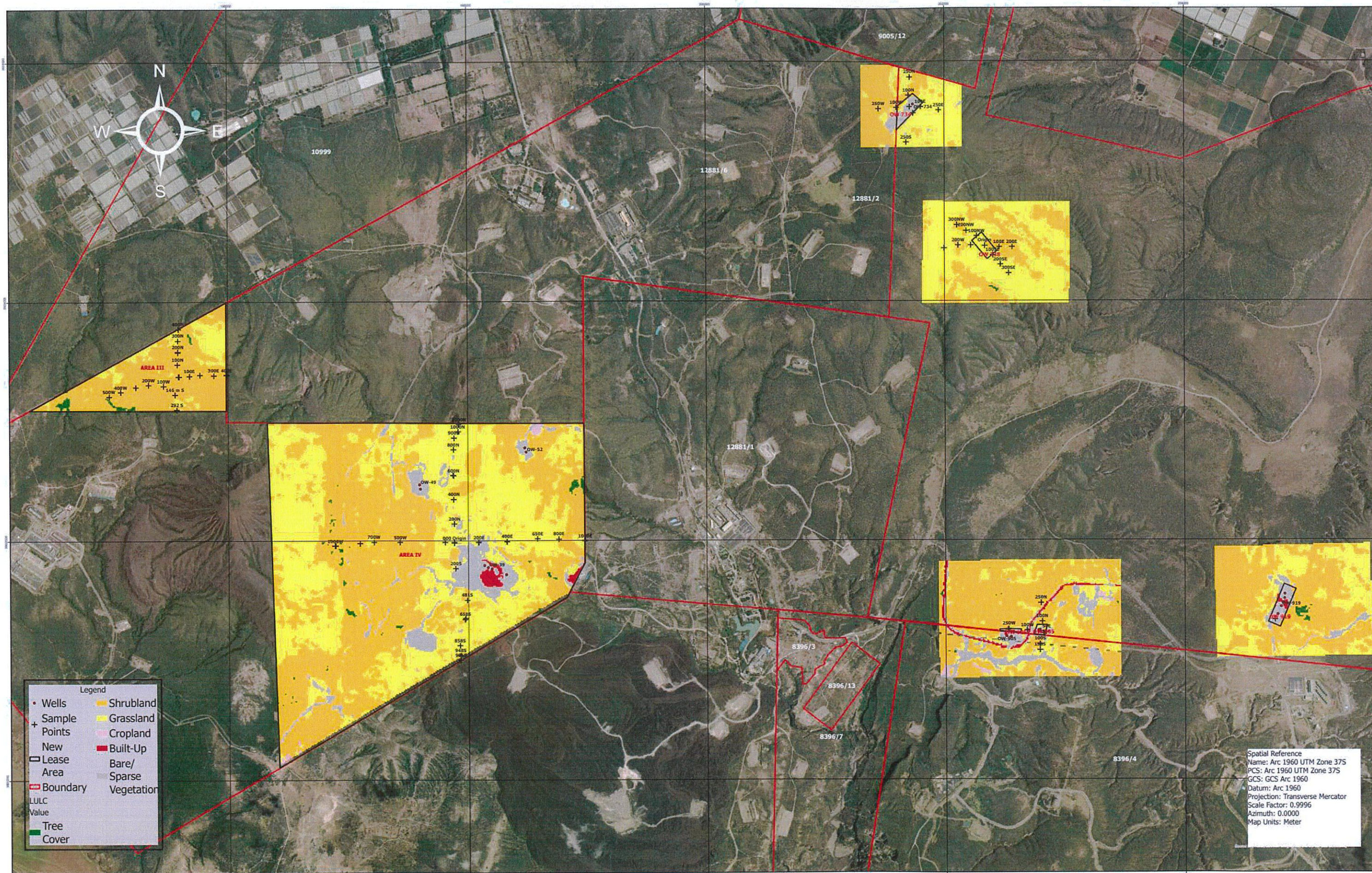
Geothermal Use Additional Sublease Area From KWS



	Name	Date	Sign
Drawn By	Ndwiga Alex	22/10/24	
Checked By	Josephat Kebu	22/10/24	
Recommended By	Daniel Saitet	22/10/24	
Approved By	Peketsa Mangi	23/10/24	

Appendix 8: Soil Sampling Points Map





Appendix 9: Laboratory Analysis Results for the sampled Water, Soil, And Vegetation

KENAS/TL/48

Serial No: CCSI12096

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: OW905A (1) Veg-18/2024-23
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12096

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.21	np
Fluoride as F, mg/Kg	CSITP 015	0.90	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	8.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	75.00	np
Calcium as Ca, mg/Kg	CSITP 003	2815.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW905A (1) Veg-18/2024-23			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12094

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: OW-734-16/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12094

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.22	np
Fluoride as F, mg/Kg	CSITP 015	1.10	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	16.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	111.00	np
Calcium as Ca, mg/Kg	CSITP 003	2225.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW-734-16/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12095

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: OW- 738(1)-19/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12095

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.44	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	12.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	77.00	np
Calcium as Ca, mg/Kg	CSITP 003	2725.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW- 738(1)-19/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12097

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: A4 200N-1/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12097

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.13	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	12.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	122.00	np
Calcium as Ca, mg/Kg	CSITP 003	2885.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A4 200N-1/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12098

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: A4 1000W-3/2024-25(Best Control)
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12098

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.73	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	9.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	51.00	np
Calcium as Ca, mg/Kg	CSITP 003	3305.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:A4 1000W-3/2024-25 (Best Control)			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12098

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: A4 1000W-3/2024-25(Best Control)
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12098

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.73	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	9.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	51.00	np
Calcium as Ca, mg/Kg	CSITP 003	3305.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:A4 1000W-3/2024-25 (Best Control)			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12099

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: OW-919-22/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12099

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.23	np
Fluoride as F, mg/Kg	CSITP 015	1.10	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	28.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	68.00	np
Calcium as Ca, mg/Kg	CSITP 003	1685.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW-919-22/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12100

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: OW-905B14/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CSI12100

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.23	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	21.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	21.00	np
Calcium as Ca, mg/Kg	CSITP 003	965.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW-905B 14/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12101

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: Area 4 Sample 1-A4 1000N-7/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12101

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.49	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	19.80	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	79.00	np
Calcium as Ca, mg/Kg	CSITP 003	3295.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:Area 4 Sample 1-A4 1000N-7/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12102

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: Area 3(1) 9/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12102

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.63	np
Fluoride as F, mg/Kg	CSITP 015	2.20	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	39.50	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	49.00	np
Calcium as Ca, mg/Kg	CSITP 003	2745.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS - Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: Area 3(1) 9/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12103

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Vegetation

Sample ID.: 4/10- A3(2)-11/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12103

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.04	np
Fluoride as F, mg/Kg	CSITP 015	1.70	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	41.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	29.00	np
Calcium as Ca, mg/Kg	CSITP 003	2405.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS - Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: 4/10- A3(2)-11/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12104

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: A4 200N-2/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12104

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	5.78	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	13.50	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	61.00	np
Calcium as Ca, mg/Kg	CSITP 003	288.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A4 200N-2/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12105

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW 905A(1)-19/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12105

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.98	np
Fluoride as F, mg/Kg	CSITP 015	2.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	29.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	91.00	np
Calcium as Ca, mg/Kg	CSITP 003	788.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW 905A(1)-19/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12105

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW 905A(1)-19/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12105

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.98	np
Fluoride as F, mg/Kg	CSITP 015	2.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	29.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	91.00	np
Calcium as Ca, mg/Kg	CSITP 003	788.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW 905A(1)-19/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12105

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW 905A(1)-19/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12105

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.98	np
Fluoride as F, mg/Kg	CSITP 015	2.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	29.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	91.00	np
Calcium as Ca, mg/Kg	CSITP 003	788.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW 905A(1)-19/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
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18/10/2024

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KENAS/TL/48

Serial No: CCSI12106

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: A4 1000W-4/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12106

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.52	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	14.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	120.00	np
Calcium as Ca, mg/Kg	CSITP 003	1674.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A4 1000W-4/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12107

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: AW905B(1)-15/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12107

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	7.08	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	11.50	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	117.00	np
Calcium as Ca, mg/Kg	CSITP 003	1209.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:AW905B(1)-15/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12108

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW-919(1)-23/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12108

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	9.62	np
Fluoride as F, mg/Kg	CSITP 015	1.97	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	25.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	113.00	np
Calcium as Ca, mg/Kg	CSITP 003	961.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW-919(1)-23/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12109

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: A4-1000N 8/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12109

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.58	np
Fluoride as F, mg/Kg	CSITP 015	0.97	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	31.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	101.00	np
Calcium as Ca, mg/Kg	CSITP 003	571.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A4-1000N 8/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:



Gloria Masitsa
Chemical Analyst
18/10/2024



Aloo Denish
Microbiology Analyst
18/10/2024



George Oindo
Quality Assurance Manager
18/10/2024



George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12110

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW 738(1)-20/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12110

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	7.03	np
Fluoride as F, mg/Kg	CSITP 015	<0.01	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	30.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	94.00	np
Calcium as Ca, mg/Kg	CSITP 003	767.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW 738(1)-20/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
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18/10/2024

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Microbiology Analyst
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George Oindo
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18/10/2024

George Okowa
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18/10/2024

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KENAS/TL/48

Serial No: CCSI12111

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: A4E 1000M 6/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12111

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.28	np
Fluoride as F, mg/Kg	CSITP 015	0.89	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	14.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	103.00	np
Calcium as Ca, mg/Kg	CSITP 003	663.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A4E 1000M 6/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
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KENAS/TL/48

Serial No: CCSI12113

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: OW-734(1) 17/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12113

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.25	np
Fluoride as F, mg/Kg	CSITP 015	1.32	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	22.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	144.00	np
Calcium as Ca, mg/Kg	CSITP 003	440.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS -Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled:OW-734(1) 17/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
Microbiology Analyst
18/10/2024

George Oindo
Quality Assurance Manager
18/10/2024

George Okowa
Laboratory Manager
18/10/2024

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KENAS/TL/48

Serial No: CCSI12114

CERTIFICATE OF ANALYSIS

Client: Kengen
Contact: 0726161667

Sample Type: Soil

Sample ID.: A3(1) 10/2024-25
Laboratory Batch No.: 24/0631

Sampled by: Client

Lab. Ref.: CCSI12114

Date Received: 11/10/2024

Date Analysis Started: 14/10/2024

Date Completed: 18/10/2024

Release Date: 18/10/2024

PARAMETER	Method	Results	¹ Standard (Max Limits)
Chemical			
pH	CSITP 002	6.50	np
Fluoride as F, mg/Kg	CSITP 015	5.46	np
Sulphate as SO ₄ ²⁻ , mg/Kg	CSITP 014	26.00	np
Chromium as Cr, mg/Kg	CSITP003	<0.01	np
Copper as Cu, mg/Kg	CSITP003	<0.01	np
Zinc as Zn, mg/Kg	CSITP003	116.00	np
Calcium as Ca, mg/Kg	CSITP 003	543.00	np
Iron as Fe, mg/Kg	CSITP 003	<0.01	np
Cadmium as Cd, mg/Kg	CSITP 003	<0.01	np
Lead as Pb, mg/Kg	CSITP 003	<0.01	np
Mercury as Hg, mg/Kg	CSITP 003	<0.01	np
Selenium as Se, mg/Kg	CSITP 003	<0.01	np
Boron as B, mg/Kg	CSITP 003	<0.01	np
< 0.001/0.01- below detection level of 0.001/0.01 mg/Kg			
NP- No Reference values quoted for these parameters			
APHA - American Public Health Association			
KS - Kenyan Standard			
ISO - International Organization for Standardization			
CSITP - CSI International Laboratories Work Procedure. Adopted from KS, ISO and APHA Methods			
To maintain the correct history ensure that the next sample is labeled: A3(1) 10/2024-25			
The results relate to the sample (s) submitted. The Laboratory shall not be held accountable for any error due to sampling.			

For Chemistry Lab:

For Microbiology Lab:

Reviewed By:

Authorised By:






Gloria Masitsa
Chemical Analyst
18/10/2024

Aloo Denish
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18/10/2024

George Oindo
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S2 PICOFOX - TRACE ELEMENT ANALYSIS

Listed at 18/10/2024 14:15:42

User: Administrator

Project: OW-918 Cuttings.rtx

ID-No.:

Quant. type: Solid

Meas.date: 18/10/2024 14:05:13

Count rate: 3520 cps

Voltage: 50 kV

Excitation: Mo K radiation

Method: Metals Dec 2023 (Profile bayes optimized fit)

Comment:

Serial number: 423400423

Sample: OW-918 Cuttings

Disc:

Spectrum: OW-918 Cuttings_1

Live time: 300 s

Dead time: 1.4 %

Current: 700 µA

Element	Line	Conc./ g/kg	Sigma/ g/kg	RSD/ %	LLD/ g/kg	Net area	Backgr.	Chi
Na	K12	3800	1800	45.6	2600	105	558	1.64
Mg	K12	Not det.			2400	7	348	1.01
Al	K12	2670	450	16.7	170	998	431	0.66
P	K12	Not det.			10	49	394	1.47
S	K12	25.2	7.0	27.7	7.3	207	397	1.03
Cl	K12	35.2	7.2	20.5	4.8	424	377	0.60
K	K12	1600	210	12.9	0	35926	508	1.75
Ca	K12	326	44	13.4	2	10258	329	0.65
Sc	K12	Not det.			1	1	309	2.37
Ti	K12	87	12	14.2	1	3986	441	1.27
V	K12	Not det.			1	14	434	0.97
Cr	K12	1.39	0.67	48.0	1.01	105	642	1.30
Mn	K12	43.9	6.2	14.1	0.6	4142	310	1.11
Fe	K12	1750	220	12.6	0	206158	305	1.03
Co	K12	Not det.			0	2	292	1.71
Ni	K12	72.1	9.6	13.3	0.3	12386	274	0.63
Cu	K12	2.02	0.45	22.1	0.36	404	570	0.92
Zn	K12	37.1	5.0	13.5	0.2	8732	238	0.95
Ga (IS)	K12	1.00	0.25	24.8	0.23	273	438	1.80
As	K12	0.95	0.20	21.0	0.13	306	189	1.36
Se	K12	Not det.			0.11	1	165	0.62
Br	K12	0.185	0.082	44.2	0.115	69	208	1.53
Rb	K12	10.9	1.5	14.0	0.2	4714	648	0.89
Sr	K12	1.55	0.30	19.3	0.19	708	842	0.97
Y	K12	6.25	0.97	15.5	0.33	3014	2819	1.47
Zr	L1	Not det.			27.24	1	326	1.20
Sn	L1	Not det.			3.30	8	325	1.35
Ba	L1	Not det.			1.69	10	408	1.57

Element	Line	Conc./ g/kg	Sigma/ g/kg	RSD/ %	LLD/ g/kg	Net area	Backgr.	Chi
W	L1	Not det.			0.26	36	230	2.09
Hg	L1	Not det.			0.14	3	150	0.99
Pb	L1	0.90	0.19	21.4	0.13	275	172	1.42



S2 PICOFOX - TRACE ELEMENT ANALYSIS

Listed at 18/10/2024 13:59:49

User: Administrator

Serial number: 423400423

Project: OW-919 Cuttings 1.rtx

Sample: OW-919 Cuttings

ID-No.:

Disc:

Quant. type: Solid

Spectrum: OW-919 Cuttings_1

Meas.date: 18/10/2024 13:54:26

Live time: 300 s

Count rate: 3726 cps

Dead time: 1.4 %

Voltage: 50 kV

Current: 700 µA

Excitation: Mo K radiation

Method: Metals Dec 2023 (Profile bayes optimized fit)

Comment:

Element	Line	Conc./ g/kg	Sigma/ g/kg	RSD/ %	LLD/ g/kg	Net area	Backgr.	Chi
Na	K12	[1150]	640	55.3	1170	65	491	1.17
Mg	K12	Not det.			1110	11	308	1.63
Al	K12	1020	110	10.9	80	792	451	0.84
P	K12	Not det.			10	43	358	0.99
S	K12	64.3	6.2	9.6	3.4	1092	376	1.04
Cl	K12	15.6	2.4	15.3	2.7	388	494	2.02
K	K12	707	44	6.3	2	32878	628	1.77
Ca	K12	279	18	6.5	1	18152	387	1.06
Sc	K12	Not det.			1	1	377	2.12
Ti	K12	79.7	5.5	6.9	0.8	7582	579	0.77
V	K12	Not det.			0.5	2	367	1.11
Cr	K12	Not det.			0.4	5	469	1.44
Mn	K12	52.9	3.6	6.7	0.3	10340	343	0.91
Fe	K12	1589	93	5.9	0	387032	324	1.34
Co	K12	Not det.			0	1	292	0.96
Ni	K12	13.18	0.95	7.2	0.13	4693	251	1.11
Cu	K12	0.379	0.094	24.9	0.141	157	375	1.30
Zn	K12	9.77	0.71	7.2	0.09	4762	216	0.67
Ga (IS)	K12	1.00	0.11	11.4	0.08	566	239	1.34
As	K12	0.168	0.041	24.7	0.059	112	171	1.52
Se	K12	Not det.			0.045	11	117	0.39
Br	K12	0.128	0.032	24.8	0.044	99	129	1.00
Rb	K12	4.25	0.32	7.5	0.07	3821	400	0.62
Sr	K12	0.457	0.067	14.7	0.074	432	545	1.01
Y	K12	2.82	0.24	8.5	0.12	2822	1670	1.49
Zr	L1	20.6	8.0	39.1	13.8	85	358	0.86
Sn	L1	Not det.			1.7	20	375	1.83
Ba	L1	2.57	0.58	22.4	0.82	191	412	1.19

Element	Line	Conc./ g/kg	Sigma/ g/kg	RSD/ %	LLD/ g/kg	Net area	Backgr.	Chi
W	L1	Not det.			0.12	1	207	1.66
Hg	L1	Not det.			0.07	1	137	0.67
Pb	L1	0.129	0.039	30.0	0.059	82	156	1.72

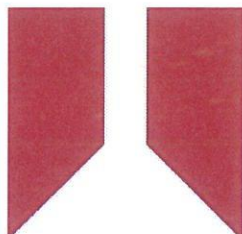
Appendix 10: Calibration Certificate for the Sound Level Meter

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 10 April 2024

CERTIFICATE NUMBER 212245



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

K.Besau

Electronically signed:

Sound Level Meter : IEC 61672-3:2013

Instrument information

Manufacturer: Cirrus Research plc
Model: CR:162C
Serial number: G305475
Class: 2
Firmware version: 5.8.3251

Notes:

Test summary

The calibration was performed respecting the requirements of ISO/IEC 17025:2017.
Periodic tests were performed in accordance with procedures from IEC 61672-3:2013.

The sound level meter submitted for testing successfully completed the class 2 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 because (a) evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to determine that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

Notes

This certificate provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory. The results within this certificate relate only to the items calibrated. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a coverage probability of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number:

212245

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Before	Pressure: 100.73 kPa	Temperature: 22.8 °C	Humidity: 39.4 %
After	Pressure: 100.81 kPa	Temperature: 23.4 °C	Humidity: 37.1 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Signal Generator	KEYSIGHT	33511B	MY59003445
Attenuator	Cirrus Research	ZE:952	80380
Environmental Monitor	Comet	T7510	21961307

Additional instrument information

Instruction manual:

Reference level range: Single range

Pattern approval: No

Source of pattern approval: -

Preamplifier

Model: MV:200F

Serial number: 14220F

Microphone

Model: MK:216

Serial number: 415100D

Test results summary

Test	Result
Overload indication	Complies
Electrical noise-floor	Complies
Toneburst response	Complies
Linearity	Complies
Electrical Frequency weightings	Complies
Frequency and time weightings at 1 kHz	Complies
C-weighted peak	Complies
High level stability	Complies
Long-term stability	Complies

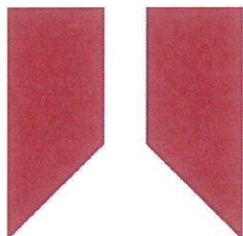
Appendix 11: Calibration Certificate for the Sound Level Meter Calibrator

CERTIFICATE OF CALIBRATION

ISSUED BY Cirrus Research plc

DATE OF ISSUE 10 April 2024

CERTIFICATE NUMBER 212247



Cirrus Research plc
Acoustic House
Bridlington Road
Hunmanby
North Yorkshire
YO14 0PH
United Kingdom

Page 1 of 2

Approved signatory

R.Thomas

Electronically signed:

Sound Calibrator : IEC 60942:2017

Instrument information

Manufacturer: Cirrus Research plc

Notes:

Model: CR:514

Serial number: 103866

Class: 2

Test summary

Date of calibration: 09 April 2024

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC60942_2017 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer's data.

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2017, the sound calibrator tested is considered to conform to all the Class 2 requirements of IEC 60942:2017.

The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC60942_2017 Annex A to Class 2. This has been confirmed by Physikalisch-Technische Bundesanstalt (PTB).

Notes:

CERTIFICATE OF CALIBRATION

Certificate Number:

212247

Page 2 of 2

Environmental conditions

The following conditions were recorded at the time of the test:

Pressure: 98.99 kPa

Temperature: 21.9 °C

Humidity: 46.5 %

Test equipment

Equipment	Manufacturer	Model	Serial number
Distortion Meter	Keithley	2015	0839263
Acoustic Calibrator	Bruel and Kjaer	4231	2610257
Environmental Monitor	Comet	T7510	21962628

Results

	Expected	Sample 1	Sample 2	Sample 3	Average	Deviation	Acceptance limit	Uncertainty
Level (dB)	94.00	93.98	94.00	93.97	93.98	-0.02	±0.40	0.11 dB
Distortion (%)	< 4.00	0.18	0.24	0.34	0.25	0.25	+3.00	0.13 %
Frequency (Hz)	1000.0	1000.0	1000.3	1000.4	1000.2	0.2	±1.7	0.1 Hz

End of results

Appendix 12: Calibration Certificate for the Gas Analyzer

TEST CERTIFICATE

NO: YT-QR-06A

Model NO: SKY8000-L-M7	
Serial NO: 02102C49A5001	Date of issue: 2024.9.10
version NO: V4.5	Next Calibration: 2025.9.9

Appearance/structure/function/mark inspection				
Item	Test results			Remark
Appearance/Structure	<input checked="" type="checkbox"/> Passed	<input type="checkbox"/> Failed	<input type="checkbox"/> Other	
Function	<input checked="" type="checkbox"/> Passed	<input type="checkbox"/> Failed	<input type="checkbox"/> Other	
Mark	<input checked="" type="checkbox"/> Passed	<input type="checkbox"/> Failed	<input type="checkbox"/> Other	

Calibration						
Measurement Unit						
NO	Calibration gas	Calibration gas concentration	Value before calibration	Value after calibration	Response time(T90)	Remark
1	O2	20.9%VOL	22.8%VOL	20.9%VOL	<30s	
2	H2S	80PPM	88.9PPM	80PPM	<30s	
3	NO2	40PPM	38.2PPM	40PPM	<30s	
4	SO2	80PPM	88.2PPM	80PPM	<30s	
5	CO	700PPM	758PPM	700PPM	<30s	
6	CO2	25000PPM	25863PPM	25000PPM	<30s	
7	CH4	60%VOL	58%VOL	60%VOL	<30s	

Certification	
We Certified that this equipment have been checked, maintained and calibrated according to manufacturer's specification.	
<div><input checked="" type="checkbox"/> Test Passed</div> <div><input type="checkbox"/> Test Failed</div>	
<div>Shenzhen YuanTe Technology Co., Ltd</div> <div>Quality Department</div> <div>QC:ZHU YUAN XIAN</div>	

Appendix 13: Water Abstraction Permit

Chief Executive Officer

Water Resources Authority

P.O. Box 45250 00100, Ngong Road,
Nairobi, Kenya
Nairobi



Form:WRA 010

Catchment:

WRMA ID:WRA\20\00543

File:WRA/20/NSA/2GD/22/S

Water Resources Authority WATER PERMIT

(Rule 3

By virtue of the authority vested in us by the Water Act 2016, we, the Water Resources Authority, do hereby

grant unto (name) **KENGEN OLKARIA GEOTHERMAL PROJECT**, on **24 May 2017**, or his/her/their executors, Administrators

and assigns permission to use water in accordance with the details contained herein, subject to the provisions of the Water Act 2016, and the Rules thereunder, and the conditions following hereafter and endorsed hereon and attached hereto: -

Permit No.	WRA/20/NSA/2GD/22/S				Permit Expiry Date	24-May-2032 <i>27</i>		
Type of Water Use	Surface water				GroundWater		Effluent discharge	Swamp Drainage
	Diversion	Abstraction	In-stream Works	Storage	Shallow Well	Bore Hole		
Tick Box		X						

PARTICULARS OF APPLICANT				DETAILS				
1. Full name of applicant(s) (In Block letters)				KENGEN OLKARIA GEOTHERMAL PROJECT				
2. Category of applicant - Individual, Group [Association, Society], Company, Institution				Company				
4. ID Number of Applicant (Individual) or Certificate of Incorporation or Registration for Group or Companies				C 20/55				
5. PIN Number (where available)				P00059153V				
Physical Address where water is to be used				Contact of Applicant				
6. L/R Number(s)	8399			7. Box Number	785			
8. Villages(s) / Ward(s)	OLKALIA			9. Town	NAIVASHA			
10. Sub-location(s)	OLKARIA			11. Post Code	20117			
12. Location(s)	HELLS GATE			13. Telephone Contact (Landline)	+254722202894			
14. Division(s)	NAIVASHA			15. Telephone Contact (Mobile)	+254722202894			
16. District(s)	NAIVASHA			17. Email Contact	comms@kengen.co.ke			

WATER RESOURCE DETAILS		DETAILS
17. Name of Body of Water or Aquifer where is to be diverted, abstracted or stored		LAKE NAIVASHA
18. Is the point of abstraction or storage in a Protected Area or a Groundwater Conservation Area? (yes/no)		NO
19. Sub-catchment Number		2GD
20. Class of Water Resource		(none)
21. Name of Body of Water or Aquifer where effluent is to be discharged		(none)
22. Sub-catchment Number (Effluent)		(none)
23. Class of Water Resource (Effluent)		(none)
24. Category of Application (Class of Permit)		D

Chief Executive Officer
Water Resources Authority
P.O. Box 45250 00100, Ngong Road,
Nairobi, Kenya
Nairobi



Form: WRA 010
Catchment:
WRMA ID: WRA\20\00543
File: WRA/20/NSA/2GD/22/S

SUPPLEMENT TO PERMIT/AUTHORISATION

25. Does permit include Supplements approved under Section 21 of WRMA Rules (yes/no)	NO
26. List Reference Number for each Supplement	

Brief Description of Project and Intended Use for Water Type of Water Use				
Type of Water Use	Groundwater (m3/day)	Surface Water (m3/day)		
		River - Normal Condition	River - Flood Condition	Lake
1. Public				
2. Domestic				90.00
3. Livestock				
4. Subsistence Irrigation				
5. Commercial Irrigation				
6. Industry / Commercial				7910.00
7. Hydropower				
8. Others				
9. Sub-Total				8000.00
10. Quantity Returned				
11. Water Abstracted (row 34 - row 35)				8000.00
12. Effluent Discharge				

Chief Executive Officer

Water Resources Authority

P.O. Box 45250 00100, Ngong Road,
Nairobi, Kenya
Nairobi



Form:WRA 010


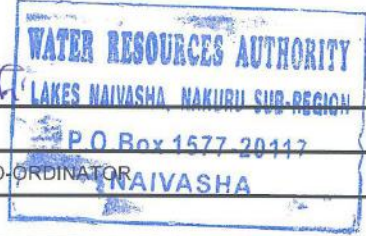
Catchment:

WRMA ID:WRA\20\00543

File:WRA/20/NSA/2GD/22/S

SIGNATURE

Yours faithfully,

Signature of WRA Officer		
Name of Officer	EDWARD WEKESA	
Position of Officer	SUB-BASIN AREA CO-ORDINATOR	
Date of Signature	24 -Nov-2022	

Evidence of Public Participation

Appendix 14: Invitation letter for Key Stakeholders Meeting

Our Ref: GEO-816/KO/kdt

1st October, 2024

To:

Dear Sir/Madam,

INVITATION TO KEY STAKEHOLDERS' CONSULTATIVE MEETING ON ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 1 2 8 8 1 /5) IN HELL'S GATE NATIONAL PARK

KenGen has entered into a sub-lease agreement for expansion of geothermal development at Olkaria. The right to access the piece of land was granted by Kenya Wildlife Service (KWS) on 16th May 2024. The piece of land, IR 105419/1 (LR NO.12881/5), measures approximately 1580.29 acres. It is part of Hell's Gate National Park. Among the sub-lease covenants include the requirement for KenGen to comply with the provisions of Environmental Management and Coordination Act (EMCA), 1999 and the Wildlife Conservation and Management Act, 2013. KenGen intends to drill additional geothermal wells on the leased land. However, drilling of the wells cannot commence until an Environmental and Social Impact Assessment study has been undertaken and the project approved by National Environment Management Authority (NEMA).

As part of the ESIA study, KenGen invites you to the Stakeholders' Consultative Meeting that will be held on Friday 11th October 2024 at Astorian Grand Hotel, Naivasha from 0930 hours. The purpose of the consultative meeting is to disclose project details and to seek your input on potential environmental and social impacts. A questionnaire is herein enclosed for completion and submission to us during the meeting. In the event that you will not be available or represented, kindly notify our team in advance and email your filled questionnaire by 9th October 2024. The ESIA Team Leader is Philip Barasa (Mobile: 0724455061 and Email: pbaraza@kengen.co.ke).

Yours faithfully,

For: THE KENYA ELECTRICITY GENERATING COMPANY PLC

Kizito Opondo

KIZITO OPONDO

Ag. MANAGER, GEOTHERMAL RESOURCE ASSESSMENT

Appendix 15: Public Notices for Public Barazas



ENTUMO OLOPENY EMURUA E RAPLAND O KAMBI TURKANA

Kiata enchipai kira enkampuni e KenGen kintoomon intae e loopeny emurua te tentumo natii;

Ntarikini: **08/10/2024**

Esaa: **2pm**

Etii: RAPland Social Hall

Ore enkipirta entumo naa;

1. Aitayiolo intae enturore ong'umot enkima te Hellsgate National
2. Niking'amu induat inyi tialo ina ramatare

Kintoomon intae pookin

Cc: Chief Olkaria location



ORKILIKWAI

ENTUMO OLOPENY EMURUA E OLOOMAIYANA KUBWA

Kiata enchipai kira enkampuni e KenGen kintoomon intae e loopeny emurua te tentumo natii;

Ntarikini: **07/10/2024**

Esaa: **1000Am**

Etii: Baptist Church

Ore enkipirta entumo naa;

1. Aitayiolo intae enturore ong'umot enkima te Hellsgate National
2. Niking'amu induat inyi tialo ina ramatare

Kintoomon intae pookin

Cc:Chief Olkaria location



**ENTUMO OLOPENY EMURUA E NARASHA, OLOMUNYAK, ORMARA O
INKORIENTO**

Kiata enchipai kira enkampuni e KenGen kintoomon intae e lopeny emurua te tentumo natii;

Ntarikini: **08/10/2024**

Esaa: **1000AM**

Etii: Harvest Church

Ore enkipirta entumo naa;

3. Aitayiololo intae enturore ong'umot enkima te Hellsgate National

4. Niking'amu induat inyi tialo ina ramatare

Kintoomon intae pookin

Cc:Chief Olkaria location



TANGAZO

MKUTANO WA WAKAAZI WA RAPLAND NA KAMBI TURKANA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya RAPland na Kambi Turkana kwa mkutano utakaofanyika:

Tarehe: 8/10/2024

Saa: Saa nne mchana (1000hrs)

Mahali: RAPland Social Hall

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO
MKUTANO WA WAKAAZI WA OLOMAYIANA KUBWA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa kijiji cha Olomayiana Kubwa kwa mkutano utakaofanyika:

Tarehe: 7/10/2024

Saa: Saa nne asubuhi (1000hrs)

Mahali: Baptist Church-Olomayiana

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO

MKUTANO WA WAKAAZI WA NARASHA, ORMARA, INKORIENTO, NA NKAAMPANI

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya Narasha, Olomunyak, Ormara, Inkorienito, na Nkaampani kwa mkutano utakaofanyika:

Tarehe: 7/10/2024

Saa: Saa nane asubuhi (1400hrs)

Mahali: Harvest Church-Narasha

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO

MKUTANO WA WAKAAZI WA DCK, KAMERE NA KWA MUHIA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya DCK, Kamere na Kwa Muhia kwa mkutano utakaofanyika:

Tarehe: 09/10/2024

Saa: Saa nne asubuhi (1000hrs)

Mahali: Mvuke Social Hall

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



MKUTANO WA WAKAAZI WA RAPLAND NA KAMBI TURKANA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya RAPland na Kambi Turkana kwa mkutano utakaofanyika:

Tarehe: 8/10/2024

Saa: Saa nne mchana (1000hrs)

Mahali: RAPland Social Hall

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO
MKUTANO WA WAKAAZI WA OLOMAYIANA KUBWA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa kijiji cha Olomayiana Kubwa kwa mkutano utakaofanyika:

Tarehe: 7/10/2024

Saa: Saa nne asubuhi (1000hrs)

Mahali: Baptist Church-Olomayiana

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO
MKUTANO WA WAKAAZI WA NARASHA, ORMARA, INKORIENTO,
NA NKAAMPANI

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya Narasha, Olomunyak, Ormara, Inkorienito, na Nkaampani kwa mkutano utakaofanyika:

Tarehe: 7/10/2024

Saa: Saa nane asubuhi (1400hrs)

Mahali: Harvest Church-Narasha

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location



TANGAZO

MKUTANO WA WAKAAZI WA DCK, KAMERE NA KWA MUHIA

Kampuni ya Kuzalisha Umeme Nchini Kenya (KenGen) ina furaha kualika wakaazi wa vijiji vya DCK, Kamere na Kwa Muhia kwa mkutano utakaofanyika:

Tarehe: 09/10/2024

Saa: Saa nne asubuhi (1000hrs)

Mahali: Mvuke Social Hall

Agenda ya mkutano huo ni ifuatayo:

- a. Kufahamishwa kuhusu mradi wa kuchimba visima vya mvuke wa kuzalisha umeme kwenye Hifadhi ya Taifa ya Hell's Gate
- b. Kupokea maoni ya wakaazi kuhusu mradi unao pendekezwa kwa mujibu wa sheria ya usimamizi wa Mazingira

Mnakaribishwa wote kwa mkutano huo

Cc: Chief Hell's Gate Location

Appendix 16: Signed Attendance Sheets for the Public Barazas and Key Stakeholders' Meeting


Attendance Sheet

Title: Stakeholder consultation for (ESIA) for the proposed drilling of geothermal wells on IR 105419/1 (L.R no. 12881/5) in Hell's Gate National Park, Naivasha Sub-County in Nakuru County

Location: OLOMAYIANA

Convener/ Facilitator: KenGen Plc

Date: 7/10/2024

No.	Name	Staff No. (Or Email for Stakeholders)	Designation (Or Organization)	Signature
1.	Imre Tobiko	36126173	0741096267	
2.	Catherine Narengo			
3.	Maniam Kidenye		0710761424	
4.	Diana Matai	39237254	0146381850	
5.	Florence Tangaro	25944027	0706547148	 ✓
6.	Mary Kiraison	22008863	0712578413	
7.	Felix Sangale	40293083	0706747478	
8.	Samuel Mardeigo	35983277	0799310378	
9.	Rt Kaleki	24032569	0715214645	
10.	Reuben Kisare	27330741	0791521161	
11.	Dominic Leming	20091425	0728820996	
12.	Mbayo Senjo		07112063593	
13.	Isaac Leshishi	27190050	0722166411	 ✓
14.	Stephen Karani	30974481	0717323060	
15.	James Kimamanti		0710299606	
16.	Siloma Nairnyu	0841394	0721214434	 ✓
17.	NKavarika ole Otun	0909923	0705666494	
18.	Loiboo ole Kureti	0908140		
19.	Joseph Kediemye	25943677	0729593196	
20.	Alice Simatui	40740504	0795087567	
21.	Ruth Kungu	21412591	0721723672	
22.	LILIAN K. WAKIERU	Community Facilitator	0791082310	
23.	Ruth Chauri	71822	F.O	
24.	Elizabeth Mwangi	F0341	ARIEG	
25.	FRANCIS KARANI	33319546	07915078781	
26.	Grace Maina	29093190	Inten	

No.	Name	Staff No./ID (Or Email for Stakeholders)	Designation (Or Organization)	Signature
27.	PHILIP BARASA	21192463	RIA EXPERT	PS
28.	PENINAH MBUTHI	71042	KenGen	APull
29.	SANDRA CHEBET	0788	KenGen	OG
30.	Rolox A. Lang'at	2833598	RIA Team	JR
31.	Kelly Tamakano	70360	Eng Team	A
32.	Sharon Kinga	0789	KenGen	Sharon
33.	Damarice Waitera	20423442	CHIEF	A
34.	Lemaiduk Karani	20872958	Oloosinyat	MM
35.	Sipoi Tobiko	24479050	Cultural centre	Sen
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Attendance Sheet

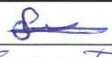
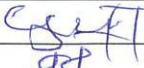









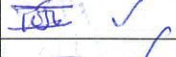
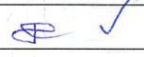
Title: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK

Location: NARASHA BAPTIST CHURCH

Convener/ Facilitator: KenGen Plc

Date: 7/10/2024

No.	Name	Staff No. ID (Or Email for Stakeholders)	Designation Phone No. (Of Organization)	Signature
✓ 1.	RUTH KUTIGU	27412891	ASST/CHIEF	[Signature]
2.	LILIAN K. WAWERU	33575983	Facilitator	[Signature]
3.	PENINAH MBUTHI	71042	KenGen	[Signature]
✓ 4.	Damario Waitera	20423442	CHIEF OFFICER	[Signature]
5.	RODNEY A. RANGANG'A	28335798	ESIA-TEAM	[Signature]
6.	Philip Barasa	21192463	ESIA-EXPERT	[Signature]
7.	Shaa leperes		MEMBER	
8.	Kumari Parkare		MEMBER	
9.	Ohenchoro		MEMBER	
10.	Simon Kipino	37651422	Member	[Signature]
11.	Ontuma Richard	32876709	Member	[Signature]
12.	Wilson Teretta	35245440	Member	[Signature]
13.	Rompere Fred	3398735	Member	[Signature]
14.	YIKIWA Pansamwui	21742015	Member	[Signature]
15.	Amose Arama		MEMBER	[Signature]
16.	JOSEPH NKUTUWA	0727264398	MEMBER	[Signature]
17.	RETEJI KILOKU	072030897	MEMBER	[Signature]
18.	Sadera Rumpo	35089637	MEMBER	[Signature]
19.	ELISHA SHATA	0706375379	MEMBER	[Signature]
20.	LIEPERES SHISHA	26489500	MEMBER	[Signature]
21.	MOSSES CENKUKA	07911023	MEMBER	[Signature]
22.	sandra Chebet	39542643	KenGen	[Signature]
23.	Grace Maina	29093190	KenGen	[Signature]
24.	Sharon Kinga	0789	Ken Gen	[Signature]
25.	Dennis Mutekeni	0740372231	Member	[Signature]
26.	JULIUS MALL	0757771440	member	[Signature]

No.	Name	Staff No (Or Email for Stakeholders)	Designation (Or Organization)	Signature
27.	S Simon Kiliu	23457882	member	
28.	Tinai hoSoni	25842471	member	
29.	STEPHAN KASIND	32384369	MEMBER	
30.	EVANS KILELU	34032811	MEMBER	
31.	AINES KOILEU	—	Member	
32.	DAVID SHAA	35453352	Member	
33.	SHAA OLE LEPERES	0907770	Chairman	
34.	KIRISIET PARKIRE	4555830	Elder	
35.	LETUATI OLE KELOKO	0478325	Elder	
36.	PURITY LESKEI	—	Member	
37.	WATAANA KILOKU	1065174	MEMBER	
38.	KOSEN SHAA	—	MEMBER	
39.	ARAMI SHAA	—	MEMBER	
40.	Joshua Torihke	21742012	SCC	 ✓
41.	John pasampula	11407133	0702426416	 ✓
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Attendance Sheet
































Title: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK

Location: RAPLAND, CANAAN, KAMBI TURKANA & MLIMA TATU

Convener/ Facilitator: KenGen Plc

Date: 8/10/2024

No.	Name	Staff No. ID No (Or Email for Stakeholders)	Designation (Or Organization)	Signature
1.	LORUNYEI NGIKEBOTOKH	7965542	Kambi Turkana	[Signature]
2.	JOSEPH SIKI	24403540	Canaan	[Signature]
3.	ISAAC ROTULA	21222295	Canaan	[Signature]
4.	ALFRED EROTIS	9833009	KAMBI EUR	EROTIS
5.	SAMUEL ADOME	5165475	Canaan	[Signature]
6.	DAVID AMUGT		Kambi Turkana	[Signature]
7.	EMMAN KWARE	3633944	Canaan	[Signature]
8.	DANIEL MACHELA	23712808	Kambi Turkana	[Signature]
9.	JOSEPH NJERU	1034369	Kambi Turkana	[Signature]
10.	RISO HELEINA	833783	Kambi Turkana	[Signature]
11.	PAUL KIMITA	26847871	Canaan	[Signature]
12.	OTUKOI STEPHEN	27098114	Kambi Turkana	[Signature]
13.	Simon Heleina	9053166	Kambi Turkana	[Signature]
14.	LOKURUSHU LOKITOE	3647938	Kambi Turkana	[Signature]
15.	MARK EBONGON	34133681	Kambi Turkana	[Signature]
16.	KEVIN EKAI	36485445	Kambi Turkana	[Signature]
17.	GEOFRY LEKIRWA	20709974	Kambi Turkana	[Signature]
18.	MURINJO KURE	3280280	Kambi Turkana	[Signature]
19.	JAMES EUREAN	13550985	Kambi Turkana	[Signature]
20.	ALEX EKAI		Kambi Turkana	[Signature]
21.	PROTUS WAFUNA	22610227	Kambi Turkana	[Signature]
22.	LOTIKENYA EKWAR	34394463	Kambi Turkana	[Signature]
23.	LOCHUCH LOMALA		Kambi Turkana	[Signature]
24.	ESTHER ADUNG'O		Kambi Turkana	[Signature]
25.	SILAS LOCHICHI	13048029	Kambi Turkana	[Signature]
26.	AKADELI LOKAMITA	7887220	Canaan	[Signature]

No.	Name	Staff No (Or Email for Stakeholders)	Designation (Or Organization)	Signature
27.	MARY NGONYEN	36627225	Canaan	
28.	LEAH AKAI	41983157	Kambi Turkana	
29.	TERESIA AKAMAI	37410767	Kambi Turkana	
30.	JOHN OKEMO	40723135	Kambi Turkana	
31.	MOSES EKAMAR		Kambi Turkana	
32.	DAMARIK NGANASA	12452542	Kambi Turkana	
33.	MARIA AKAI		Kambi Turkana	
34.	JULIES EKIRU	28707231	Kambi Turkana	
35.	ANN NKAMASIAI		OLonongot	
36.	AGNES KALEKI		OLonongot	
37.	MUHAMMAD HALKANO	21187171	Cultural Centre	
38.	FRANCIS LONGOLE	13550973	Kambi Turkana	
39.	ELIMLIM KIBOTO	8550272	Kambi Turkana	
40.	Solomon Nkamasi	29840132	Okoboi	
41.	WILSON MURUKU	29162566	OLosinyat	
42.	SOLOMON NKAMASIAI	22857521	OLONONGOT	
43.	Sipoi TOBIKO	24479050	Cultural Centre	
44.	JOHN ERENG		Kambi Turkana	
45.	NAMURON EYANKE		Kambi Turkana	
46.	CHARLES LOKAAL	01159266306277	Kambi Turkana	
47.	JOSPHAT KARANGA	35799147	Mlima tatu	
48.	SIMON KAMAU	0908972	Kambi Turkana	
49.	SAMUEL NONGUNA	21632486	Mlima tatu	
50.	EMERI LONGOR	20135616	Mlima tatu	
51.	JOSEPH GITHUKA	8576519	Mlima tatu	
52.	TIMOTHY KARANI	20872958		
53.	HEMANUK KARANI	20872958	Mim.	
54.	IPANO I NKAMASIAI	35206945	Mim.	
55.	MOSES KOOL	40888886	M/M4	
56.	HEMIAH NAIREYU	11709587	M/M4	
57.	EDUNG EKURU	5946988	Mlima tatu	
58.	APIPA ENE	21170685	Cultural Centre	

Attendance Sheet

Title: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK

Location: RAPLAND, CANAAN, KAMBI TURKANA & MLIMA TATU

Convener/ Facilitator: KenGen Plc

Date: 8/10/2024

No.	Name	Staff No. (Or Email for Stakeholders)	Designation (Or Organization)	Signature
1.	DORCAS NKAMASHAI		Olonogot	
2.	EVAM EILA	6685739	Canaan	
3.	ELIMIM MUSA		Kambi Turkana	
4.	Lawrence Karani		Rapland	
5.	Benjamin Nkamasai	0200492	Rapland	
6.	PETER NARIMU	12787164	Kambi Turkana	
7.	KISOTU TONO	6155954	Rapland	
8.	TATIE PARKIRE	21175465	Rapland	
9.	EKUWOM EKADON	0611805	Mlima Tatu	
10.	SIMONE NKIRASON	0908335	Rapland	
11.	NASIRU PARSEMBULA		Cultural Centre	
12.	VIN MORAA		Kambi Turkana	
13.	ANNA NKOKOR		Kambi Turkana	
14.	Peter Seno	46652884	Rapland	
15.	Joseph Benet	9885577	Rapland	
16.	PETER SUNDUKA	21688324	Rapland	
17.	EUNICE AKIMAR	24505091	Kambi Turkana	
18.	JOYCE TOTO AKIRU	26055335	Canaan	
19.	JANE IKONE	35326244	Kambi Turkana	
20.	SABINA LOREI	12972072	Kambi Turkana	
21.	HANNAH KARARU	7116136	Kambi Turkana	
22.	GEOFFRY NJOROGE	6846347	Mlima Tatu	
23.	MARGRET NKAMASHAI	11709715	Rapland	
24.	DAVID ESEKON		Kambi Turkana	
25.	PETER LONGALAN		Kambi Turkana	
26.	Charles Lengua	33540652	Cultural Centre	

No.	Name	Staff No (Or Email for Stakeholders)	Designation (Or Organization)	Signature
27.	John Kipencu	38051565	Cultural Center	[Signature]
28.	JOHN SENTERO	24806414	Cultural Centre	[Signature]
29.	JOSEPH MUNGA	11514182	Mlima tatu.	[Signature]
30.	VRIVU KISESE	30746702	Kambi Turkana	[Signature]
31.	EPETAT MANTIR		Kambi Turkana	[Signature]
32.	NATOI ENE	0148071	Rapland	[Signature]
33.	SINDERO OLE NASARUN	0478321	Rapland Centre	[Signature]
34.	KURUNYI LENKOR		Mlima tatu	[Signature]
35.	JACKSON SERSERO		Rapland	[Signature]
36.	LILIAN K WAKIERU	33575983	Facilitator	[Signature]
37.	KUTH KUTHU	27412591	ABSTRACT	[Signature]
38.	Damarice Matlwa	20423442	CHIEF OF KARIA	[Signature]
39.	Grace Maina	0799	KenGen	[Signature]
40.	Sandra Chebet	0788	KenGen	[Signature]
41.	Sharon Kinga	0789	KenGen	[Signature]
42.	Mercy Muritu	41022060	KenGen	[Signature]
43.	Peninah Muthi	71042	KenGen	[Signature]
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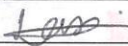



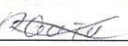
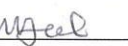


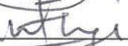
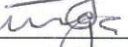

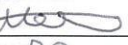
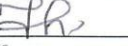



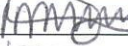









Attendance Sheet

Title: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED DRILLING OF FOURTY TWO (42) GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) WITHIN HELL'S GATE NATIONAL PARK

Location: MIVUKE SOCIAL HALL

Convener/ Facilitator: KenGen Plc

Date: 09/10/2024

No.	Name	Staff No. (Or Email for Stakeholders)	Designation (Or Organization)	Signature
1.	LEAH CHEPKURUI	23181539	KWA MUIHA	
2.	EVALINE AMUNDI	27902601	KAMERE	
3.	MONICA SAFARI	22139473	KAMERE	
4.	GABRIEL ATIGEND	14591359	KAMERE	 ✓
5.	RAPHACK JUMA	28632512	KAMERE	
6.	WILFRED OROGH	14587957	Kamere	
7.	Walter Ang'at	andigat@gmail.com	Kamere	
8.	Collins Jibet	39380212	Kamere	
9.	VICTOR MUTHENGI	29696342	KAMERE	
10.	Samuel Mirenga	29220654	KAMERE	
11.	ELWICKYAN JAMU	2321045	KAMERE	
12.	EDWIN ANOLI	24899453	KAMERE	
13.	Rolax A. Kangasia	28335798	BSA-Team	
14.	LILIAN K KAKIERU	33575983	Facilitator	
15.	Peter Mwarura	39114498	Kamere	
16.	Grace Wambui	9714934	Kwamuhia	
17.	Robert Opondo	2579014	MEAT's office	 ✓
18.	COLLINS MUKOMA	32922434	Hell's Gate	
19.	STEPHEN EMUDI	26770878	CHAIRMAN Kamere	 ✓
20.	Daniel Mwangi	0114755678	KAMERE	
21.	Andrew Juma	29389592	Kwamuhia	
22.	Peter M. Amwong	22079823	Kwamuhia	
23.	Munibabu Oluluny	9884505	Oludunyu	 ✓
24.	Jacob Wanjiku	205274	KAMERE	
25.	FREDRICK JUMA	JumafredrickB@gmail.com	KASARA	
26.	JOHN KAMARE	23160697	KAMERE	

No.	Name	Staff No (Or Email for Stakeholders)	Designation (Or Organization)	Signature
27.	Enah Juma	22404865	Kamere	[Signature]
28.	Egra Otiemo	23848663	Kamere	[Signature]
29.	AGNES EKIRU	33728167	Kamere	[Signature]
30.	Sharon Kinyo	0789	KenGen	[Signature]
31.	Sandra Chebet	0788	KenGen	[Signature]
32.	Grace Maina	0799	KenGen	[Signature]
33.	Ruth Waka	22171397	HELIS GATE	[Signature]
34.	Elizabeth Mwangi	70341	KenGen	[Signature]
35.	PENINAH MUBITHI	71042	KenGen	[Signature]
36.	RUTH KUNGU	21412891	[Signature]	[Signature]
37.	Damarice Wanjiru	20423442	CHIEF Oka	[Signature]
38.	Charity Kathae	20210416051	ACC	[Signature]
39.	Mercy Muriu	41022060	KenGen	[Signature]
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**KenGen**

Energy for the nation.

Title: Key Stakeholders Meeting for ESIA study for the proposed drilling of forty-two (42) geothermal wells on IR 105419/1 (L.R.No. 12881/5) within Hell's Gate National Park

Location: Astorian Grand Hotel

Date: 11th October 2024

No.	Name	Designation	Institution	Phone Number	ID number	Signature
1.	Felix Mwarania	Resv. Eng	Ken Gen	0721596656	22728132	
2.	STEPHEN OUMA	Deputy Officer	LANAKUBA	0798709277	36615939	
3.	BENEDICT MIWANTAIWA	KEFS Officer	KEFS	0718471275	32672666	
4.	Francis Irugul	WEMA-ED	Ntongorons	0792318799	22489428	
5.	Rose KIAMA	Environmental Scientist	CIOC	0722413554	13882979	
6.	Beatrice Mwangi	Snr. WQ/PCO	WRA	0720860722	9507712	
7.	Nicholas Omenys	Ag. CIM	KenGen	0722677894	23451576	
8.	Peter N. Mwangi	AS CSP	KEWS	0722487341	11767554	
9.	Edith Nancy Aringi	Sr. HELS LAB	KEWS	0715913601	11230582	
10.	Lucia NAKOSI	SAD- KWS CELA	KWS	072127084	11358961	
11.	DESSY MURANDA	DCS - KONGONI	NPS	0746810030	80037003	
12.	MARGARET KUIBITA	SCPHD-NAIVASHA	NCA-DOKS	0721459046	9063968	
13.	ROLEX A RANG'ANG'A	ESIA-Team	KenGen	0725540089	28335798	
14.	Ruth cheruif	ESIA Team	Ken Gen	0700750540	28043472	
No.	Name	Designation	Institution	Phone Number	ID number	Signature



KenGen

Energy for the nation.

NAME		DESIGNATION	INSTITUTION	PHONE NO	ID NUMBER	SIGN
15.	Simon Irata	P-Tech	Verderi	0723169016	22164412	Simion
16.	Prestene Mulundig	D/Eng	Kengen	0718469207	27775083	Mulundig
17.	Ndaiga Alex	Geomaticist	Kengen	0701777251	32362075	Alex
18.	Elizabeth Njiru-Gachari	ARTES	Kengen	0722429111	125545849	Elizabeth
19.	Kell Tamalewa	Q-CRO	Kengen	0726029366	11428531	Kell
20.	Samuel Njiru	AMDO	Kengen	0722201282	13778736	Samuel
21.	George Wambugu	Infrastructure	Kengen	0705112124	10331229	George
22.	Mary Kimani	Environment	KENGEN	0702684070	32655775	Mary
23.	Kazito M. Ombao	QRA	Kengen	0727938515	9182376	Kazito
24.	Silas Mutiga	General Manager	KNRA	0729834870	24276375	Silas
25.	Daniel Sereva	Drum	K.W.S	0720691833	13806968	Daniel
26.	Jonathan Njiru	Drum	K.W.S	0722635314	10245253	Jonathan
27.						
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KenGen

Energy for the nation.

Title: Key Stakeholders Meeting for ESIA study for the proposed drilling of forty-two (42) geothermal wells on IR 105419/1 (L.R No. 12881/5) within Hell's Gate National Park

Location: Astorian Grand Hotel

Date: 11th October 2024

No.	Name	Designation	Institution	Phone Number	ID number	Signature
1.	Charley Gitau	KCC	Min. of Interior	0721811165	22597729	CR.
2.	Damarice Wollera	CHIEF	Min of Interior	0721291749	20423442	DR
3.	Philip Barasa	EIA EXPERT	KenGen	0722253061	21192463	PRSS
4.	PENINAH MIBUHI	KenGen School	KenGen	0716516238	10996172	NRUKS
5.	DIANA MWADINE	LP Officer	MOALF	0714947001	37650126	DR
6.	LILIAN KATUMBIAWIERU	FACILITATOR CONSERVATION	COMMUNITY	0791082310	33575983	DR
7.	ANTHONY KALINGE	ELSAMERE	ELSAMERE	0725426603	8484833	DR
8.	SAMMY WANJAU	HT-OLKARIA	OLKARIA PH	0723876332	7400908	DR
9.	HANNATH MACHARIA	ESM MANAGER	ORPOWER4	0721607937 0719876525	13410264	DR
10.	JOICE W MUEGWAT	LIAISON	NATVISA	0724410404	13211280	JINDI
11.	CHARLES H KAMBURU	Projects Inspector	NATVISA	0717003166	31386688	DR
12.	ALICE CHAREM	Sociologist	AKIRI	0726391103	22828705	DR
13. ✓	FIDELYS RESIAN	CLO	AKIRI	0726091680	27041671	DR
14.	AGNES KOILEL	NCDG (NARASHA Program Officer	NCDG (NARASHA NATVISA)	0729723647	28317169	DR
15.	JANE KIKO	PROJECT OFFICER	IMARISHA NATVISA	0715472895	28237234	DR

Attendance Sheet

Title: Stakeholder consultation for (ESIA) for the proposed drilling of geothermal wells on IR 105419/1 (L.R no. 12881/5) in Hell's Gate National Park, Naivasha Sub-County in Nakuru County

Location: Geothermal SPA

Convener/ Facilitator: KenGen Plc

Date: 3.10.2024

No.	Name	Staff No. ^{HTD} (Or Email for Stakeholders)	Designation (Or Organization)	Signature
1.	Kelly Tamakano	70360	P-CRO	
2.	Prestone M. Mulunda	72235	D/Engineer	
3.	Sharon Kinga	0789	Intern	
4.	Hellen Eresca	13066303	NCDG	
5.	Jackson Shag	11709601	NCDG	
6.	AGNES KOTLEL		NCDG	
7.	Daniel Mbatia	22549166	NCDG	
8.	Wilson TEKELTA	35245440	NCDG	
9.	JACKSON TORINKE	27264222	NCDG	
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Appendix 17: Signed minutes for the 4 Public barazas & Key Stakeholders Meeting

MINUTES OF PUBLIC PARTICIPATION FOR THE ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF 42 GEOTHERMAL WELLS PROJECT HELD AT THE COMMUNITY WATER POINT-OLOMAIYANA KUBWA VILLAGE AT 1100HRS ON OCTOBER 7, 2024

Attendance sheet attached

AGENDA:

1. Preliminaries
2. Presentation by ESIA team
3. Plenary Session
4. Resolution
5. A.O.B

Min	Agenda	Discussions/ Issues/ Resolutions		
1.	Preliminaries	The meeting was called to order by the Chief, Olkaria Location at 1100hrs, She invited a Community representative, Mr. Isaac Leshishi to open the meeting with a word of prayer and invited the Assistant Chief to make her remarks. The KenGen Community Liaison Officer Mr. Kelly Tamakaro introduced the KenGen ESIA team.		
2.	Presentation by ESIA team	<ul style="list-style-type: none"> The ESIA team led by the Lead expert, Mr. Philip Barasa informed the public that the Environmental Management and Coordination Act, 1999 (EMCA), requires that Environmental and Social Impact Assessment (ESIA) must be undertaken for any proposed project likely to have impacts on the environment. The resulting ESIA report is then submitted to National Environment Authority (NEMA) for review and decision making. Therefore, public participation and consultation is an integral process in the exercise to get views, comments and concerns from the general public. He also requested consent from the community to collect data including taking contact details and photos which the community consented to. He further informed the community that KenGen intends to drill and develop 42 Geothermal Wells within the KWS leased land which is approximated to be 639 hectares. The Team Lead further gave the details on the anticipated impacts associated with the proposed project. He further presented the potential mitigation measures as follows: 		
		Nature of Impacts	Description	Mitigation

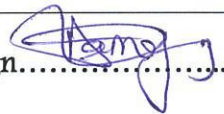
		Positive impacts	<ul style="list-style-type: none"> Increased electricity output Employment & economic opportunities to the local community such as through supply of goods and services Improved infrastructure such as road networks Skills and knowledge transfer to the local communities Improved security No displacement of the local community Climate mitigation measures and carbon revenue KenGen corporate social responsibility benefits including school scholarship opportunities 	
		Nature of Impacts	Description	Mitigation
		Negative impacts	Air pollution from geothermal gases, dust emissions from vehicle movements and construction works	<ul style="list-style-type: none"> Speed limits will be enforced and regular watering of pathways Enhanced H₂S gas monitoring in the project site and its environs
			Accidents	<ul style="list-style-type: none"> Provide work specific PPEs Sensitize workers on safety Enforce traffic rules including on speed limits
			Water resource use	Ensure sustainable use of water during the drilling process
			Noise pollution and excessive vibration	<ul style="list-style-type: none"> Considering the distance of drilling activities from settlement areas, vibration is not expected to have impacts beyond site boundaries; All machines that exceed acceptable noise limits will be equipped with silencers or lagging materials or specially designed acoustic enclosures Install improved silencers to minimize the noise levels Ensure regular noise monitoring using both mobile and stationary H₂S detectors Use of signage Construction of the well pads, road networks and water supply system to be done between 6am to 6 pm Provide and enforce the use of PPEs
			Solid waste	<ul style="list-style-type: none"> All generated solid waste will be disposed appropriately.

				<ul style="list-style-type: none"> • Apply the 5R system, Refuse, Repurpose, Reduce, Reuse, Recycle • Ensure all wastes are fully segregated
			Clearing of vegetation and trees	<ul style="list-style-type: none"> • Ensure controlled clearing of vegetation and trees. • Rehabilitation of disturbed sites with indigenous species once the drilling of wells and construction of well pads, road networks and water supply system is completed.
			Health and safety	Safety of residents, workers and visitors will be provided for in line with OSHA 2007 including equipping workers with safety protection
			Insecurity	Necessary security will be provided (through contracted firms) and backed up by the Critical Infrastructure Protection Unit (CIPU).
			Social conflicts	Sensitization program will be rolled out aimed at raising awareness to the local community and KenGen workforce on communicable diseases
			Liquid Waste	Provide portable toilets and where necessary pit latrines to ensure ultimate containment of sewage
3.	Plenary session			
	Name of stakeholder	Question/comment/clarification	Response from ESIA team	
i.	Mzee Siloma Community Elder	<ul style="list-style-type: none"> • He supported the project and appreciated KenGen's commitment to engage the community before project commencement. • The community has lived in harmony with KenGen but only few community members have been employed by the company. He also stressed the importance of engaging their community members especially the youths, women and the less fortunate to be employed during the implementation of the proposed project. 	<ul style="list-style-type: none"> • For permanent employment, KenGen has an equal employment policy, and the community will be informed when such opportunities arise. • Semi and non-skilled labour opportunities are 100% reserved for the local community and administered through Stakeholder Coordination Committee (SCC). 	

		<ul style="list-style-type: none"> • He was concerned about the lack of electricity for the locals yet KenGen generates locally and sell electricity. • Increased corrosion of iron sheet roofs • He requested KenGen to consider constructing a water pond next to the water tank for their domestic animals • He was concerned about the brine overflow through the gorge from Well R-3 	<ul style="list-style-type: none"> • KenGen is mandated by law to only generate electricity in bulk. The community was advised to visit KPLC or REREC offices for consideration for power connectivity since these are mandated to distribute to local consumers. • No research work done to ascertain the allegation that there's increase in the corrosion of the iron sheets • The community was urged to make an official request to the company for consideration. However, this is subject to CSR budget availability. • When the Power plant was developed there was no provision for re-injection. However, with the current rehabilitation of Olkaria I Geothermal Power Plant all the brine will be reinjected to abate the brine overflow
ii.	Ngararika Oitosi	<ul style="list-style-type: none"> • He requested KenGen to employ more locals in permanent jobs • He asked KenGen to distribute electricity to the locals • Survey works be done to establish the boundary between KenGen and community land 	<ul style="list-style-type: none"> • For permanent employment, KenGen has an equal employment policy and the community will be informed when such opportunities arise • KenGen is mandated by law to only generate electricity in bulk. The community was advised to visit KPLC and REREC offices for consideration for power connectivity since these are mandated to distribute to local consumers. • The drilling project will be done within the KWS land which has been leased to KenGen

iii.	Mbaayo Sencho (Nyumba Kumi)	<ul style="list-style-type: none"> No community benefits from KenGen proposed and ongoing projects He alleged that the community was relocated He requested for an MOU or an Agreement between KenGen and community for ease of follow up of community demands 	<ul style="list-style-type: none"> KenGen will implement employment and economic opportunities through the existing channels such SCC with emphasis to the directly affected communities. It was noted that there are already opportunities but there is room for improvement. The proposed project will not cause any human displacement MOU-agreement-the ESIA team plans to communicate to the top management, however MOUs are done based on human or assets displacements.
iv.	Isaac Leshishi	<ul style="list-style-type: none"> The community has always welcomed KenGen projects From experience contractors always bring more foreigners than locals KenGen should deter contracting H-Young, Sinopec-Rent-Co Written to MD and CEO KenGen against contracting H-young, Sinopec and Rent-Co Let KenGen and community have an MOU or an agreement before the project 	<ul style="list-style-type: none"> KenGen will implement employment and economic opportunities through the existing channels such SCC with emphasis to the directly affected communities. It was noted that there are already opportunities but there is room for improvement. Employment issues, SEPCoIII sub-contracted Sino hydro working with projects office. KenGen to hold a meeting to discuss the community issues especially employment related sharing formula criteria. Uniscope Labour contractor manages the KenGen-casual engagement contracting and administered by Human resources office. RentCo is a company contracted by KenGen for a wellhead leasing project Therefore KenGen, doesn't have control of whom RentCo has subcontracted to undertake any of its works MOU-agreement-the ESIA team plans to communicate to the top management,

		<p>can be rolled out for ease of follow up</p> <ul style="list-style-type: none"> How did KenGen obtain the land title? 	<p>however MOUs are done based on human or assets displacements.</p> <ul style="list-style-type: none"> The drilling project will be done on KWS land sublease which has been leased to KenGen
v.	Tongei Sencho	<ul style="list-style-type: none"> He supported the proposed project The community sent an official letter to the company yet, they haven't received any feedback. Dissatisfaction in the constitution of SCC Requested to visit the KenGen Liaisons Office on October 8, 2024 	<ul style="list-style-type: none"> The alleged letter wasn't addressed to KenGen but the contractor hence there was no an obligation from KenGen to respond to the said letter. SCC has a 3-year term limit. KenGen through the SCC has always shared the available opportunities with the communities The visit was welcome by KenGen as has always been the norm.
vi.	Joseph Nairenyu Youth	<ul style="list-style-type: none"> Brine overflows at R3 causing death to domestic animals H₂S monitoring- lateral measurements how about vertical measurements He noted rainfall pattern change Death of plants around the 800 series wells 	<ul style="list-style-type: none"> When the Power plant was developed there was no provision for re-injection. However, with the current rehabilitation of Olkaria I Geothermal Power Plant all the brine will be reinjected to abate the brine overflow H₂S is denser than air so it displaces it resulting to more concentration at the ground level hence no cause for concern for H₂S concentration in the atmosphere. Climate change is a global issue Not scientifically proven to be associated with drilling of wells
vii.	Elijah Leshishi	<p>The company needs to mobilize the community well for the public participation or public baraza.</p>	<p>Poor attendance of public baraza –those mentioned to be absent at the public baraza were contacted and they had promised to attend, so KenGen shouldn't be blamed for their absence</p>

viii.	Florence Tangaro Woman	<ul style="list-style-type: none"> • She supported the project. • Consider bringing a KenGen HR Officer to aid in clarification of the job-related issues • Foreigners get the casual job opportunities than the community • She appreciated KenGen for water supply and school where pupils learn • Chinese refused to employ female labourers from the community • Only politicians get the most important job opportunities especially in Uniscope jobs. 	<ul style="list-style-type: none"> • Presence of HR person will be considered in future ESIA meetings. • It was communicated that efforts are in place to give more priority to the nuclear villages in SCCs as opposed to the current situation where opportunities are shared even outside the immediate project environment. • KenGen will address unequal employment distribution of opportunities and strike a balance on gender biasness • Uniscope jobs are controlled at the HR office, and the concern raised will be communicated to them.
4.	Resolution	The community fully agreed to support the proposed project but asked KenGen to consider them on priority basis for employment and economic opportunities.	
5.	Adjournment	There being no AOB, the Chairperson thanked all the participants for their contributions and requested KenGen to take into consideration the views and concerns of residents. The meeting was adjourned at 1255hrs with a word of prayer from Isaac Leshishi.	
Adoption		<p>Chairperson.....<u>DAMARICE WARIHERA</u>.....Sign.....</p> <p>CHIEF</p> <p>Date.....<u>OLKARIA-LOCATION</u>.....</p> <p>P.O. Box 11, NAIVASHA</p> <p>Date: <u>23/10/2024</u></p> <p>ESIA Lead Expert.....Sign.....</p> <p>Date.....</p>	

MINUTES OF PUBLIC PARTICIPATION FOR THE ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF 42 GEOTHERMAL WELLS PROJECT HELD AT RAPLAND COMMUNITY SOCIAL HALL AT 1100HRS ON OCTOBER 8, 2024

Attendance sheet attached

AGENDA:

1. Preliminaries
2. Presentation by ESIA team
3. Plenary Session
4. Resolution
5. A.O.B

Min	Agenda	Discussions/ Issues/ Resolutions		
1.	Preliminaries	The area Chief being the chairperson called the meeting to order at 11.00am and the meeting commenced with a word of prayer from Pastor Peter Nkamasiai. One Rap land Chairperson said it was unfair to call public barazas on very short notice saying early notices should be done. The Chairperson was informed that the notices were sent quite early and were distributed to various churches.		
2.	Presentation by ESIA team	<ul style="list-style-type: none"> The ESIA team led by the Lead expert, Mr. Philip Barasa informed the public that the Environmental Management and Coordination Act, 1999 (EMCA), requires that Environmental and Social Impact Assessment (ESIA) must be undertaken for any proposed project likely to have impacts on the environment. The resulting ESIA report is then submitted to National Environment Authority (NEMA) for review and decision making. Therefore, public participation and consultation is an integral process in the exercise to get views, comments and concerns from the general public. He also requested consent from the community to collect data including taking contact details and photos which the community consented to. He further informed the community that KenGen intends to drill and develop 42 Geothermal Wells within the KWS leased land which is approximated to be 639 hectares. The Team Lead further gave the details on the anticipated impacts associated with the proposed project. He further presented the potential mitigation measures as follows: 		
		Nature of Impacts	Description	Mitigation
		Positive impacts	<ul style="list-style-type: none"> Increased electricity output Employment & economic opportunities to the local community such as through supply of goods and services Improved infrastructure such as road networks Skills and knowledge transfer to the local communities Improved security No displacement of the local community Climate mitigation measures and carbon revenue KenGen corporate social responsibility benefits including school scholarship opportunities 	

		Nature of Impacts	Description	Mitigation
	Negative impacts		Air pollution from geothermal gases, dust emissions from vehicle movements and construction works	<ul style="list-style-type: none"> Speed limits will be enforced and regular watering of pathways Enhanced H₂S gas monitoring in the project site and its environs
			Accidents	<ul style="list-style-type: none"> Provide work specific PPEs Sensitize workers on safety Enforce traffic rules including on speed limits
			Water resource use	Ensure sustainable use of water during the drilling process
			Noise pollution and excessive vibration	<ul style="list-style-type: none"> Considering the distance of drilling activities from settlement areas, vibration is not expected to have impacts beyond site boundaries; All machines that exceed acceptable noise limits will be equipped with silencers or lagging materials or specially designed acoustic enclosures Install improved silencers to minimize the noise levels Ensure regular noise monitoring using both mobile and stationary H₂S detectors Use of signage Construction of the well pads, road networks and water supply system to be done between 6am to 6 pm Provide and enforce the use of PPEs
			Solid waste	<ul style="list-style-type: none"> All generated solid waste will be disposed appropriately. Apply the 5R system, Refuse, Repurpose, Reduce, Reuse, Recycle Ensure all wastes are fully segregated
			Clearing of vegetation and trees	<ul style="list-style-type: none"> Ensure controlled clearing of vegetation and trees. Rehabilitation of disturbed sites with indigenous species once the drilling of wells and construction of well pads, road networks and water supply system is completed.
			Health and safety	Safety of residents, workers and visitors will be provided for in line with OSHA 2007 including equipping workers with safety protection
			Insecurity	Necessary security will be provided (through contracted firms) and backed up by the Critical Infrastructure Protection Unit (CIPU).
			Social conflicts	Sensitization program will be rolled out aimed at raising awareness to the local community and KenGen workforce on communicable diseases

			Liquid Waste	Provide portable toilets and where necessary pit latrines to ensure ultimate containment of sewage
3.	Plenary session			
	Name of stakeholder	Question/comment/clarification		Response from ESIA team
i.	Nkamasiai Randoine	<ul style="list-style-type: none"> • Thanked KenGen for being good neighbors, • Requested for grading of the roads leading to Rap land, • Raised concern that job opportunities are usually man but KenGen management give so many jobs outside the local community due to personal interests. Many a times contractors also bring in workers from away denying the local community the chances. 		<ul style="list-style-type: none"> • Request had already been forwarded to the Civil division for action. • The liaison office will check on the issue to ensure that the community benefits from available jobs and economic opportunities.
ii.	Isaac Lotula-Kanaan	<ul style="list-style-type: none"> • Majority of the community members accepted the proposed project. • Employment opportunities is a major contagious issue, especially because contractors tend to hire casual workers outside the villages. • Economic opportunities that come with such projects are not available to the community, especially the ones far from the project area. • Asked why the project could not be done near Kambi Turkana. 		<ul style="list-style-type: none"> • The liaison office will check on the issue to ensure that the community benefit from available jobs and economic opportunities. • The wells are drilled far from the people because of possible negative impacts on the people and also not all areas have the required resource.
iii.	Peter Etabo-Kambi Turkana	<ul style="list-style-type: none"> • The children within the Community have been educated and therefore should be considered in the project as skilled workers. • The project is a good idea that will bring benefits to the community. • Requested for support from KenGen on construction of three classrooms and a teacher as the children 		<ul style="list-style-type: none"> • The contractors within KenGen have had issues regarding employment but the problem is being addressed. • Promised to be supported whenever possible but reminded that the land they live in is private and so difficult for KenGen to do CSR activities. • The liaison office will check on the issue to ensure that the

		<p>have to walk for over five kilometers to Olkaria Primary school.</p> <ul style="list-style-type: none"> • Raised a concern that the Chinese at Olkaria 1 rehabilitation project were extremely arrogant. • Requested KenGen to provide bowser water as Kambi Turkana only gets water from Rapland community. 	<p>community benefit from available jobs and economic opportunities</p> <ul style="list-style-type: none"> • KenGen will try to assist in water provision, but there are other government bodies that can help as well.
iv.	Robert Ekwam-Mlima tatu	<ul style="list-style-type: none"> • Support for the project. • Need to separate Turkanas from the Rapland community in future meetings, • Request for road repair • Requested the community concerns to get to the management no for NEMA approval only. 	<ul style="list-style-type: none"> • The separation to be considered in future ESIAs. • Request already forwarded to infrastructure for action. • Promised to get the community concerns to KenGen management for action.
v.	Timothy Karani-Oloosinyat	<ul style="list-style-type: none"> • Support for the project. • Need to separate Turkanas from the Rapland community in future meetings, • Request for road repair • Requested the community concerns to get to the management no for NEMA approval only. 	<ul style="list-style-type: none"> • The separation to be considered in future ESIAs. • Request already forwarded to infrastructure for action. • Promised to get the community concerns to KenGen management for action.
vi.	Tatiye Parkire-Oloonongot	<ul style="list-style-type: none"> • Raised concerns that contractors on the ground are importing workers from other places failing to consider local community for the jobs. • KenGen need to promote community by employing their children who are trained Engineers • Needed to pay for the meeting to social hall committee. 	<ul style="list-style-type: none"> • Promised that the liaison office was going to handle this with the project team. • KenGen was offering internship and attachment opportunities to the children from the local communities. Promised to pay for holding the meeting at the hall.
vii.	Lawrence Karani-Youth	<ul style="list-style-type: none"> • What is the project timeline? • Will KenGen do the drilling itself or hire a contractor. • There is need to strengthen the communication between the community leadership and KenGen. 	<ul style="list-style-type: none"> • If NEMA approves the project it should start around April. • KenGen will conduct the drilling itself. • KenGen will engage the community leadership in the best way possible.
viii.	Charles Lokan	<ul style="list-style-type: none"> • Local community not getting jobs from KenGen contracts 	<ul style="list-style-type: none"> • The liaison office will check on the issue to ensure that the

			Community benefit from available jobs and economic opportunities.
ix.	Ester Kadelo	<ul style="list-style-type: none"> Request for blue drums for Kambi Turkana 	<ul style="list-style-type: none"> The drums are to undergo normal company disposal process but a request will be forwarded to the disposal committee.
x.	Damaris	<ul style="list-style-type: none"> Request for the blue drums for Kambi Turkana and Canaan. KenGen to consider Turkana for jobs 	<ul style="list-style-type: none"> Request will be forwarded to the disposal committee. All communities are treated equally when casual jobs are shared out.
xi.	Mark	<ul style="list-style-type: none"> Turkana children left out during scholarship awards among Rap land pupils. Was not considered for internship though had applied. Requested to be considered for job opportunities 	<ul style="list-style-type: none"> Rap land scholarships are for the Maasai children only whose families were relocated as it was part of the MOU. Asked to ensure he has graduated and has a certificate to be considered. Jobs are shared out by the SCC committee and so should contact his SCC member for Kambi Turkana
4.	Resolution	<ul style="list-style-type: none"> Employ the skilled members of the community during the project period and after the project. The elected representatives should ensure that the new projects come with opportunities for members. 	
5.	Adjournment	<ul style="list-style-type: none"> The Chief encouraged residents to plant trees in the area. All those burning charcoal were given a stern warning by NGAO office and anyone caught would face the law. There being no other business, the Chairperson thanked all the participants for their contributions and requested KenGen to take into considerations the views and concerns of residents. The meeting was adjourned at 1455hrs with a word of prayer from Pastor Peter Nkamasiai 	
Adoption		<p>Chairperson.....<u>DAMARICE WANGHERA</u>.....Sign.....<u>[Signature]</u></p> <p>Date.....<u>OLKARIA -LOCATION</u>.....</p> <p>.....<u>P.O. BOX 11, NAIVASHA</u>.....</p> <p>.....<u>Date: 23/10/2024</u>.....</p> <p>ESIA Lead Expert.....Sign.....</p> <p>Date.....</p>	

MINUTES OF PUBLIC PARTICIPATION FOR ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF 42 GEOTHERMAL WELLS PROJECT HELD AT NALEPO HARVEST CHURCH COMPOUND- NARASHA VILLAGE AT 1510HRS ON 8TH OCTOBER 2024

Attendance sheet attached

AGENDA:

1. Preliminaries
2. Presentation by KenGen PLC
3. Plenary Session
4. Resolution
5. A.O.B

Min	Agenda	Discussions/ Issues/ Resolutions						
1.	Preliminaries	<p>The meeting was called to order by the Chief-Damaris Waithera, Olkaria Location, at 1510hrs followed by opening prayers from Mzee Shaa Ole Peres. The chairperson welcomed and appreciated all present for creating time for the public baraza. It was followed by self-introduction by the community representatives, local administration and the KenGen-ESIA Team. The Chairperson invited the KenGen Team to elaborate to the public on the main agenda of the day.</p>						
2.	Presentation by KenGen	<p>The ESIA team led by the lead expert, Mr. Philip Barasa informed the public that all the other proposed projects which were subjected to ESIA's were still in progress and a disclosure will be given to the community once the projects commence.</p> <p>The team lead explained to the public that the Environmental Management and Coordination Act, 1999 (EMCA), requires that Environmental and Social Impact Assessment (ESIA) must be undertaken for a proposed project likely to have impacts on the environment. The report is then submitted to National Environment Authority (NEMA) for review and decision making. Therefore, public participation and consultation is an integral process in the exercise to get views and concerns from the general public. He also requested consent from the community to collect data including taking contact details and pictures which the community consented.</p> <p>He further informed the community that KenGen intends to develop a 42 Geothermal Wells within the KWS leased land which is approximated to be 639 hectares.</p> <p>The team lead further gave the details on the anticipated impacts associated with the proposed project. He further presented the potential mitigation measures as follows:</p> <table border="1"> <thead> <tr> <th>Nature of Impacts</th><th>Description</th><th>Mitigation</th></tr> </thead> <tbody> <tr> <td> </td><td> </td><td> </td></tr> </tbody> </table>	Nature of Impacts	Description	Mitigation			
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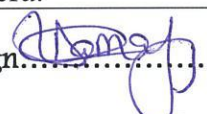
		Positive impacts	<ul style="list-style-type: none"> • Increased electricity output • Employment & economic opportunities to the local community such as through supply of goods and services • Improved infrastructure such as road networks • Skills and knowledge transfer to the local communities • Improved security • No displacement of the local community • Climate mitigation measures and carbon revenue • KenGen corporate social responsibility benefits including school scholarship opportunities 	
		Nature of Impacts	Description	Mitigation
		Negative impacts	Air pollution from geothermal gases, dust emissions from vehicle movements and construction works	<ul style="list-style-type: none"> • Speed limits will be enforced and regular watering of pathways • Enhanced H2S gas monitoring in the project site and its environs
			Accidents	<ul style="list-style-type: none"> • Provide work specific PPEs • Sensitize workers on safety • Enforce traffic rules including on speed limits
			Noise pollution and excessive vibration	<ul style="list-style-type: none"> • Considering the distance of drilling activities from settlement areas, vibration is not expected to have impacts beyond site boundaries. • All machines that exceed acceptable noise limits will be equipped with silencers or lagging materials or specially designed acoustic enclosures • Install improved silencers to minimize the noise levels • Ensure regular noise monitoring using both mobile and stationary H2S detectors • Use of signage

				<ul style="list-style-type: none"> Construction of the well pads, road networks and water supply system to be done between 6am to 6 pm Provide and enforce the use of PPEs
			Liquid Waste	Provide portable toilets and where necessary pit latrines to ensure ultimate containment of sewage
			Solid waste	<ul style="list-style-type: none"> All generated solid waste will be disposed appropriately. Apply the 5R system, Refuse, Repurpose, Reduce, Reuse, Recycle Ensure all wastes are fully segregated
			Clearing of vegetation and trees	<ul style="list-style-type: none"> Ensure controlled clearing of vegetation and trees. Rehabilitation of disturbed sites with indigenous species once the drilling of wells and construction of well pads, road networks and water supply system is completed.
			Health and safety	Safety of residents, workers and visitors will be provided for in line with OSHA 2007 including equipping workers with safety protection
			Insecurity	Necessary security will be provided (through contracted firms) and backed up by the Critical Infrastructure Protection Unit (CIPU).
			Social conflicts	Sensitization program will be rolled out aimed at raising awareness to the local community and KenGen workforce on communicable diseases
3.	Plenary session			
	Name of stakeholder	Question / comment / clarification	Response from ESIA team	
i.	Jackson Torinke – SCC Committee Member	<ul style="list-style-type: none"> Was okay with the project so long as the drilling of wells is within the KWS land. Previous drilling of wells resulted into brine overflow. Inform the community of the specific well sites 	<ul style="list-style-type: none"> The drilling project will be done within KWS land which has been leased to KenGen Brine flow will be controlled through re-injection whenever necessary. The well sites will be within the KWS land leased to KenGen and not community owned land. 	

		<p>to aid in avoidance of conflicts in case the site is contentious</p> <ul style="list-style-type: none"> • Conduct survey works to establish the land boundaries 	<ul style="list-style-type: none"> • KenGen GIS experts together with KWS and community representative will undertake survey works to establish the land boundaries
ii.	Simon Kita	<ul style="list-style-type: none"> • Monitor the levels of H₂S production after completion of the well drilling to assure the community of the health and safety from the H₂S • Limited benefits by the community unlike foreigners- lack of benefits from proposed projects including CSR projects. • No employment of locals even those with skills and experience in drilling • Be involved in the job related issues • Employ the Narasha locals in the drilling process so as to support the proposed projects 	<ul style="list-style-type: none"> • Results have shown that the level of H₂S in the Olkaria Geothermal Field is below 0.1 ppm hence the community should not worry about the levels of H₂S even if they don't have H₂S detectors • KenGen has undertaken several CSR projects for the community such as education scholarships, internship opportunities, attachments and water project among others. The community is however requested to make formal request to KenGen for consideration of other projects. • KenGen as a public institution is mandated by the laws, rules and guidelines on employment issues • The SCC Committee are tasked with the responsibility of sharing the information on all opportunities arising from the proposed projects
iii.	Wilson Katuret – Youth	<ul style="list-style-type: none"> • Why is KenGen conducting the ESIA study using its own officers rather than a consultant? • Why there was No NEMA officer present in the public participation meeting? • He requested KenGen to avail to the locals the map showing the proposed well sites • He noted that 	<ul style="list-style-type: none"> • KenGen has an internal capacity to conduct the ESIA. According to the law, anyone registered with NEMA is allowed to conduct ESIA. • The law doesn't demand the presence of NEMA officers in the public baraza, but they are represented in the one-on-one meetings with other key stakeholders. • KenGen presented a map showing the proposed well sites

		<p>overflowing brine finds its way to Narasha affecting their animals.</p> <ul style="list-style-type: none"> • What measures will KenGen put in place to ensure safety of their animals from the brine ponds? • He recommended full re injection of all the brine. • He observed that from the map(source not known), the boundary of the leased area runs into the community land • He voiced his concerns that fencing the leased area will reduce access to the park 	<ul style="list-style-type: none"> • The brine ponds will be fenced off to limit unauthorized access • Brine re-injection will be done 100%. Brine ponds will be used during emergency situations. • KenGen GIS experts will be used to survey the land boundaries together with KWS in the presence of the community representatives. • KWS says the law does not allow for grazing in the park, and there will be no fencing to be done in the park.
iv.	<ul style="list-style-type: none"> • Joseph Loitike 	<ul style="list-style-type: none"> • He requested KenGen to ensure the locals are shown the proposed well drilling site. • He noted that there were several cases of ear and eye problems within the locals and requested KenGen to assist the community • He alleged KenGen had blocked the construction of the Narasha community dispensary. 	<ul style="list-style-type: none"> • KWS together with KenGen experts will ensure the community representatives shall be shown the specific well sites • KenGen requested the community to make an official request to the company for consideration through the Mvuke Clinic • The land on which the said dispensary was to be built is disputed and KenGen may not support such a request.
v.	Elisha Ole Shaa	<ul style="list-style-type: none"> • He urged the proponent to ensure all the views, comments, concerns and complaints be included in the final report • What safety measures 	<ul style="list-style-type: none"> • The proponent assured the community that all their views, concerns and comments will be incorporated in the final report.

		will KenGen put to guard against access to the brine ponds to prevent domestic and wild animals drowning?	<ul style="list-style-type: none"> • Brine re-injection will be done 100%. Brine ponds will be used during emergency situations. All ponds will be fenced off to limit access
vi.	Hellen Eresia	<ul style="list-style-type: none"> • Land demarcation was done without community engagement • Let the community not be affected by the proposed project • She requested KenGen to have MOU with Narasha community for ease of follow up on agreed issues • She requested KenGen to consider offering permanent job opportunities to the community 	<ul style="list-style-type: none"> • KenGen wasn't aware of the land demarcation since the land has been leased from KWS • KenGen through the ESIA team assured the community that all the anticipated negative impacts will be mitigated through EMP • MOU-agreement-the ESIA team plans to communicate to the top management on the same. However, they were informed that MOUs are only necessary where there is displacement or damage on property, which does not apply in this case. • Employment-permanent jobs are dictated by employment act. KenGen as a public company is an equal employer with job opportunities being advertised openly for all to apply.
vii.	Agnes Koilel-NGO representative	<ul style="list-style-type: none"> • She requested KenGen to have a MOU with the local Narasha community before the commencement of the proposed projects for ease of follow up on agreed issues • She also urged KenGen to consider giving internship opportunities to the youth 	<ul style="list-style-type: none"> • MOU-agreement-the ESIA team plans to communicate to the top management • Skills transfer is done to the youth through internship and attachments in KenGen. KenGen ensures that the youths from the local community benefits fully from such opportunities. This however isn't dependent on the proposed project
viii.	David Shaa	<ul style="list-style-type: none"> • Supported the proposed project 	

		<ul style="list-style-type: none"> He urged KenGen to continue balancing the villages while job opportunities arise during the implementation of the proposed project. 	<ul style="list-style-type: none"> The SCC Committees are tasked with the responsibility of sharing the information on all opportunities arising from the proposed projects
ix.	Mzee Shaa Ole Peres	<ul style="list-style-type: none"> KenGen hasn't constructed any structure in any school in Narasha village The bone of contention between the Narasha community and KenGen is few or no benefits from the KenGen projects 	<ul style="list-style-type: none"> The community was requested to make an official request to the company subject to availability of funds. KenGen has undertaken several CSR projects for the community such as education scholarships, internships, attachments and water project among others. The community is requested to make formal request to KenGen for any further consideration.
5.	Resolution	The community fully agreed to support the project but asked KenGen to incorporate the views and concerns of the community for consideration.	
6.	Adjournment	There being no AOB, the Chairperson thanked all the participants for their contributions and requested KenGen to take into considerations the views and concerns of residents. The meeting ended at 1714hrs with a word of prayer from Chief-Damaris Waithera.	
Adoption		<p>Chairperson.....<u>DAMARICE WATHERA</u>.....Sign.....</p> <p style="text-align: center;">CHIEF</p> <p>Date.....<u>OLKARIA LOCATION</u>.....</p> <p style="text-align: center;"><u>P.O. Box 11, NAIVASHA</u></p> <p style="text-align: center;">Date: <u>23/10/2024</u></p> <p>KenGen Rep.....Sign.....</p> <p>Date.....</p>	

MINUTES OF PUBLIC PARTICIPATION FOR THE ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF 42 GEOTHERMAL WELLS PROJECT IN NAIVASHA SUB COUNTY, NAKURU COUNTY (OLKARIA LOCATION) HELD AT MVUKE SOCIAL HALL 1155HRS ON OCTOBER 09, 2024

Attendance sheet attached

AGENDA:

1. Preliminaries
2. Presentation by ESIA team
3. Plenary Session
4. Resolution
5. A.O.B

Min	Agenda	Discussions/ Issues/ Resolutions
1.	Preliminaries	The meeting was called to order by the ACC- Ms. Charity Kathure, Naivasha Sub-County, at 1155hrs followed by opening prayer from one of the community members. The chairperson welcomed and appreciated all present for creating time for the public baraza. It was followed by self-introduction by the community representatives, local administration and the KenGen-ESIA Team. Thereafter, the Liaison officer invited the Assistant County Commissioner, Naivasha-Sub-County, Ms. Charity Kathure to make her introductory statements and to chair the meeting. She declared the meeting officially open and invited ESIA Team Lead to elaborate to the public on the main agenda of the day.
2.	Presentation by ESIA team	<p>The ESIA team led by the lead expert, Mr. Philip Barasa informed the public that all the other proposed projects which were subjected to ESIA's were still in progress and a disclosure will be given to the community once the projects commence.</p> <p>The team lead explained to the public that the Environmental Management and Coordination Act, 1999 (EMCA), requires that Environmental and Social Impact Assessment (ESIA) must be undertaken for a proposed project likely to have impacts on the environment.</p> <p>The report is then submitted to National Environment Authority (NEMA) for review and decision making. Therefore, public participation and consultation is an integral process in the exercise to get views and concerns from the general public. He also requested consent from the community to collect data including taking contact details and photos which the community consented to.</p> <p>He further informed the community that KenGen intends to drill 42 Geothermal Wells within the KWS leased land which is approximated to be 639 hectares.</p>

		The team lead further gave the details on the anticipated impacts associated with the proposed project. He further presented the potential mitigation measures as follows:		
		Nature of Impacts	Description	Mitigation
		Positive impacts	<ul style="list-style-type: none"> Increased electricity output Employment & economic opportunities to the local community such as through supply of goods and services Improved infrastructure such as road networks Skills and knowledge transfer to the local communities Improved security No displacement of the local community Climate mitigation measures and carbon revenue KenGen corporate social responsibility benefits including school scholarship opportunities 	
		Nature of Impacts	Description	Mitigation
		Negative impacts	Air pollution from geothermal gases, dust emissions from vehicle movements and construction works	<ul style="list-style-type: none"> Speed limits will be enforced and regular watering of pathways Enhanced H₂S gas monitoring in the project site and its environs
			Accidents	<ul style="list-style-type: none"> Provide work specific PPEs Sensitize workers on safety Enforce traffic rules including speed limits.
			Noise pollution and excessive vibration	<ul style="list-style-type: none"> Considering the distance of drilling activities from settlement areas, vibration is not expected to have impacts beyond site boundaries. All machines that exceed acceptable noise limits will be equipped with silencers or lagging materials or specially designed acoustic enclosures Install improved silencers to minimize the noise levels Ensure regular noise monitoring using both mobile and stationary H₂S detectors Use of signages

				<ul style="list-style-type: none"> Construction of the well pads, road networks and water supply system to be done between 6am to 6 pm Provide and enforce the use of PPEs
			Liquid Waste	Provide portable toilets and where necessary pit latrines to ensure ultimate containment of sewage
			Solid waste	<ul style="list-style-type: none"> All generated solid waste will be disposed of appropriately. Apply the 5R system, Refuse, Repurpose, Reduce, Reuse, Recycle Ensure all wastes are fully segregated
			Clearing of vegetation and trees	<ul style="list-style-type: none"> Ensure controlled clearing of vegetation and trees. Rehabilitation of disturbed sites with indigenous species once the drilling of wells and construction of well pads, road networks and water supply system is completed.
			Health and safety	Safety of residents, workers and visitors will be provided for in line with OSHA 2007 including equipping workers with safety protection
			Insecurity	Necessary security will be provided (through contracted firms) and backed up by the Critical Infrastructure Protection Unit (CIPU).
			Social conflicts	Sensitization program will be rolled out aimed at raising awareness to the local community and contractors' workforce on communicable diseases
3.	Plenary session			
	Name of stakeholder	Question/comment/clarification		Response from ESIA team
	Robert Opondo-MCA Rep	<ul style="list-style-type: none"> He noted the locals don't like attending public participation forums. KenGen uses the local community as a gate pass to project implementation without benefitting the locals He supported the proposed project but requested KenGen to consider the Kamere 		<ul style="list-style-type: none"> It was communicated that unemployment is a Kenyan challenge and not localized. In addition, it was emphasized that KenGen permanent jobs are open to the public and are advertised online.

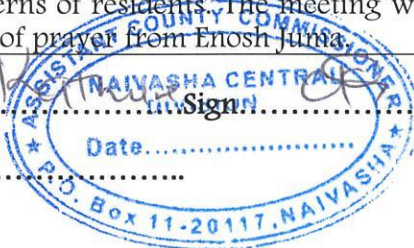
		<p>locals for benefits arising from the proposed projects</p> <ul style="list-style-type: none"> • He is aware of the structure (SCC) used by KenGen in sharing the limited job opportunities, but KenGen should consider the Kamere locals by giving them more slots due to high population. 	<ul style="list-style-type: none"> • For KenGen casual work, a labour contractor (Uniscope) was engaged to source and supervise work, and it is being administered by HR office. • All the opportunities coming from the proposed project will be shared among the villages through SCC and the associated sub-committees.
	Peter Amuoma-DCK-kwa muhia	<ul style="list-style-type: none"> • Consider the DCK community for the job opportunities arising from the proposed project • He requested KenGen to consider offering permanent jobs to the local community 	<ul style="list-style-type: none"> • For KenGen casual work, a labour contractor (Uniscope) was engaged to source and supervise work, and it is being administered by HR office. • All the opportunities coming from the proposed project will be shared among the nuclear villages through SCC and the associated sub-committees. • It was communicated that unemployment is a Kenyan challenge and not localized. In addition, it was emphasized that KenGen permanent jobs are open to the public and are advertised online.

	Collins –DCK YOUTH	<ul style="list-style-type: none"> • What impact will the power generated from the proposed wells have on the national grid? • Thanked KenGen for organizing the public baraza • He urged those present to embrace public participation because of its importance in development • He supported the proposed projects because of the associated benefits to the community and the country as a whole • More foreigners have been employed than the locals due to lack of working structure. KenGen needs to bring forth a working structure – all villages should be considered in the structure • Get more representatives from the village especially women representative • Will there be relocation of any household? 	<p>There will be increase in the electricity in the national grid subsequently aiding in the lowering of unit price while also mitigating against climate change since it comes from a renewable source of energy.</p> <p>KenGen contractor jobs and economic opportunities are shared out by the SCC subcommittees on Employment and Economic benefits.</p> <p>Gender balance is taken into consideration any time opportunities are given. The SCC also has both men and women.</p> <p>The project site is in KWS land leased by KenGen and so no communities live in the area.</p>
	Juma Fredrick – Kasarani	<ul style="list-style-type: none"> • He was perplexed with the fact that most people only talked about unemployment. • KenGen should consider Kasarani locals for job opportunities during the implementation of the proposed project 	<ul style="list-style-type: none"> • For KenGen casual work, a labor contractor (Uniscope) was engaged to source and supervise work, and it is being administered by HR office. • All the opportunities coming from the proposed project will be shared among the nuclear villages through SCC and the associated sub-committees.

		<ul style="list-style-type: none"> • Will there be compensation for any relocation? • He noted that the surrounding villages present today haven't benefitted from KenGen projects. • How will Kasarani locals' benefit? • Will the price per unit be reduced after implementation of the proposed project? 	<ul style="list-style-type: none"> • There will be no relocation of any household hence no compensation • The locals will benefit through increased electricity output, boosted local economy through supply of goods and services, employment & economic opportunities to the local community, skills and knowledge transfer to the local communities, no displacement of the local community and KenGen corporate social responsibility benefits. • The price of the electricity is not determined by the proponent. The proponent is mandated by law to only generate electricity.
	Agnes Kaikuru – Woman /Youth	<ul style="list-style-type: none"> • Surface instability/ vibration- how will this be curbed? • How will the youths benefit from the proposed project • Need for gender balance when job opportunities arise. 	<ul style="list-style-type: none"> • Geothermal fields are prone to tremors. KenGen usually conducts monitoring • The youths shall benefit through skills transfer by getting attachment and internship opportunities from the KenGen. • Gender balance is taken into consideration any time opportunities are given. The SCC also has both men and women.
	Grace Wambui Kamau- Kwa Muhia	Change the employment structure especially the skilled and semi-skilled	For KenGen casual work, a labor contractor (Uniscope) was engaged to source and supervise work, and it is being administered by HR office. All the opportunities coming from the proposed project will be shared among the nuclear villages through SCC and the associated sub-committees.

	Pastor Enosh Juma –Mzee Nyumba Kumi Kamere	<ul style="list-style-type: none"> • He noted the locals only pay attention to job related issues • He thanked KenGen for living in harmony with Kamere locals • He highlighted that unemployment is a national disaster • He supported the proposed project, however he noted that there was nothing to smile about as far as employment of locals in permanent positions by the proponent is concerned. • How will KenGen curb against dust pollution in case it arises from the implementation of the proposed project? • He noted corrosion of iron sheets within Kamere Community • He voiced his concern about arrest of youths who aid vandalism/ theft of scrap metals to sell to the scrap metal dealers in Kamere 	<ul style="list-style-type: none"> • It was communicated that unemployment is a Kenyan challenge and not localized. In addition, it was emphasized that KenGen permanent jobs are open to the public and are advertised online. • In case of dust pollution, water will be sprinkled to reduce or to mitigate against dust. • No evidence to back up the allegation that only H2S emanating from the Geothermal fields cause acid rain hence corrosion of iron sheets • The ACC warned the youths against indulging in illegal businesses and urged those interested in knowing the genuine scrap metal dealers to seek her guidance
i.	Stephen Emudu-Employment Chairman	<ul style="list-style-type: none"> • Requested those present to welcome the project • He alleged that KenGen doesn't recognize the villages present • His main worry was the number of job opportunities the people he was representing 	<ul style="list-style-type: none"> • For KenGen casual work, a labor contractor (Uniscope) was engaged to source and supervise

		<p>would get, he gave an example of Olkaria 1 Rehabilitation Project- one chance given since December 2023 up to date against over 2000 people</p>	<p>work, and it is being administered by HR office.</p> <ul style="list-style-type: none"> • All the opportunities coming from the proposed project are shared among the nuclear villages through SCC and the associated sub-committees.
i.	Karen Juma-Kamere beach	<ul style="list-style-type: none"> • She noted invasion of baboons in the neighbourhood resulting in incidences of human-wildlife conflict. • Requesting KenGen to consider the locals for job openings. 	<ul style="list-style-type: none"> • The locals were advised to report human-wildlife conflict to KWS. • For KenGen casual work, a labor contractor (Uniscope) was engaged to source and supervise work, and it is being administered by HR office. All the opportunities coming from the proposed project will be shared among the nuclear villages through SCC and the associated sub-committees. • It was communicated that unemployment is a Kenyan challenge and not localized. In addition, it was emphasized that KenGen permanent jobs are open to the public and are advertised online.
	Peter Mwaura-Kamere Youth	<ul style="list-style-type: none"> • He noted there was high unemployment for the youths • Youth are indulging in illegal activities 	<ul style="list-style-type: none"> • It was communicated that unemployment is a Kenyan challenge and not localized. In addition, it was emphasized that KenGen permanent jobs are open to the public and are advertised online. • The ACC warned the youths against indulging in illegal businesses and urged those interested in knowing the genuine scrap metal dealers to seek her guidance

	Raphael Juma – Beach leader	Made official request to KenGen for fresh water supply in Kamere but this has never been done.	The locals were advised to make official requests for any CSR support though they were also reminded of the hard economic times that is currently being experienced in the country.
4.	Resolution	The community fully agreed to support the project but asked KenGen to incorporate the views and concerns of they had aired.	
5.	Adjournment	<p>The Assistant County Commissioner encouraged residents and especially youth to be aggressive in looking for opportunities including self-employment opportunities from other institutions without putting their hope solely in KenGen.</p> <p>There being no other business, the Chairperson thanked all the participants for their contributions and requested KenGen to take into considerations the views and concerns of residents. The meeting was adjourned at 1455hrs with a word of prayer from Enosh Juma.</p>	
Adoption		<p>Chairperson.....<i>Chastity</i>.....</p> <p>Date.....<i>9/10/2024</i>.....</p> <p>ESIA Lead Expert.....Sign.....</p> <p>Date.....</p>	

MINUTES OF KEY STAKEHOLDERS' CONSULTATION MEETING FOR THE ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT FOR THE PROPOSED DRILLING OF 42 GEOTHERMAL WELLS PROJECT IN NAIVASHA SUB COUNTY, NAKURU COUNTY HELD AT ASTORIAN GRAND HOTEL, NAIVASHA AT 1102HRS ON OCTOBER 11, 2024

Attendance sheet attached

AGENDA:

1. Preliminaries
2. Presentation by KenGen (lessor)
3. Presentation by ESIA team
4. Plenary Session
4. Resolution
5. A.O.B

Min.	Agenda	Discussions/ Issues/ Resolutions
1.	Preliminaries	The meeting was opened by a prayer from Mr. Stephen Ouma at 1102hrs. Mrs. Peninah invited ACCI, Mrs. Charity Kathure-Naivasha –Sub-County to make her opening remarks and she in turn invited the stakeholders and KenGen ESIA Team to introduce themselves. The Chairperson invited ESIA Lead Expert to make remarks and give a power point presentation on the proposed project before opening the plenary session.
2.	Presentation by KenGen	KenGen representative, Kizito Opondo introduced the concept of drilling of 42 geothermal wells within the KWS land leased to the proponent aimed at ensuring that sufficient steam supply from renewable geothermal sources of energy for geothermal power generation within the Olkaria Geothermal Field was expanded and increased to help in mitigating against the energy demands in the country. He reiterated that KenGen and KWS had conducted a Joint Cadastral Survey for the Additional Sub-Lease where the proposed project is to be developed to the tune of 1580 acres approximately, 639 hectares of land within Hell's Gate National Park. He further informed the stakeholders present that for the sublease to be granted KenGen had to undertake the ESIA for the proposed project. He stated that this study is in place to assess environmental and social impacts and propose mitigation measure and ultimately lead to acquisition of an EIA license.
3.	Presentation by ESIA team	<p>The ESIA team led by the lead expert, Mr. Philip Barasa introduced the ESIA team and made remarks on the KenGen operations and its mandate. He made reference to the geothermal operations by KenGen including drilling operations. He stated that KenGen has an installed capacity of 799 MWs in Olkaria and Eburru regions.</p> <p>The lead team explained that the scoping of the proposed drilling of 42 geothermal wells falls under the high-risk project category pursuant to Legal Notice No. 31, legislative Supplement No. 16, which amended the second schedule of EMCA 1999.</p> <p>The ESIA Team Lead informed the stakeholders about the KenGen's intention to drill 42 geothermal wells categorizing into: production, re-injection and</p>

<p>monitoring wells which is in line with the company's G2G Strategy, LCPDP 2022-2041, the Government's BETA Model, and the Government's Plan of Phasing out the gas turbines(Muhoroni GT-2025) and Thermal Power plants (Kipevu III-2031) in Kenya</p> <p>The team lead explained to the public that the Environmental Management and Coordination Act, 1999 (EMCA), requires that Environmental and Social Impact Assessment (ESIA) must be undertaken for a proposed project likely to have impacts on the environment. The report is then submitted to National Environment Authority (NEMA) for review and decision making. Therefore, public participation and consultation is an integral process in the exercise to get views and concerns from the general public.</p> <p>The team lead further gave the details on the anticipated impacts associated with the proposed project and presented the potential mitigation measures in form of an Environment Management Plan as follows:</p>		
Nature of Impacts	Description	Mitigation
Positive impacts	<ul style="list-style-type: none"> • Injection of additional green energy into the grid. • Climate change mitigation via phase-out of thermal energy. • Cheap and reliable electricity. • Employment opportunities – roustabouts, security guards. • Spurring local socio-economic development. • Economic opportunities to the local community such as through supply of goods and services. • Improved infrastructure such as road networks. • Skills and knowledge transfer to the local communities. • Carbon revenue. • KenGen corporate social responsibility benefits including school scholarship opportunities. 	
Nature of Impacts	Description	Mitigation
Negative impacts	Loss of Habitat & Soil Erosion	<ul style="list-style-type: none"> • Joint KWS-KenGen baseline studies. • Multiple wells (2 to 4 No.) on a single well pad. • Road and well pad construction works to be confined within pegged areas. • Slope gradients shall be designed to assure stability and erosion protection measures like gabions and grassing incorporated. • Cut slopes shall be regularly monitored to detect erosion and remediate promptly.

			Air emissions from the internal combustion engines	<ul style="list-style-type: none"> • Periodic maintenance and servicing of the engines. • Quality checks of fuel supplied at the rigs. • Fuelling of vehicles at accredited pumping stations. • Annual measurement of levels of air emissions from the diesel generators and implementation of corrective actions.
			Noise emission from engines & discharging wells	<ul style="list-style-type: none"> • Limit civil works to daytime (0800 to 1700 hrs). • Preventive & condition based maintenance of the engines. • Limit duration of vertical discharge test as far as practicable. • Discharge tests for wells on the same well pad shall not be carried out concurrently. • Use of improved silencer for well discharge tests. • Monitoring of noise levels. • Calibration of noise metres.
			Geothermal fluids (brine & drilling fluid)	<ul style="list-style-type: none"> • Provision of ponds lined with HPDE. • Recirculation of the drilling fluid to save on materials. • Ponds shall be positioned on the upper side of the well pads. • Enclosure of the ponds and suitable drainage provision. • Installation of safety signage written in Maa, Swahili & English languages. • Monitoring the pond levels and implementation of corrective actions. • Physicochemical analysis of the fluids.
			Risk of Contamination of Shallow Aquifers	<ul style="list-style-type: none"> • Proper casing design for each well. • Monitoring program for boreholes in the neighborhood
			Hydrogen Sulphide Gas Emissions	<ul style="list-style-type: none"> • Gas emission will be monitored. • Calibration of H2S metres. • A contingency plan for high levels of H2S will be implemented. • Installation of safety signages at H2S prone areas. • Identification and marking of evacuation routes.

			Dust emission	<ul style="list-style-type: none"> • Application of water sprays using water bowsers. • Cement will be transported using portable trailer silos. • Enforcement of defined speed limits. • Monitoring and implementation of corrective actions.
			Road Traffic Accidents (RTA)	<ul style="list-style-type: none"> • Implementation of Traffic Management Plan (enforcement of speed limits and limiting night time driving). • Inclusion of education on wildlife protection in the project employee induction program and toolbox talks. • Implementation of safe driving protocols. • Use of escort vehicle during rig move.
			Solid Waste (Food waste, shoe casings, plastic containers, oily rags, used oil filters)	<ul style="list-style-type: none"> • Waste segregation & containment at the source. • Dispose via licensed scrap metal dealers & incinerator operators. • Reuse of plastic containers e.g. drilling detergent drums. • Provision of water dispensers to avoid single use plastic bottles. • Engagement of NEMA licensed waste handlers. • Tracking of wastes from “cradle to the grave”.
			Used oil	<ul style="list-style-type: none"> • Storage in a secure area with controlled access. • Provision of spill containment measures. • Training and awareness program. • The spill/leak contingency plans shall be activated as necessary. • Dispose via NEMA licensed handlers. • Dully filled waste tracking sheets shall be maintained.
			Domestic Sewage	<ul style="list-style-type: none"> • Provision of portable toilets. • Monitor sewer lines for leakages and institute corrective actions. • Exhaust and dispose via NEMA licensed handlers. • Dully filled waste tracking sheets to be maintained.

		electricity to the neighbouring communities?	<p>measures like: animal translocation and sacrificing the alpha males or females; and KWS have plans to speed up the compensatory procedures</p> <p>b. KenGen has a CSR project of supplying water to the Narasha community and the proposed project won't interfere with this</p> <p>c. The proponent is mandated by law to only generate electricity, the community is advised to visit relevant offices like KPLC & REREC to be considered especially through the last mile connection</p>
ii.	Jane Kioko-Imarisha Naivasha	Does KenGen have plans to undertake water balance study?	<p>The proponent has no plans to undertake water balance study. This is a mandate of the WRA</p> <p>KenGen has a permit to abstract water from Lake Naivasha. Quantities abstracted are monitored on a monthly basis</p>
iii.	Hannah Macharia-Orpower4	<p>a. What is the distribution of wells in the South East Geothermal Field?</p> <p>b. Is there a buffer zone between KenGen and other developers like Orpower4?</p> <p>c. Is KenGen intending to apply for a new water abstraction permit from WRA?</p> <p>d. Will there be relocation or resettlement during the implementation of the proposed project?</p> <p>e. Is security aspect incorporated in the proposed project?</p> <p>f. Is KenGen open to joint H2S Monitoring with Orpower4?</p> <p>g. Will KenGen be able to share with Orpower the map showing the proposed well sites?</p> <p>h. Does KenGen have a community support program?</p> <p>i. Consider sharing the power point presentation</p>	<p>a. The well distribution in the South East Field was demonstrated during the meeting (Area III-12; Area IV-12-13, Area I & II-7)</p> <p>b. The Ministry of Energy should authorize the provision of a bufferzone</p> <p>c. WRA response: Lake Naivasha has enough water to support the proposed project; the current water abstraction permit will suffice hence no need for a new water abstraction permit application</p> <p>d. The proposed project will not relocate any household hence no compensation anticipated</p> <p>e. Critical Infrastructure Protection Unit (CIPU) is in place at the Olkaria Geothermal Field to secure the KenGen installations</p> <p>f. Orpower4 is requested to communicate officially to the proponent for consideration</p> <p>g. The map showing the proposed well sites will be shared as requested.</p>

			Risk of Spread of Communicable Diseases	<ul style="list-style-type: none">• Unskilled labour will be sourced from the local community instead of importing.• Education of the drilling crew on mode of spread and prevention of contagious diseases.• Periodic psychosocial support for the affected employees.• Promotion of wellness activities at the workplace.
			Conflicts with Local Community, Orpower & Oserian	<ul style="list-style-type: none">• Establish Grievance Redress Mechanism.• Ensure fair and equitable sharing of job and economic opportunities.• Establish adequate buffer zones.• Engagement of Narasha and Oloomayiana Kubwa communities prior to drilling of wells closest to the established buffer zones.
			General Health & Safety Aspects	<ul style="list-style-type: none">• An inventory of all the hazardous chemicals in the work area shall be completed.• Suitable Personal Protective equipment (gloves, helmet, boots, apron, eye protection, ear protection) shall be provided.• Audiometric tests for workers exposed to high noise levels.• Approved self-contained or supplied-air breathing equipment shall be used in atmospheres where tests indicate presence of toxic or hazardous gases.• Risk of falling shall be prevented by guardrail systems, safety net systems, fall restraints, or personal fall arrest systems.
4.	Plenary session			
	Name of stakeholder	Question/comment/clarification	Response from ESIA team	
i.	Agnes Koilel-NGO-Narasha Development Group	<p>a. What plans do KWS have to minimize Human-Wildlife conflicts?</p> <p>b. How will KenGen ensure sufficient supply of water to the Narasha Community?</p> <p>c. Can the proponent supply</p>	<p>a. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife and reporting human-wildlife incidences; animal control</p>	

			<p>h. The proponent has set up a liaison Office which deals with all the CSR activities such as installation of water supply system to the community with tanks and taps for the neighbouring communities.</p> <p>i. The power point will be shared as requested. ESIA study will be disclosed in the media, Kenya Gazette and local newspaper where stakeholders will submit comments within 30 days.</p>
iv.	Joyce Ndegwa-LANARUA Naivasha	<p>a. Does the proponent have a plan to plant more trees within Hell's Gate National Park?</p> <p>b. How will the proponent prevent against siltation in Lake Naivasha?</p> <p>c. Human –wildlife conflict?</p>	<p>a. KenGen has a tree nursery near Geothermal Spa where trees seedlings are issued free of charge to support social afforestation</p> <p>b. Slope gradients shall be designed to assure stability and erosion protection measures like gabions and grassing incorporated; and cut slopes shall be regularly monitored to detect erosion and remediate promptly.</p> <p>c. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife and reporting human-wildlife incidences; animal control measures like: animal translocation and sacrificing the alpha males or females; and KWS have plans to speed up the compensatory procedures</p>
v.	Margaret Kuibita-Sub-County Social Health Officer	<p>a. Update stakeholders on the progress of the project</p> <p>b. Is the proponent undertaking underground or borehole water contamination within the Olkaria Geothermal Field?</p> <p>c. Is KenGen undertaking the geothermal emissions and its effects on animals and human being? Allegation of impacts of geothermal to livestock and human</p> <p>d. Is there an ambulance in place in case of an emergency situation?</p>	<p>a. The proponent agreed to share with the stakeholders any updates regarding the status of the proposed project</p> <p>b. WRA response: there are no boreholes within the Olkaria Geothermal Field hence no monitoring conducted by WRA.</p> <p>c. KenGen-Livestock Department conducted the research after the allegation and there was no connection between the death of the animals and geothermal emissions as alleged.</p> <p>d. Standby ambulance will be in place, Mvuke Clinic where emergency</p>

			situation will be are handled before referrals, well stocked first aid kits, and the proponent has procured a fire engine in case of any fire emergencies
vi.	Anthony Karange-Elsemere Conservation Centre	<p>a. Will KenGen be open to including poaching as one of the anticipated negative impacts associated with the proposed project?</p> <p>b. Baboon population bloom wreaking havoc in the neighborhood</p>	<p>a. The proponent was open to including poaching as an anticipated negative impact and its mitigation measures</p> <p>b. KWS response: The community was requested to coexist with the wild animals; a team is in place who monitors the impacts arising from both human and wildlife and reporting human-wildlife incidences; animal control measures like: animal translocation and sacrificing the alpha males or females; and KWS have plans to speed up the compensatory procedures</p>
vii.	Peter Mwangi - KWS	<p>He thanked KenGen ESIA Team an informative presentation</p> <p>a. Will the steam pipeline associated with the proposed development cause disruption of wildlife movement within the Hell's Gate National Park?</p> <p>b. What will be the level of vegetation clearance within each well pad?</p> <p>c. Will there be need for a road infrastructure to the well pads?</p> <p>d. What are the mitigation plans in place to curb against the impacts associated with well-testing especially the vulture cliff?</p>	<p>a. The project will not have steam gathering system. Therefore, there will be lower impact to movement of wildlife.</p> <p>b. The project proponent will maximize on the number of wells per well pad thereby minimizing the number of vegetation cleared.</p> <p>c. Yes. For ease of access to the well pads a road infrastructure will be developed.</p> <p>d. The proponent intends to use improved silencers to mitigate against noise pollution during well testing</p>
viii.	Beatrice Mwangi-WRA	<p>WRA permits effluent discharge</p> <p>a. What are the effluent discharge controls?</p> <p>b. What controls does the proponent have to prevent surface water contamination from brine in case of any emergency? Hence preventing brine coming into contact with Lake Naivasha water.</p>	<p>a. Brine discharge will be controlled through re-injection and in case of brine ponds will be needed liners will be used to prevent underground seepage</p> <p>b. Brine discharge will be controlled through re-injection and in case of brine ponds will be needed liners will</p>

		<p>c. Is the proponent planning to have brine ponds lined to prevent seepage into the ground?</p> <p>d. Why is KenGen undertaking ESIA using an internal capacity?</p>	<p>be used to prevent underground seepage</p> <p>c. In case of brine ponds will be needed liners will be used to prevent underground seepage</p> <p>d. Through the leadership of Lead Expert, the ESIA Team is guided by the code of conduct</p>
ix.	Silas Wanjala-Lake Naivasha Riparian Association	Is it possible to reduce the number of well pads by maximizing the number of wells per well pad?	Yes. The project proponent will maximize on the number of wells per well pad i.e. 2, 3 & 4 no. per well pad.
5.	Resolution	The stakeholders agreed to support the project because of its objectives and the outlined EMPs. There was a general agreement that KenGen should undertake the projects in consultation with key stakeholders such as the KWS.	
6.	Adjournment	There being no AOB, the MC, Mr. Kelly thanked all the participants for their contributions and participation. The meeting was adjourned at 1449hrs with a word of prayer from Chief-Damaris Waithera, Olkaria location.	
Adoption		<p>Chairperson..... <u>Chasny Kathy</u> Sign.....</p> <p>Date..... <u>11/10/2024</u> Date.....</p> <p>ESIA Lead Expert Sign.....</p> <p>Date.....</p>	



Appendix 18: Filled in questionnaires

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

KenGen intends to drill geothermal wells on land IR 105419/1 (LR NO.12881/5) leased from KWS. The proposed project is located within Hell's Gate National Park in the Olkaria Geothermal Field at Olkaria Sub-Location, Hell's Gate Location in Naivasha Sub-County, Nakuru County.

In compliance with the requirements of the Environmental Management and Coordination Act (EMCA) 1999, KenGen PLC is required to undertake the ESIA Study for the proposed development. Public consultation is an integral part of the ESIA process as provided under EMCA 1999 and subsidiary legislation. The purpose of this questionnaire is, therefore, to seek your views, comments and suggestions concerning the proposed development.

Kindly submit the hard copy of the filled questionnaire to Philip Barasa, the Lead EIA/Audit Expert. For further clarification contact (+254)724455061 or via email pbaraza@kengen.co.ke.

Name: STEPHEN OUMA ID No. 36615939
Occupation: Environmentalist Organization: Lake Naivasha Water Resources Users Association
Mobile No. and/or Email Address: 0710805798 / stephen128@gmail.com
Area of Residence: Naivasha Town Distance to the Proposed Site (km) 38.8Km

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

- ✓ It's most likely to be a source of employment due to need of labour
- ✓ Low cost of power supply
- ✓ Reduce cost of living
- ✓ Improve road network to areas of the construction sites
- ✓ Compensation to KWS (money may be used to protect wildlife) ^{endless}

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

- ✓ Noise pollution during the drilling of the wells.
- ✓ Wildlife habitat destruction.
- ✓ Air pollution; dust
- ✓ Human-wildlife conflicts in the protected area that may lead to loss of lives
- ✓ Ground water contamination during the drilling of wells.
- ✓ Spread of diseases i.e HIV/AIDS
- ✓ Waste pollution from construction materials.
- ✓ Accidents/Injuries.


4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

- ✓ Use of advance-modern technology with low noise pollution emissions
- ✓ Advance security to prevent human-wildlife conflict
- ✓ Reduce/limit destruction of wildlife habitat
- ✓ Sprinkle water to kill dust.
- ✓ Proper surveillance of the ground water levels for proper reverse pumping.
- ✓ Conducting civic education on the impact of diseases to health
- ✓ Proper waste disposal. ✓ Use of PPE

5. Please provide any other comment that might be useful during the implementation of the proposed project.

- ✓ Proper fencing of the work areas

Signature of Respondent:



Date:

6/10/2024

Thank you for participating in this exercise.



QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: WAMBURU CHARLES ID No. 31386688

Occupation: PI Organization: NAIWAASCO

Mobile No. and/or Email Address: 0717003166

Area of Residence: NAIWAASCO Distance to the Proposed Site (km) 20

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Energy Independence and Security
Job creation
Improvement of infrastructure
Boost to tourism
Revenue generation for local governments

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ✓ }

No { }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

Air quality issues - The release of gases like hydrogen sulfide (H_2S) can affect air quality and pose health risks.
Visual and noise pollution - Drilling noise and equipment could impact the aesthetic and quiet environment, affecting wildlife & tourism.
Seismic activity - Changes in underground pressure during drilling could potentially trigger minor seismic events.

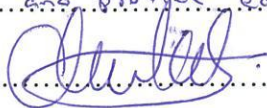
4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

Air quality issues → Install gas capture systems to limit harmful emissions and monitor air quality regularly.
Visual and noise pollution - Limit noise by restricting operations to certain hours and use noise barriers. Minimizing visual disruption by strategically placing equipment and restoring the landscape after drilling.

5. Please provide any other comment that might be useful during the implementation of the proposed project.

Regular community engagement and consultations should be held to keep residents and stakeholders informed.
The project to include Corporate Social Responsibility (CSR) initiatives to improve local infrastructure and provide educational opportunities in geothermal energy.

Signature of Respondent:



Date:

10/10/2022

Thank you for participating in this exercise.

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: Anthony M. KARINGE I.D No. 8484833

Occupation: CONSERVATION MANAGER Organization: ELSAMERE

Mobile No. and/or Email Address: 0725426603 AnthonyKaringe@gmail.com

Area of Residence: Moi Sate Lake Rd Kamere Distance to the Proposed Site (km) 20km

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

- ① EMPLOYMENT TO THE RESIDENTS
- ② TECHNOLOGY TRANSFER
- ③ SOCIAL WELFARE THROUGH SUPPORTING CONSERVATION EDUCATION
- ④ SUPPORTING EDUCATION INITIATIVES
- ⑤ SUPPORTING WILDLIFE CONSERVATION
- ⑥ PROVISION OF ENERGY TO SUPPORT INDUSTRIALIZATION FOR THE COUNTRY

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { }

No { }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

1. Vegetation Distruption

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

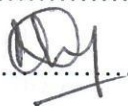
1. Once the Project is Completed Replanting of the Lost vegetative Cover.

2. Support tree Nursery and to with Seeds to be Part and Parcel of raising Seeds to be replanted.

5. Please provide any other comment that might be useful during the implementation of the proposed project.

KenGen to Continue Supporting Conservation Education.

Signature of Respondent:



Date:

8/10/2024.

Thank you for participating in this exercise.



QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: Peter Mwangi I.D No.

Occupation: EIA Expert Organization: KWS

Mobile No. and/or Email Address:

Area of Residence: Distance to the Proposed Site (km)

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

.....
— Clean energy production
— Employment
— Economic growth.
.....
.....

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

- The area under exploration is a wildlife protected area and drilling activities have major impacts on wildlife including displacement due to loss of habitat and disruption of wildlife movement in the area.
- Pollution from hydrogen sulphide emissions.
- Dust and noise pollution.
- Pollution from brine ponds.

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

- Fence brine ponds
- Use directional drilling to minimize no. of wells in the park.
- Restrict the no. of wells to existing oilfield well pads.
- No more clearing of well pads in Area IV well
- Ensure re-injection of brine water

5. Please provide any other comment that might be useful during the implementation of the proposed project.

All well pads in the wildlife Conservation Zone to maintain eco friendly initiative.

Signature of Respondent:



Date:

11/10/2024

Thank you for participating in this exercise.

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: Beatrice Mwangi ID No. 9507712
Occupation: Water quality & Pollution Control Organization: Water Resources Authority
Mobile No. and/or Email Address: 0720860722 Email: mwangibetty7@gmail.com
Area of Residence: Naivasha Distance to the Proposed Site (km) ~ 16 km

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

- Employment creation
- More energy generated

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

① Water pollution into nearby water resources due to spillage of brine

② Displacement of wild animals

③ Interference of cultural heritage by local communities.

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

① Proper disposal & treatment of brine

5. Please provide any other comment that might be useful during the implementation of the proposed project.

None.

Signature of Respondent:



Date:

7/10/2024

Thank you for participating in this exercise.

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: ELIAS WANJARA I.D No. 24276375
Occupation: GENERAL MANAGER Organization: LAKE NAIVASHA RIPARIAN ASSOCIATION
(SOCIAL ECOLOGIST)
Mobile No. and/or Email Address: 0729834870 gm@lnra.or.ke
Area of Residence: Distance to the Proposed Site (km)

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

- ADDITION OF POWER TO THE NATIONAL GRID
- EMPLOYMENT OPPORTUNITIES WILL BE CREATED (BOTH DURING DRILLING AND THE OPERATIONAL PHASE)
- ECONOMIC OPPORTUNITIES

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

- POTENTIAL DISPLACEMENT OF WILDLIFE
- HABITAT DEGRADATION
- NOISE POLLUTION
- POTENTIAL RISK OF WILDLIFE ACCIDENTS AS A RESULT OF MOVEMENT OF TRAFFIC
- POTENTIAL PROLIFERATION OF INVASIVE SPECIES AS A RESULT OF SOIL EXCAVATION WORKS
- POTENTIAL RISKS OF EROSION

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

- DRILL MORE WELLS ON ONE WELL PAD RATHER THAN HAVING EACH WITH ITS OWN WELL PAD.
- MINIMIZE EXCAVATION WORKS AND ONLY DO IT WITH RESTRICTIONS
- PUT IN PLACE TRAFFIC CONTROL PLANS
- PUT IN PLACE MEASURES TO MINIMIZE NOISE EMANATING FROM HEAVY MACHINERY
- PUT IN PLACE INVASIVE WEEDS CONTROL MEASURES & RESTORATION PLANS

5. Please provide any other comment that might be useful during the implementation of the proposed project.

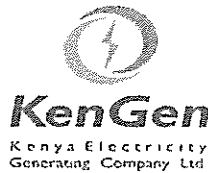
Signature of Respondent:



Date:

11th OCTOBER 2024

Thank you for participating in this exercise.



QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (LR No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: Rose Kiama I.D No. 13882979
Occupation: Environmental Scientist Organization: GDC
Mobile No. and/or Email Address: 0722413554

Area of Residence: Distance to the Proposed Site (km)

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Green Energy
Employment
Provision of Electricity
CSR Projects

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is yes, please specify the potential negative environmental and/or social impacts.

Air Pollution
Noise Pollution
Water and Soil Contamination
Vegetation (Flora and Fauna) disruption
Displacement of communities

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

- Monitor both air and noise levels before and during implementation to ensure its mitigation
- Line ponds where brine is deposited
- Drill in areas with minimal vegetation and animals
- Reserve sensitive plants
- Have a plan for resettling those displaced

5. Please provide any other comment that might be useful during the implementation of the proposed project.

Geothermal energy is green and sustainable and provides energy and also employment for nations

Signature of Respondent: Diliana Date: 11/10/2024

Thank you for participating in this exercise.

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

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Name: SAMUEL ABAYA I.D No. 21542948

Occupation: Socio-Economist Organization: KPLC

Mobile No. and/or Email Address: SAbaya@kplc.co.ke / 0723492692

Area of Residence: Distance to the Proposed Site (km)

1. What are some of the potential positive impacts associated with implementation of the proposed Drilling of Geothermal Wells?

- Creation of employment opportunities
- Generation of more electrical power
- Improvement of the national, county and local economy
- Improvement of the social infrastructure
- Benefits of corporate social responsibilities implementation

2. Are there any potential negative environmental and/or social impacts associated with implementation of the proposed Drilling of Geothermal Wells?

Yes { ☒ }

No { ☐ }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

- Land loss, Wildlife habitat loss
- Air Pollution (GHG, H₂S gas & CO₂)
- Noise, Pollution, Soil erosion, Solid wastes
- Conflicts are likely to arise
- Vegetation clearing and change of land uses
- Contamination of underground and surface water bodies
- Gender Based Violence, Sexual Exploitation and Abuse & Sexual Harassment
- HIV/AIDS, Sexual transmitted diseases, Labour influx
- Occupational, Health & Safety risks

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

- Compensation of lost land
- Selective & Restricted bush & vegetation clearing
- Regular vehicle maintenance, Speed limits, no waste burning on site
- Prepare & implement Labour Influx Management Plan
- Prepare & implement Spillage Prevention Plan
- Prepare & implement Grievance redress mechanism, Stakeholder Engagement Plan
- Ensure circulation Ponds are well lined before discharge
- Educate & Sensitization of workers & local community on HIV/AIDS, SEA/SH

5. Please provide any other comment that might be useful during the implementation of the proposed project.

- Regular public consultation during the project cycle
- Adherence to various legislations during construction and operational phases

Signature of Respondent:



Date:

11-10-2024

Thank you for participating in this exercise.

QUESTIONNAIRE FOR PUBLIC CONSULTATION

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT (ESIA) FOR THE PROPOSED DRILLING OF GEOTHERMAL WELLS ON IR 105419/1 (L.R No. 12881/5) IN HELL'S GATE NATIONAL PARK, NAIVASHA SUB-COUNTY IN NAKURU COUNTY

KenGen intends to drill geothermal wells on land IR 105419/1 (LR NO.12881/5) leased from KWS. The proposed project is located within Hell's Gate National Park in the Olkaria Geothermal Field at Olkaria Sub-Location, Hell's Gate Location in Naivasha Sub-County, Nakuru County.

In compliance with the requirements of the Environmental Management and Coordination Act (EMCA) 1999, KenGen PLC is required to undertake the ESIA Study for the proposed development. Public consultation is an integral part of the ESIA process as provided under EMCA 1999 and subsidiary legislation. The purpose of this questionnaire is, therefore, to seek your views, comments and suggestions concerning the proposed development.

Kindly submit the hard copy of the filled questionnaire to Philip Barasa, the Lead EIA/Audit Expert. For further clarification contact (+254)724455061 or via email pbaraza@kengen.co.ke.

Name: Mbogo Kamau **ID No** 8508671

Occupation Research Officer, CEO..... **Organization:** Imarisha Naivasha

Mobile No. and/or Email Address: 0722 313678, mbogokamau2001@yahoo.co.uk

Area of Residence: Naivasha, Lake View Ward. **Distance to the Proposed Site (km)** 29Km

1. What are some of the potential positive impacts associated with the implementation of the proposed Drilling of Geothermal Wells?

Job creation, increased market for goods, enhanced regional and national economy, an increase of electric power to the National grid, Generation of Green energy, and Enhanced urban development.

2. Are there any potential negative environmental and/or social impacts associated with the implementation of the proposed Drilling of Geothermal Wells?

Yes { X }

No { }

3. If the answer to Q2 above is **yes**, please specify the potential negative environmental and/or social impacts.

Landscape disturbances including soil Erosion, Ecosystem deconstruction, displacement and or loss of Flora and fauna, atmospheric pollution (dust and gases emission), Influx of human populations to

Naivasha due to migration for Job speculation, potential medical issues due to population increase and human influx, Cultural dilution, increased pressure on social amenities.

4. How should each of the potential negative impacts highlighted in Q3 above be avoided, mitigated, or minimized during the project implementation?

Implementation of the Environmental Management plan to the letter, Identification of the potential critical habitats and species that will potentially be affected, and Identification of feasible easements to reduce the impact on critical habitats and species (both Flora and Fauna).

5. Please provide any other comment that might be useful during the implementation of the proposed project.

All along the life of this project, there will be a need to constantly engage the stakeholders for consultations over the diverse issues that may arise including possible ways of undertaking ecosystem improvement.

Signature of Respondent:



Date: 10th Oct. 2024

Thank you for participating in this exercise.