



**AFRICAN DEVELOPMENT
BANK GROUP**

**PROJECT: QUANTUM POWER -MENENGAI GEOTHERMAL
POWER DEVELOPMENT: 1X 35MW PROJECT IN
NAKURU COUNTY KENYA**

COUNTRY: REPUBLIC OF KENYA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY

Date: March 2018

Appraisal Team	Team Leaders:	A. Mukasa (Senior Investment Officer RDGE1), J. Jakoet (Senior Investment Officer RDGE1), F. Mohamed
	Team Members:	F. Oku, Senior Environmental Specialist RDGE
	Divisional Manager:	Aida Ngom
	Sector Director:	Wale Shonibare
	Regional Director:	Gabriel Negatu

**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT [ESIA]
SUMMARY**

Project Title: QUANTUM POWER MENENGAI Project Number: P-KE-FZ0-013	
Country: KENYA	Department: PESR
Division: PESR2	Project Category: 1

1. INTRODUCTION

The Project to be financed includes a modular geothermal power plant, consisting of one single-flash condensing steam turbine, generating approximately 35MW net (37.7MW gross) of power located in the Menengai Geothermal field in Nakuru County, Kenya, approximately 180 km to the north-west of Nairobi, and on the outskirts of Nakuru Town. The sole sponsor, equity provider and sole shareholder of the proposed project is Quantum Power East Africa (QPEA), who have set up a Special Purpose Vehicle, QPEA GT Menengai Ltd, as the Project Company to develop and operate the project via a Build-Own-Operate (BOO). The Kenya Electricity Transmission Company (KETRACO) has completed the construction of the 15 km 132 kV transmission line (Menengai to Soilo Substation) to evacuate the produced electricity from the power plant.

This ESIA summary highlights the key environmental and social (E&S) assessment and management plans designed by QPEA GT to ensure the proposed project component activities comply with both Kenyan and the African Development Bank's E&S policy requirements.

2. POLICY LEGAL AND ADMINISTRATIVE FRAMEWORK

The ESIA has been carried out in accordance with applicable environmental, social and power sector policies, standards, regulations and legislation in Kenya, relevant international conventions and standards as well as E&S Operational Safeguards of the African Development Bank. These include but not limited to Policy Paper on Environment and Development (Sessional Paper No 6 of 1999), Vision 2030, National Policy on Water Resources Management and Development, 1999, The Constitution of Kenya, Energy Act, 2006, Environmental Management and Coordination Act, 1999, Environmental (Impact Assessment and Audit) Regulations, 2003, Environmental Management and Coordination (Water Quality) Regulations, 2006, The Environmental Management and Coordination (Waste Management) Regulations, 2006, Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009, Wildlife (Management and Conservation) Act 2013, Forestry Services Act, 2005, Land Act, 2012, National Land Commissions Act, 2012, Land and Environment Court Act, 2011, Land Registration Act, 2012, Water Act, 2002, Water Quality Regulations, 2006, Water Resources Management Rules (2007), Public Health Act (Cap 242), Public Health (Drainage and Latrines) Rules, Cap 130, 1958, Physical Planning Act, 1996, Occupational Safety and Health Act, 2007, Employment Act No 11 of 2007.

AfDB's Operational Safeguard Review

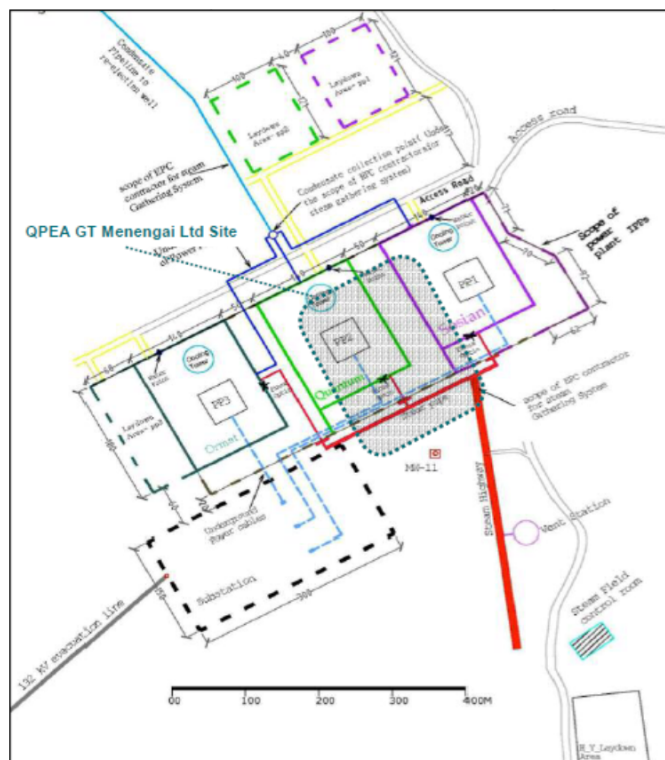
The project has been assigned a category 1 by the African Development bank in line with the guidelines within the Bank's ESAP for all power generating plants exceeding a generating capacity threshold of 30MW. Consequently Operational Safeguards (OS) 1 on Environmental Assessment have been triggered because the component activities have the potential to generate significant environmental and social impacts to identified receptors within its area of influence. Operational Safeguard (OS2) has also been triggered because the 15km 132kV T-line which is an Associated Facility has led to displacement of people and assets. OS 3 is also triggered because the project is sited within a nationally gazetted forest (Caldera Forest). OS 4 on Pollution Prevention and Hazardous Substances is triggered since construction will involve use of fuels and possibly some hazardous materials. OS 5 on Labor, Working Conditions, Occupational Health and Safety is applicable since the construction will involve a significant number of construction workers.

3. PROJECT DESCRIPTION AND JUSTIFICATION

The Geothermal Development Company (GDC) is fully owned by the Government of Kenya with a mandate to mobilize the country's geothermal resources. The GDC has currently drilled over twenty wells within the Menengai Caldera, each with an estimated production of 5 to 10MW. Ancillary infrastructure also developed by the GDC includes the steam gathering and distribution systems, brine sump ponds, reinjection wells, access roads, boreholes and water pipelines.

QPEA is one of three Independent Power Producers (IPPs) to be awarded a tender by the GDC to develop a 1x35MW modular geothermal power plant on a Build Own and Operate (BOO) basis. The general layout of the QPEA plant, in relation to the other two geothermal plants, and in relation to the Menengai geothermal complex as a whole is shown in Figure 3.1 below;

Figure 3.1: Technical Design Layout plan for the project



GDC will supply/deliver steam to the plant based on parameters in the PISSA. GDC will also supply water to the plant, and any brine produced by the plant will also be collected by the GDC for deep well re-injection. The power produced by QPEA (and the other two IPPs) is routed to a substation on site adjacent to the three power plants, from where KPLC will transmit this power via the Soilo substation into the national grid.

The main project components are as follows;

- Steam System: High pressure steam piping is carbon steel with 3 mm corrosion allowance, rock wool insulated with aluminium cladding. The design pressure and temperature of main steam system is 11 barg and 190°C;

- Steam metering and purity monitoring system: Steam flow rate at the boundary will be measured by the venturi flow meter consisting of single tube and double metering/differential pressure transmitter;
- A turbine generator unit with power output rating of 37.63 MW as measured at the generator terminal;
- Condenser and turbine drain system;
- Non Condensable Gas (NCG) extraction system through a 30m high steel stack;
- Main and Auxiliary cooling water circuit;
- Compressed air system: for air supplies to pneumatic operated valves;
- Electrical system: voltage levels in the system are 415V, 690V, 11kV and 132kV, 50Hz; connected power is dimensioned to 50MVA at the main transformer with 11kV at the MV side and 132kV at the HV side; and the Generator power output is 37.63MW electrical power.
- Earthing and Lightning protection;
- Transformers: Step Up transformer rated at 11/132 kV, 50 MVA; Station Service transformer rated at 11/0.69 kV, 4 MVA; and Auxiliary transformer rated at 690/415 V, 315 kVA
- Instrument and control system
- Process Control System for the total power plant based upon Distributed Control System (DCS), including the SCADA functionality with I/O, internal and external communication;
- Fire, Security and Detection System;
- Heating, ventilation and Air Conditioning (HVAC) system;
- H2S safety system: for both human hazard detection system and equipment protection system

Justification of the Project:

The security of energy supply especially electricity generation in Kenya seems to be threatened by climate change induced phenomenon, chief among them, drought which negatively impacts other sources of power generation, notably hydro. Inadequate electricity generation capacity and high power bills have been perennial problems in Kenya prompting the Government to explore various ways of tackling the glitches.

A shift to alternative sources of energy such as geothermal power which is environmental friendly and more affordable to run compared to other sources of energy like fossil fuel will insulate the country against the effects of drought, which often interferes with hydroelectric power which historically has been the major source of installed power.

According to Vision 2030, it is estimated that the national power requirements in the next 17 years will reach 15000MW, which is about ten times the current 1700MW power generation capacity. This justifies the immediate need to more than double the power generation to 5000MWe in the next 5 years to meet the rising demand and move in tandem with economic growth projections.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

The ESIA studies undertaken show that the project area is classified into two main agro-climatic zones. The lowland areas of Mogotio and Kisanana in the north are located in semi-arid zone IV with an annual rainfall of 800 mm and mean temperatures of 30°C. Bahati and

parts of Kampi ya Moto divisions with an altitude of between 1800 m and 2400 m above sea level and average rainfall of between 760 mm and 1270 mm per year fall within a dry sub-humid equatorial climatic zone.

As per the 2009 national housing and population census, Nakuru North and Rongai sub counties have a total population of 211,691 (103,316 males and 108,375 females) and 163,864 (82,665 males and 81,199 females) respectively. From the socioeconomic survey undertaken in the project area, persons between the ages of 30-34 have the largest proportion of 11.0%. When taken together, as large as 29.4% of the sample are below the age of 15 years. The productive segment of the population (20 – 55yrs) is about 52.1% while old people (> 55 years) accounted for 8.4%. Majority of households surveyed were male-headed (81.7%) whereas 18.3% of the households are female headed. Nakuru North and Rongai are predominantly agricultural sub counties with maize and wheat crops being the predominant crops grown and cattle rearing for milk production, especially in areas neighbouring the project area.

Vegetation survey in the Menengai Caldera carried out during the ESIA study identified a total of 217 plant species consisting of herbs (132), shrubs (45) and trees (40). *Rhus natalensis*, *Dodonea* sp. and *Tarchonanthus comphoratus* are among the most dominant species. The caldera also contain some plant species that are believed to be rare and unique to this area such as *Artemisia afra*, *Protea gaguedi*, *Tetradenia riparia*, *Diplolophium africanum*, *Agauria salicifolia* and *Osyris lanceolata*. None of the identified species have been assessed for the IUCN red list (IUCN, 2014). However, *Osyris lanceolata* is listed in the sixth schedule of wildlife conservation and management Act of 2013 as endangered. Jimsonweed, *Datura stramonium* listed in the same schedule as an invasive species was also found in the caldera. At the rim of the caldera, mainly on the eastern and south eastern side, plantation forest (mainly of *Eucalyptus* spp.) under Kenya forest service exists.

There are few wild animal species in the project area. This is because large parts of the area outside the caldera are farmlands with no open grazing and dispersal areas. Representatives of 9 mammalian species, 4 herpertofauna species and 40 species of aves were noted in the caldera. Of these species, the African Rock Python, *Python sebae* is classified as endangered and one bird, the Nyanza swift is protected under the Wildlife Conservation and Management Act of 2013. No wildlife migratory corridors have been established in the project area. There are no recorded archaeological sites and no surface artefacts were seen on the proposed development site.

The caldera is not pristine and already various types of infrastructure are developed through the preceding geothermal exploration, drilling of steam production wells and a number of activities related activities are still ongoing. Pre-project noise levels were established to be already higher than legal thresholds provided in Environmental Management and coordination (Noise and Excessive Vibration Pollution) (Control) Regulations of 2006. Furthermore, archaeological studies undertaken shows absence of any significant and important cultural heritage with the project area.

5. PROJECT ALTERNATIVES

The ESIA considered project alternate analyses various options including the No project alternative, different power generating sources and alternative Geothermal technologies for the proposed power plant. Geothermal energy is generally considered environmentally friendly and does not cause significant amounts of pollution with reservoirs able to naturally replenish

itself. A single flash Steam Cycle is recommended for the Menengai power plant due to the following advantages;

- The risk of well enthalpy turning out to be different than planned because of well drilling and plant building being done simultaneously;
- The risk of well enthalpy changing when utilization of the reservoir starts;
- The second separator stage is usually at pressures below silica saturation limit. This calls for acid or inhibitor dosing and has potential to cause increased maintenance cost or operational problems.

6. POTENTIAL IMPACTS

The following potential positive and negative environmental and social impacts are anticipated throughout the different project development phases;

i. Positive Impacts

During construction, the key positive impacts will be creation of employment opportunities for estimated 300 construction staff for a period of about two years; income generation activities to the local communities through sale of local construction materials and food by women; improvement in local economy from increased trade activities and potential diffusion and transfer of communication and knowledge from specialist construction staff to the local participants.

During operation phase, the most significant positive impact of the project will be the realization of its objective by injecting additional 35 MW of electric energy into the national grid. This will enhance the country's energy supply and security through a relatively more environmentally friendly energy generation process. Similarly, it is in line with enabling the energy sector make strides towards the policy directions envisaged in the Vision 2030.

Further, the operation phase is anticipated to: create 15 direct permanent job opportunities in the plant management and maintenance and numerous other indirect opportunities; generate income to the IPP and local power distributor; potentially attract Clean Development Mechanism funding; and enhance tourism activities within the Menengai caldera.

ii. Negative Impacts

The proposed project will be associated with a number of negative impacts both at construction and operation phases. At the construction phase, major impacts will be the common construction environmental and safety issues including: limited vegetation clearance within the plant area to be replaced by infrastructure; generation of construction dust, occupational and general public safety and health hazards emanating from construction traffic, working at heights, exposure to heat and elevated H₂S during connection of steam pipelines with the plant and excessive noise and vibrations; potential disturbance of encountered wildlife including the endangered and protected species noted within the caldera; and increased risks of wildfires within the caldera. Other potential negative impacts include:

- Impact from materials quarry sites;
- Construction waste generation;
- Potential spread of HIV/AIDs and other Sexually Transmitted Infections;
- Impact on flora: spread of invasive *Datura stramonium*, exposure to escaping steam
- containing Non Condensable Gases (NCGs);
- Impacts on Soils
 - ✓ Soil erosion and increased sedimentation

- ✓ Soil pollution
- ✓ Soil compaction;
- Visual and landscape impacts; and
- Pressure of existing water Resources

Given absence of recorded archaeological sites or observed artefacts within the project site, no potential impacts on archaeological features are anticipated. However, a chance find procedure has been developed as a precautionary measure for use during construction excavation works.

During the operation phase, the major negative impact of the power plant will be associated with discharge of Non Condensable Gases (NCGs) into the atmosphere and noise generation from the steam turbine, generator and other associated plant equipment. NCGs constitute 3.3% to 4% of the geothermal steam from Menengai and hydrogen sulphide (H₂S) and carbon dioxide (CO₂) are the predominant NCGs. H₂S presents an unpleasant, typically “rotten eggs” odour at relatively low concentrations and is toxic in higher concentrations. CO₂ is not significant in terms of direct impact to human health in open environments but is a greenhouse gas. Specialist air quality (H₂S) and noise impact assessment study established the area is dominated by winds from the SSE and NNW. Any long term air quality and noise impacts are therefore expected to be the most significant to the NNW and SSE of proposed operations. Several air quality sensitive receptors (AQSRs), mainly rural settlements and small rural centres, are situated within the vicinity of the proposed power plant.

The H₂S modelling results showed that the WHO daily guideline value of 150 µg/m³ is not exceeded at any of the AQSRs even with the highest probable NCGs concentration in the steam of 4% and with all the three power plants operating simultaneously. This indicates that no adverse public health impacts are anticipated with H₂S emissions from the plant’s operation relative to WHO standards. On likely impacts on occupational health of power plant workers, the modeling results indicate that the anticipated levels are not likely to exceed the WHO Lowest Observable Adverse Effect Level (LOAEL) of 10ppm. However, the WHO odour annoyance threshold of 0.005ppm will be exceeded at the nearby AQSRs causing odour annoyance. QPEA has incorporated two separate H₂S safety systems for of one central unit with 4 ports and 4 fixed detectors for 1-500 ppm H₂S level; and equipment protection system designed for 1-1000 ppb H₂S detection.

To ensure the lowest possible impact on AQSRs and the environment it is recommended that an air quality management plan should be adopted. This includes:

- The mitigation of sources of emission;
- The management of associated air quality impacts; and
- Ambient air quality monitoring;
- Training of all workers on the dangers exposure to elevated H₂S levels;
- Installation of H₂S monitors with alarm system including use of personal monitors by staff in potentially dangerous areas
- Liaison strategy for communication with communities who may be affected by odour nuisance.

Noise impact modelling results indicate that with all the three power plants operating simultaneously the overall maximum increase in noise level over the baseline will be less than 3 dBA at around 1.72 km from the boundary of operations. As expected the noise impact would be most notable at night when baseline noise levels are lower and assessment criteria more stringent. Since the closest NSRs are situated at least 3 km away from these sites it unlikely a

change in day or night time noise levels will be detected at these locations. The relatively small impact area is the combined result of the baseline noise levels (already in exceedance of assessment criteria), the design specifications of the facilities (i.e. galvanized steel sheet cladding of building that contains major noise sources), and the absence of permanent NSRs within 2 km radius from site.

To minimize noise generation, it is recommended that:

- equipment vendors must be required to guarantee optimized equipment design noise levels;
- Acoustic attenuation devices should be installed on all ventilation outlet and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device;
- Vibrating equipment must be on vibration isolation mountings;
- Develop a plan to monitor noise levels and respond to complaints and mitigate impacts.

From the above impact modelling outcomes, no resettlement of community for safety reasons is envisaged in the project implementation process. Other negative operation impacts include:

- Accidental chemical spills;
- Operation wastes;
- Impacts on groundwater resources;
- Ground subsidence;
- Impact on Air Quality;
- Operation Noise impacts

Climate Change

Based on the vulnerability analysis conducted by the Bank's Climate Safeguard System, the project has been classified in Category 2 which requires a review of its climate change risks and adaptation measures. Practical risk management and adaptation options shall be integrated into the project design and implementation plans.

7. ENVIRONMENTAL MANAGEMENT PLAN (ESMP)

The ESIA has developed an ESMP to manage the residual environmental and social impacts associated with the project development works following identification and analysis of all the identified potential environmental and social impacts. The ESMP contains mitigation measures developed in line with the hierarchy of mitigation with their associated cost, names of the responsible implementing units/agencies, monitoring regimes for the adopted performance indicators and evaluation to assess both compliance and performance as summarized in Table 7.1 overleaf;

Table 7.1: Environmental and Social Management Plan (ESMP)

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
Construction phase ESMP				
Impact on Flora	<ul style="list-style-type: none"> ○ Any sandal wood identified on site should be marked out and made known to the engineers and contractor; ○ Ensure that construction site is clearly demarcated and there is selective clearing of the vegetation to allow future re-growth and regeneration. This will ensure minimal disruption of wild fauna’s natural movement, territoriality, and other ecological processes; ○ Re-vegetate disturbed areas along roads, pipelines and steam lines and other construction sites. While the invasive <i>Datura stramonium</i> will rapidly colonize the disturbed bare grounds and still act as surrogate habitat for some fauna species, it is still desirable to minimize/discourage its dominance by planting native trees such as <i>Croton megalocarpus</i>-. Additionally, <i>Digitaria</i> sp a native grass commonly growing at the site can be very used in checking soil erosion especially on loose soil dumps or bare slopes created during construction. ○ Create awareness among the local communities and discourage them from engaging in charcoal burning; ○ Monitor regeneration of natural vegetation as well as the appearance/spread of invasive or opportunistic species within the disturbed areas. Monitoring should include spotting and uprooting of unwanted germinating plants. 	Construction site	Contractor QPEA GDC KFS	500,000
Impact on micro fauna	<ul style="list-style-type: none"> ○ Limit speed of construction traffic within the caldera e.g. through erection of bumps and signage; ○ Vehicular disturbances such as hooting should be discouraged accordingly; ○ Incident records (of poaching, accidents and other human wildlife conflicts etc.) should be kept by monitoring and taking of corrective measures; ○ Roads into/out of the Caldera area should be maintained as routes for tourist’s activities and wildlife management; ○ Access for earthmoving machines should be regulated; ○ Ensure that forest rules are enforced within the caldera throughout; ○ Brine ponds should be located close to the source. Distant flow should be piped to prevent animal or vegetation contact; and ○ Monitor wildlife abundance, distribution and movement in relation to this infrastructural development during construction and operation stages to aid in decision making. 	Construction Site Menengai Geothermal Field	Contractor QPEA GDC KWS	500,000
Impact on Avifauna	<ul style="list-style-type: none"> ○ High heat points and emission vents within the project area should be sheltered or fitted with inhibitors to deter birds which may get killed as a result of using such areas ○ High voltage transmission lines should be fitted with wire markers and flappers to alert birds on flight; and ○ Develop and implement an avifauna monitoring scheme, assessing bird population trends and direct hazards relating to the project 	Construction Site Menengai Geothermal Fie	Contractor QPEA, GDC and KETRACO. KWS FOMECC	1,500,000
Impact Herpetofauna and invertebrates	<ul style="list-style-type: none"> ○ Capture any reptiles encountered hiding under rocks and sheltered terrains such as <i>Python sebae</i> and safely release them in suitable habitats; and ○ Re-vegetation of the cleared vegetation. 	Construction Site Menengai Geothermal Field	Contractor QPEA GDC KWS	
Livestock access to brine ponds	<ul style="list-style-type: none"> ○ Fence off any constructed ponds; and ○ Control access to the caldera by herders. 	Menengai Geothermal Field	QPEA; and KFS	
Landscape and visual intrusion	<ul style="list-style-type: none"> ○ Limitation of vegetation clearance and earthworks to construction areas only Implementation of soil conservation measures; 	Construction site	Contractor QPEA	2,000,000

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
impacts	<ul style="list-style-type: none"> ○ Re-vegetation of the cleared vegetation as soon as feasible; ○ The color of structures within the project area should be carefully selected to reduce visual impact. Neutral, non reflective colors blend well with the surrounding landscape. ○ Pipeline coloring should be green or given appropriate color ○ Lighting to be switched off when not required; ○ Lighting of temporary working areas and site compounds during periods of darkness to be minimized where possible; ○ Preparation of a landscaping plan for the entire project area. Planting plan to be comprised of 75% indigenous species and to be rid of any invasive species. ○ Stripped topsoil to be preserved and used during landscaping; and ○ All embankments to be vegetated or stone pitched to prevent soil erosion 	Menengai Geothermal Field	GDC	
Soil Erosion	<ul style="list-style-type: none"> ○ No grey water runoff or uncontrolled discharges from the site/working areas (including wash down areas) to adjacent watercourses and/or water bodies shall be permitted; ○ Water containing pollutants such as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site; ○ Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered; ○ Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted. 	Construction site	Contractor QPEA	1,000,000
Impact on natural sources of construction materials	<ul style="list-style-type: none"> ○ Obtain appropriate authorization including from NEMA and Mines and Geology department to do or use any proposed borrows pits and quarries will be obtained before commencing activities; ○ Any new borrow pits and quarries shall be located more than 100 meters from watercourses in a position that will facilitate the prevention of storm water runoff from the site from entering the watercourse; ○ Notice will be given 14 days to nearby communities of intention to excavate in the borrow pits or quarries; ○ Borrow areas' rehabilitation plans will be prepared prior to use and approved by the local authorities; ○ Storm-water and groundwater controls through appropriate drainage shall be implemented to prevent runoff entering streams and the slumping of soil from hillside above; ○ The use of borrow pits or quarries for material spoil sites must be approved by the local authorities (and/or with the appropriate consent of the "landowner"). Where this occurs, the materials spoiled in the borrow pit shall be profiled to fit into the surrounding landscape covered with topsoil and re-vegetated. and ○ In the event that blasting for rock will be done: <ul style="list-style-type: none"> ✓ A current and valid authorization from the Department of Mines prior to any blasting activity shall be obtained; ✓ A qualified and registered blaster by the Department of Mines and Geology shall supervise all blasting and rock-splitting operations at all times. ✓ The Contractor shall ensure that appropriate pre blast monitoring records are in place (i.e. photographic and inspection records of structures in close proximity to the blast area); ✓ QPEA and the Contractor shall ensure that emergency services are notified, in writing, a minimum of 24 hours prior to any blasting activities commencing on Site; ✓ QPEA and the Contractor shall take necessary precautions to prevent damage to special features and the general environment, which includes the removal of fly-rock. Environmental damage caused by blasting/drilling shall be repaired at the Contractor's expense; 	Quarry site	Contractor	1,000,000

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
	<ul style="list-style-type: none"> ✓ The Contractor shall ensure that adequate notification is provided to the local communities immediately prior to all blasting. It is preferable that warning / informative signage and billboards be erected at the site indicating operation hours as well as commencement and end of operations. All signals shall also be clearly given; ✓ QPEA and the Contractor shall use blast mats for cover material during blasting. Topsoil shall not be used as blast cover. ✓ Precautionary and corrective measures will be taken to avert defacing and deformation of the land features 			
Impact on water resources	<ul style="list-style-type: none"> ○ GDC and the Contractor shall ensure that necessary approvals/permits from the water authorities for the abstraction of water is adhered to; ○ Accidental leakages and bursts of water supply pipelines should be reported and repaired immediately; ○ Recycle water as much as possible should be encouraged for example water used for curing of concrete can be used for spraying dusty roads; ○ Control of the water flows and the water consumption records must be kept and availed to the supervising and QPEA Resident Engineers at the end of working day; ○ All employees should be sensitized on water usage practices like discouraging unnecessary opening of taps; ○ Monitoring of taps and their efficiency should be done regularly; ○ Where feasible, curing of concrete should be done in conservancy tank to avoid wastage; ○ Harvest water during rainfall times to complement other sources; ○ The Contractor will be required to comply with the water quality regulations; ○ No grey water runoff or uncontrolled discharges from the site/working areas (including wash-down areas) to adjacent watercourses and/or water bodies shall be permitted; ○ Water containing pollutants such as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site; ○ The Contractor shall instruct their staff and sub-contractors that they must use toilet provided and not the bush or watercourses; and ○ Continued monitoring of underground water levels. 	Menengai Geothermal Field	WRMA GDC QPEA contractor	
Air Quality and Dust	<ul style="list-style-type: none"> ○ Mobile machinery or vehicle maintenance and services should be undertaken away from project site in a yard set aside for this or by an approved garage or service station to prevent any incident of oil and fuel spills that could contaminate soils and possibly ground water quality. ○ All construction machinery shall be maintained and serviced in accordance with the manufactures specifications; ○ Workers shall be trained / sensitized on dust minimization techniques and management of air pollution from vehicles and machinery; ○ The removal of vegetation shall be avoided until such time as clearance is required and exposed surfaces shall be re-vegetated or stabilized as soon as practically feasible; ○ Frequent watering of exposed surfaces and piles of soil to prevent airborne dust emissions; ○ All vehicles accessing the site shall observe low speed limits; ○ Minimize vehicles idling time; ○ Incorporate dust/fumes arrestors in the batching plant e.g. use of dust nets ○ Provision of appropriate protective personal equipment including respirators and aprons to affected personnel. 	Construction site	Contractor QPEA	1,000,000

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
Solid waste	<ul style="list-style-type: none"> ○ Apply the 3R (Reduce, Reuse and Recycle) principles. Diligence on the part of the Contractors during construction activities will minimize the amount of debris, and also will ensure that debris is disposed of in a sensible manner, at a specified and approved dump site; ○ The tender documents should specify the proper disposal of waste during construction; ○ The tender documents should also ensure that the contractor leaves the site in a clean condition on completion of works. The Contractors should be required to restore and landscape all areas to the satisfaction of the GDC and QPEA. ○ All solid waste generated during construction should be carefully monitored, collected, stored, and taken out of the crater for final disposal. ○ The development and rehabilitation of spoil areas shall include the following activities: ○ Stripping and stockpiling of topsoil; ○ Removal (to a nominal depth of 500mm) and stockpiling of subsoil; ○ Placement of spoil material; ○ Contouring of spoil site to approximate natural topography and drainage and/or reduce erosion impacts on the site; ○ Placement of excavated subsoil and then topsoil over spoil material; ○ Contouring and re-vegetation; ○ The Contractor shall ensure that the placement of spoil is done in such a manner to minimize the spread of materials and the impact on surrounding vegetation and that no materials ‘creep’ into ‘no-go’ areas. 	Construction site	Contractor QPEA	750,000
Increase in the amount and tonnage of traffic	<ul style="list-style-type: none"> ○ Upgrading of existing roads where necessary to take care of the new traffic; ○ Erection of proper signage along all roads exploited for the construction process especially on approaches to blind corners and in populated areas ; ○ Construct speed bumps along Bahati entrance road and the roads within the caldera; ○ Sensitization and training of construction drivers; ○ Monitoring, enforcement and disciplinary action of offenders. ○ Use of escort and chase vehicles where necessary. 	Construction site	Contractor QPEA	800,000
Occupational and public health and safety	<ul style="list-style-type: none"> ○ QPEA should establish an Environment, Safety and Health department with qualified personnel to oversee environmental and safety management throughout its operations; ○ Contractor must develop Construction Safety and Health Policy in compliance with OSHA, and international best practice e.g. IFCs Environmental, Health and Safety Guidelines; ○ Undertake comprehensive assessment for PPE requirements, provide and enforce use of all ranges of required PPEs; ○ Contractors to establish a comprehensive Health and Safety Policy which should be in compliance with GDC’s Occupation Health and Safety Policy and be approved by Environment, Health and Occupation Manager from GDC; ○ Ensure compliance with all standards and legally required health and safety regulations in line with OSHA; ○ Include standard best practice health and safety provisions in the construction contract. The provisions should include insurance to enable the contractor to pay for any and all treatments required by his workers including those of all sub-contractors, together with any subsequent lifelong disability payments in line with WIBA; ○ Employ a full time qualified Health and safety Officer; ○ Include a specific and independent task in the supervision contract concerning H&S supervision and compliance, together with the staff resources to carry this out; 	Construction site Menengai Geothermal Field	Contractor QPEA	

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
	<ul style="list-style-type: none"> ○ Establish and enforce a strict code of conduct for all project drivers including outside suppliers delivering materials. The code should focus on safety, especially speed, and loading, especially banning all carriage of staff, workers and passengers except in seats; ○ Implement the specified H&S programme throughout the construction period. This should incorporate but not limited to: <ul style="list-style-type: none"> ✓ An emergency response procedure and display on all work areas. This is likely to require one vehicle on site equipped as an ambulance and a paramedic on site at all times during construction activities; ✓ Provision of a standard first aid kit at the site office at all times; ✓ Provision of fire-fighting equipment available at the workers camp; ✓ Provision of medical facilities for staff; ✓ Installation of appropriate safety signage for all work sites; ✓ Registration of the work place; ✓ Maintain an accident register; ✓ Carry out accident and incidents investigations and implement corrective actions; ✓ Establishment of Occupational Health and Safety Committee; ✓ Staff and visitor induction; ✓ Toolbox and monthly safety meetings; ✓ Routine inspections. 			
HIV/AIDs and STIs	<ul style="list-style-type: none"> ○ Education and sensitization of workers and the local communities on HIV/AIDs and STIs in conjunction with Rongai and Nakuru North Sub-County Public Health Officers; ○ Provision of condoms to the construction workers, project team and the public. This should be kept in places that are not locked and are accessible to the above persons; ○ Where possible conduct regular sensitization campaigns and monitoring and evaluation of the modes used during course of the project; ○ Formation of peer groups from among the project staff to ensure continuity in training and awareness raising; ○ The contractor has to institute HIV/AIDS awareness and prevention campaign amongst workers for the duration of the contract e.g. erect and maintain HIV/AIDS information posters at prominent locations as specified by the Resident Engineer in consultation with the GDC Community Liaison Office; ○ The contractor has to ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases; and ○ The contractor should ensure that the project workers are sensitized on the local culture. 	Construction site	Contractor QPEA PHO (Rongai and Nakuru North)	3,000,000
Contractor's camp	<ul style="list-style-type: none"> ○ Any contractor's camp should have a comprehensive waste management and sanitation plan and facilities commensurate with population of workers and activities in the camps; ○ Any storage tanks and equipment should have correct labels and Material Safety Data Sheets; Adequate Emergency Response Plan should be in place in the camps; ○ The contractor should employ best practice management "housekeeping" (site cleanliness, waste disposal etc.) at all times; and ○ The contractor's facilities should be completely removed from site after use and the land restored to its previous condition or better. 	Contractor's camp	Contractor QPEA GT Menengai Ltd	

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
Risk of wild fires	<ul style="list-style-type: none"> ○ Include an adequate fire buffer zone around the proposed power plant construction site. This could be open bare ground/un-vegetated areas and planting fire resistant trees e.g. Mexican green ash (Fraxinus sp) around the plant should be maintained throughout during the construction and the operation period; and ○ Liaise with the Menengai KFS office to sensitize construction and operation staff on wildfires and train on emergency responses. 	Construction site Menengai Geothermal Field	Contractor QPEA GDC KFS	
Impact of fuel and chemical storage on site	<ul style="list-style-type: none"> ○ ensure that the employees on site are aware of the company procedures for dealing with spills and leaks from oil storage tanks for the construction machinery through induction and safety training; ○ In case of spillage, isolate the source of oil spill and contain the spillage using sandbags, sawdust, absorbent material and/or other materials approved by NEMA; ○ ensure that there is always a supply of absorbent material such as saw dust on site during construction, readily available to absorb/breakdown spill from machinery or oil storage; ○ All vehicles and equipment should be kept in good working order, serviced regularly and stored in an area approved site by GDC and QPEA; ○ Ensure that filling areas, Oil storage drums / products storage areas have a smooth impermeable (concrete or thick plastic covered in gravel) floor. The floor should be bunded and sloped towards a sump to contain any spillages of substances in accordance with The Kenya Bureau of Standards (KEBS) KS 1969: 2006 The Petroleum Industry -The installation of underground storage tanks, pumps/dispensers and pipe work at service stations and consumer installations - Code of Practice. 	Construction site	Contractor QPEA	
Chance encounter and interference with buried archaeological artefacts.	<ul style="list-style-type: none"> ○ Retain an archaeologist from NMK on site during earthworks; ○ Notify NMK if any artefacts or bones are uncovered in the course of excavations in accordance with the National Museums of Kenya Chance Finds Procedure (Appendix VIII); and ○ Implement to the chance find procedure. 	Construction site	Contractor QPEA NMK	
Operation Phase of the ESMP				
Impact on flora	<ul style="list-style-type: none"> ○ Monitor invasive plant species at the project area and uproot unwanted germinating plants; ○ Assess concentration geothermal gaseous effluents such as H₂S, SO₂, NH₃ and CO₂ (e.g. by use of automatic sensors) and continually test for any evidence of acid rain; ○ Plant soil-erosion preventing grass species such as Cynodon dactylon, Digitaria abyssinica, Pennisetum clandestinum and Hyparrhenia sp at bare sloppy grounds or loose soil dumps; ○ Steam pipe insulations should have a well camouflaged colours that are maintained so that animals don't perceive pipelines as barriers ○ Brine flows and ponds should be located close to the source. Distant flow should be transmitted through closed pipes ○ Rehabilitate disturbed areas along roads, pipelines and abandoned campsites etc by planting native plant species such as Acacia meurnsii, Psidium guajava and A. melanoxylon– this should be done as soon as practicable to avoid colonization by invasive and opportunistic pioneer species; ○ Create awareness among the local communities on the importance of vegetation cover and discourage them from engaging in charcoal burning. 	Power Plant Site Menengai Geothermal Field	QPEA GT Menengai Ltd GDC KFS	
Impact on macro fauna	<ul style="list-style-type: none"> ○ Vehicular disturbances such as hooting should be discouraged accordingly; 	Power Plant Site	GDC QPEA	

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
	<ul style="list-style-type: none"> ○ Incident records (of poaching, accidents and other human wildlife conflicts etc) should be kept by monitoring and taking of corrective measures; ○ Ensure enforcement of forest rules within the caldera; ○ Brine ponds should be located close to the source and fenced. Distant flow should be piped to prevent animal or vegetation contact; ○ Monitor wildlife abundance, distribution and movement in relation to this infrastructural development during construction and operation stages to aid in decision making; and ○ Erect speed bumps in wildlife crossing zones should these be established from monitoring activities. 	Menengai Geothermal Field	KWS KFS	
Impact on Avifauna	<ul style="list-style-type: none"> ○ High heat points and emission vents like NCGS stack should be sheltered or fitted with inhibitors to deter birds from perching or hovering around; ○ Develop and implement an avifauna monitoring scheme, assessing bird population trends and direct hazards relating to the project; and ○ High voltage transmission lines should be fitted with wire markers and flappers to alert any birds on flight. 	Power Plant Site Menengai Geothermal Field	GDC Contractor QPEA KETRACO	
Impact on Herpetofauna	<ul style="list-style-type: none"> ○ Water and steam pipe lines should be laid across (perpendicular to) the valleys rather than running along them – as this will mean destroying large patch of this ecologically sensitive keystone habitat for many species; ○ re-vegetate disturbed areas along roads, pipelines and steam lines and other construction sites; and ○ Create awareness among the local communities and discourage them from engaging in charcoal burning which is evidently on the increase in this area. 	Power Plant Site Menengai Geothermal Field	GDC Contractor QPEA KFS	
Operation solid wastes	<ul style="list-style-type: none"> ○ Use integrated solid waste management system i.e. source reduction; reuse; and recycling; ○ Donate any recyclable materials to local community groups, institutions and individuals; ○ Provide segregated waste respectable/bins within the plan premises and create awareness among staff on usage; ○ Dispose waste responsibly through a licensed waste handler for final disposal at designates sites; ○ Ensure compliance with waste management regulations 	Power Plant Site Menengai Geothermal Field	GDC Contractor QPEA Nakuru County Government	
Operation liquid wastes	<ul style="list-style-type: none"> ○ Domestic waste water and sewer from septic tanks should be disposed through NEMA- licensed exhaust service providers; ○ Brine ponds should be sited close to the source; ○ Any brine ponds constructed should be lined with durable impervious materials of suitable quality and protected from any form of vandalism; ○ Brine re-injection through re-injection wells into underground reservoir; ○ Chemical composition and parameters of the brine should be regularly monitored. 	Power Plant Site Menengai Geothermal Field	GDC Contractor QPEA Nakuru County Government	
Fire risk	<ul style="list-style-type: none"> ○ A fire protection system of fire water tanks, fire extinguishers, fire hydrants, hose reels, fire alarms and sprinklers; ○ Formulate a fire emergency response plan; ○ Ensure no smoking signage is put up in the necessary areas; ○ Train some staff to be fire marshals; and ○ Carry out fire drills -Inspect firefighting equipment 	Power Plant Site	Contractor QPEA Nakuru County Government	
Accidental Oil spill/Hazardous pollution	<ul style="list-style-type: none"> ○ Spill and drip trays used during servicing of machinery; ○ Use septic tanks while ensuring doesn't flow to the surface; ○ Response plans for accidental spills to be formulated and routinely tested; ○ Bunded storage areas and secondary containment for oil and chemicals; ○ Use of an oil interceptor in the plant; 	Power Plant Site	Contractor QPEA Nakuru County Government	

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
	<ul style="list-style-type: none"> ○ Place hazardous materials up to 2 kilometres away from the public water supply reservoirs such as in OI banita groundwater reservoirs. Also avoid placing within flood levels; ○ Storage of fuel and other flammable materials shall comply with standard fire safety regulations; ○ A secured compound shall be provided for storage tanks for chemicals and fuel. All chemicals and fuels shall be stored with manufacturer's instructions in mind as per the material safety data sheets; ○ Storage areas or secondary containment shall be constructed of waterproof reinforced concrete or approved equivalent, which is not adversely affected by contact with chemicals captured within them; ○ The minimum volume for secondary containment shall be 110% of the capacity of the largest tank system, plus 10% of the total capacity of all other separate tanks and containers within the bund wall with closed valves for controlled draining during rains; ○ Pipe-work carrying product from the tank to facilities outside the containment shall be provided with secondary containment; ○ Tank equipment such as dispensing hoses, valves, meters, pumps, and gauges shall be located within the containment or provided with own containment. 			
Occupational safety and health	<ul style="list-style-type: none"> ○ Formulate a plant occupational safety and health management plan. The plan as a minimum MUST have and require: ○ Compliance with GDC Health, Safety and Environment policy; ○ Compliance with OSHA, 2007; ○ Continuous H2S monitoring within the plant premises; ○ Equipping employees with necessary Personal Protective Equipment (PPE) including personal H2S monitors for workers in exposed environments; ○ Regular and induction training, of members of the safety committee and new staff respectively on First Aid; ○ Ensure the plant and office blocks have adequate supply of First Aid Kits; ○ Location of appropriate safety and warning signs around the plant; ○ Inspections on conditions of machinery and equipment -Register the plant as a workplace with DOSH; ○ Medical examination of all employees before, during and after termination of employment; ○ Detailed emergency response plan; ○ Provision and display of relevant emergency contacts; and ○ Regular independent Occupational Health and Safety audits. 	Power Plant Site	Contractor QPEA	
Potential thermal pollution of groundwater resources	<ul style="list-style-type: none"> ○ Undertake joint studies to investigate possibility of thermal contamination of underground water aquifers within the area with geothermal steam production wells and institute appropriate mitigations where necessary 	Power Plant Site	GDC, NAWASCO and WRMA	
Air quality	<ul style="list-style-type: none"> ○ Re-injection of gases with geothermal fluids. Re-injection of geothermal fluids has already been proposed in the plant design; ○ Adopt air quality management plan incorporating: <ul style="list-style-type: none"> ✓ Installation of H2S monitors and daily monitoring of H2S with alarm system within the Plant boundaries and other active activity sites within the caldera; ✓ Training of all workers on the dangers exposure to H2S; ○ Use of personal monitors by staff in potentially more dangerous areas; and Liaison strategy for communication with communities who may be affected by odour nuisance 	Power Plant Site Menengai Geothermal Field and All identified AQSR	GDC QPEA Nakuru County Government	

Environmental and Social Aspects	Recommended mitigation and/ or management measure	Location	Responsibility for Implementation	Cost (KES)
Cumulative Noise impacts	<ul style="list-style-type: none"> ○ Require plant equipment vendors to guarantee optimized equipment design noise levels; ○ Install acoustic attenuation devices on all ventilation outlet and high pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device; ○ Ensure plant vibrating equipment are on vibration isolation mountings; ○ Ensure all exposed staff have and use noise protection equipment e.g. ear plugs; ○ Regularly monitor noise levels due to the plant and keep records; and ○ Develop a liaison strategy for communication with communities who may be affected by cumulative noise nuisance. 	Power Plant Site Menengai Geothermal Field and All identified NSRs	GDC QPEA Nakuru County Government	
Decommissioning Phase				
Occupational safety and health	<ul style="list-style-type: none"> ○ Make the site safe by ensuring all electrical connections and supplies are disconnected and any dangerous chemical stores are identified and made safe ○ Comply to the OSHA; ○ Provide for appropriate signage and warnings; ○ Any closed vessels, pipes and other areas which could have hazardous gases present would be vented in accordance with normal operating procedures. These would then be tested to ensure that they are safe for entry or removal; ○ Provide for First Aid facilities for staff as per the OSHA, 2007; ○ Monitor H2S levels during demolition works; ○ Maintain appropriate and serviceable firefighting equipment on site; ○ Designate an emergency assembly point within the plant and create general awareness on use for all staff; ○ Provide and clearly display emergency contacts; and ○ Develop a detailed and demolition-specific Emergency Response Plan 		QPEA KETRACO and KPLC QPEA and Contractor	1,500,000
Redundant plant equipment and recyclable wastes	<ul style="list-style-type: none"> ○ Careful removal and sale/recycling of plant and materials including 	Power Plant Site	QPEA	
Non-recyclable demolition waste	<ul style="list-style-type: none"> ○ Ensure demolition wastes are segregated on site; ○ Disposal of waste materials by appropriate methods in accordance with ○ waste management regulations; ○ Procure services of licensed waste handlers for safe disposal of both ○ hazardous and non-hazardous wastes; and ○ No burning of any wastes should be done on site. 	Power Plant Site	QPEA	3,000,000
Re-instatement of biophysical environment	<ul style="list-style-type: none"> ○ Landscape of the power plant site with suitable mix of indigenous species. This should be done in liaison with the; and ○ Ensure landscaped species are established prior to final close out of the site 	Power Plant Site	QPEA and KFS	2,500,000

8. ENVIRONMENTAL AND SOCIAL MONITORING PROGRAM

The Environmental and Social Management Plan will be subject to monitoring. The monitoring plan is complementary to the audits, inspections and reporting activities defined in the framework for implementation of the ESMP as summarized in Table 8.1 below. The Table lists the related indicators, the items to be measured, the measurement frequency and the person/institution responsible and monitoring cost estimate.

Table 8.1

Project Activity/Aspect	Parameter	Indicator	Institutional Responsibilities Monitoring Responsibility	frequency	Project Phase	Monitoring Cost Estimates (KES)
Impact on Flora (vegetation loss)	Visual inspection	Bare soil; Soil erosion.	Contractor QPEA Health Safety and Environment officer	Daily	Construction	To be included in Supervision scope and Costs
Air Emissions and Air Quality Dust	TSP, SO ₂ , CO, H ₂ S, CO ₂ , CH ₄ Dust fallout	Bad odour; • Use of PPE; • H&S Plan in use; • Record of Induction for Workers • Active dust suppression	Contractor QPEA's Senior Management QPEA Health Safety and Environment officer NEMA	Daily	Construction and operation	To be included in Supervision scope and Costs
Worker and Public Safety	Visual inspection Incident and accident records	• Induction training • Safe working procedures • Shoring & appropriate precautions in place	Contractor and Sub contractors QPEA Health Safety and Environment officer	Daily	Construction	To be included in Supervision scope and Costs
Occupational Safety and Health	Health and Safety records Visual inspection	OHS Management system • Active and passive monitoring • Excellent workplace safety culture • Risk management	Contractor QPEA's Senior Management QPEA Health Safety and Environment officer	Daily	Operation	To be included in Supervision scope and Costs
Protection of Ground Water Resources		• Re-injection of steam. • Incorporation in the Design;	WRMA GDC	Bi-monthly	Operation	To be included in Supervision scope and Costs
Storage of hazardous materials and chemicals	Spillages Visual inspection	• MSDS for all store Chemicals • Functioning storage containers • Chemical usage records	Contractor QPEA Health Safety and Environment officer	Monthly Audit Review	Construction	To be included in Supervision scope and Costs
Traffic concerns	Visual inspection	• Prepare and implement Traffic Management Plan • Bank's men shall be used to direct vehicle traffic around construction sites and hazards during working hours (Health and Safety Plan) • Plan approved by Project Manager • Barriers and signage.	Contractor Project Manager/Supervising Engineer	Daily		To be included in Supervision scope and Costs
Public Awareness and Community Perceptions		• Grievance management records • Evidence of Occurrence – Event Report	QPEA Project Management/Supervising Team	monthly	Construction and operation	To be included in Supervision scope and Costs
Noise	dB(A)	• Measure included in Design and Procurement plans • Hearing Protection and PPE in use • Record of Plant equipment maintenance	Contractor QPEA GT Menengai HSE officer	Daily	Construction and operation	To be included in Supervision scope and Costs
Soil Erosion	Visual inspection	• Bare soil; • Soil pillars; • Cracks across the slope • Sediment fans	Contractor QPEA GT Menengai HSE officer	Weekly	Construction	To be included in Supervision scope and Costs

Solid waste management	Slag, domestic refuse, metallic scraps, sludge	<ul style="list-style-type: none"> • Documented Approvals for placement of wastes; • Comprehensive waste management plan 	Contractor QPEA GT Menengai HSE officer	Daily	Construction	To be included in Supervision scope and Costs
Water Quality (both surface and underground)	pH, BOD, Temperature, COD, Turbidity, Conductivity, Dissolved Oxygen, Nitrates	<ul style="list-style-type: none"> • Monitoring report; • Water quality report. 	GDC QPEA GT Menengai Ltd	monthly	operation	To be included in Supervision scope and Costs

The National Environment Management Authority (NEMA) Kenya is also mandated to conduct independent monitoring of all projects based on the approval conditions for the ESIA, while the Bank will conduct bi-annual supervision mission to monitor compliance to the ESMP requirements.

8.1 ESMP Implementation Arrangement and Training and Capacity Development

The following entities should be involved in the implementation of this ESMP as detailed out in the ESMP and ESMP Monitoring Tables above;

- QPEA Senior Management;
- Project Manager;
- Contractor and Subcontractors;
- Environment, Safety and Health Department;
- NEMA;
- Project Consultant; and
- Nakuru County Government.

The Project shall undertake internal training and education activities to ensure that Project expectations regarding environmental and social performance are achieved and maintain an ESMP training matrix as follows;

ESMP Induction Training and Awareness: this training should be for visitors or individuals who do not have direct roles or responsibilities for implementing the ESMP, and should cover basic Project environmental and social commitments.

ESMP Management Training and Awareness: this training focuses attention on management, covering key aspects of the ESMP and providing an overview of the Project’s environmental and social impact management expectations and the supporting processes and procedures prescribed in the ESMS to meet performance expectations.

ESMP Job-specific Training and Awareness: job-specific training should be provided to all personnel who have direct roles and responsibilities for implementing or managing components of the ESMP. This training should also include all people whose specific work activities may have an environmental or social impact.

Onsite, these provisions and responsibilities should apply to all contractors and subcontractors. Those responsible for performing site inspections should receive training by drawing on external resources as necessary. Upon completion of training and once deemed competent by management, staff will be ready to train other people. The Project will require each contractor to institute training programmes for their personnel. All contractors and their

Estimated Budget for ESMP Implementation

To effectively implement the mitigation and monitoring measures recommended in the ESMP, a total estimated cost of **KES 19,500,000** has been budget exclusive of additional budget to be included within the Contractors costs for supervision. The cost of mitigation by the EPC Contractor shall be included in the contract as part of the project implementation cost.

9. PUBLIC CONSULTATION AND DISCLOSURE

Public participation formed an integral part of the full ESIA process and the consultation of Interested and Affected parties (I&AP's) is key to ensuring adherence to the legal requirements. A total of eight (8) public meetings were organized in the sub locations neighbouring the project area. The schedule of the meetings held is as shown in Table 9.1 below.

Table 9.1 Types of Stakeholder consultations held with key I&Aps

Rongai Sub County				
No	Sub Location	Date	Time	Venue
1	Kampi ya Moto	Thursday, 30th October, 2014	10.55 AM	GDC Kabarak Farm
Nakuru North Sub County				
2.	Kirima	Monday, 3rd November, 2014	11.30 AM	Full Gospel Church
3.	Ndungiri	Monday, 3rd November, 2014	12.15 PM	Ndungiri Cattle Dip
4.	Oi Banita	Monday, 3rd November, 2014	3.05 PM	Full Gospel Church
5.	Wanyororo	Wednesday, 5th November, 2014	11.30 AM	Wanyoro Trading Center
6.	Menengai	Thursday, 6th November, 2014	11.40 AM	Menengai Trading Center
7.	Mwaki Mugi	Friday, 7th November, 2014	11.12 AM	Kabatini Chief's Office
8.	Mutukania/Landi Mawe/Karonga	Tuesday, 11th November, 2014	11.30 AM	Rehema Church Ahero

The stakeholders were informed about the proposed project and the intention of the proponent to carry out an ESIA to ensure the environmental and socio-economic sustainability of the proposed project and to identify major issues of concerns from stakeholders. The main concerns raised by the communities during the stakeholder meetings included *provision for jobs especially for the youth and women, payment of compensation for affected families for the T-line, provision of water supply and education facilities and grading of access roads.*

GDC has already started addressing and managing some of the identified concerns from the surrounding communities and other stakeholders as part of the broader initiatives of the Geothermal Development Programme within the Region. GDC has developed a robust and well-resourced Stakeholder Engagement Plan (SEP) with community liaison officers acting as interface for information flow between the communities and GDC. Following implementation of the SEP, the needs of the communities have been identified and access to water, education and health facilities are reported to have already been provided. This SEP will be sustained by QPEA GT through the development of a project specific SEP prior to commencement of construction works.

Grievance Redress Mechanism

GDC has developed a Grievance Redress Mechanism (GRM) to address concerns from any affected communities from the ongoing geothermal development programme. This GRM has been very successful in addressing the concerns of the affected communities and/or interested parties since commencement of the geothermal development studies. This GRM will be sustained and enhanced by QPEA GT through the development of a project specific GRM

incorporating the existing arrangements of the GDC GRM prior to the commencement of any construction activities on site.

10. CONCLUSION

This ESIA Summary report responds to the environmental assessment requirements of NEMA and the African Development Bank's Integrated Safeguard System. Most of the anticipated adverse impacts associated with the project can be readily managed to acceptable levels with implementation of the recommended mitigation measures within the ESMP. There is no land take up for the development of the power plant or resettlement of community for safety reasons is envisaged in the project implementation process. Furthermore, the requisite conditions for most of the mitigation measures have been incorporated by QPEA on project design documents reviewed by the Bank.

In general, the proposed project will result in appreciable benefits to the country power production and create opportunities for both social and economic development. The project is already licensed by NEMA and QPEA has received a no objection letter from the National Museums of Kenya (NMK).

Public consultations revealed that the local communities have high socioeconomic interests and a lot of expectations with the geothermal power development activities going on within the Menengai caldera. It is recommended that QPEA develop and implement a community liaison strategy with proper communication and feedback mechanism; and a clear and transparent employment policy to manage the local community expectations

The project construction and operation activities are not expected to strain existing water supplies by NAWASCO. However, consultations with the regional office of Water Resources Management Authority and NAWASCO pointed out that since geothermal wells in the Menengai caldera were commissioned, the water temperature from the Ol Banita boreholes near the caldera have been recording increased temperatures. This has impacted on operation and maintenance cost of the bulk water service providers and complaints from water consumers. It is notable that underground water is the main water supply to the locals and the nearby Nakuru Town. *It is therefore recommended that GDC, NAWASCO and the water resources management authority undertake joint studies to investigate possibility of thermal contamination of underground water aquifers within the area with geothermal steam production and institute appropriate mitigations where necessary.*

Furthermore, the following are recommended:

- *QPEA management should establish an Environment, Safety and Health department with suitably qualified staff in the field of environment, social and occupational safety and health management. The department will work in liaison with GDC, QPEA contractors and relevant government lead agencies to ensure sound environmental and social performance;*
- *Ensure implementation of NMK chance find procedure during construction phase;*
- *In liaison with GDC Ensure that community expectations are managed through well-structured community SEP built upon the existing GDC SEP.*
- *Ensure compliance with NEMA approval conditions throughout the project phases; and*
- *Ensure compliance with the MOU of the KFS throughout the phases of the project.*
- *QPEA GT will develop an Environmental and Social Management System (ESMS) to mainstream the implementation of all the designed ESMP and other day-to-day operational aspects of its activities on the power development project.*

REFERENCES AND CONTACTS

1. *Updated Environmental and Social Impact Assessment Report for the Development of 1X 35 MW Geothermal Power Plant in Menengai* by GIBBS International Consulting, February 2015
2. *Environmental and Social Review of Facilities Relating to Quantum Power East Africa GT Menengai Limited's 1 x 35MW Geothermal Power Plant in Menengai, Nakuru County, Kenya*, ERM dated March 2015.
3. *QPEA - GT 35MW Geothermal Power Plant ESIA Licence*, 28th November 2012.
4. *Title Deed - IR No 119315 / LR No 12228*, November 2011
5. *QPEA Gt Menengai Limited Initialled PPA approval by ERC updated*, 26th June 2014
6. *Noise Monitoring In Settlement Areas Outside Menengai*, 2013
7. *Technical Review Of GDC ESIA Report*, by GIBB Africa December 2013
8. *GDC ESIA Information - 90 MW ESIA Menengai Upgrade Study report*, September 2013
9. *GDC ESIA Information – Environmental Policy*, October 2012
10. *GDC ESIA Information – NEMA Certificate and Licence*, November 2012
11. *GDC ESIA Information – Policy Statement*
12. *GDC ESIA Information – HSE Policy*, Feb 2011
13. *Noise Impact Assessment for the Proposed Menengai Geothermal Power Plant in Kenya*, February 2015

For more information, please contact:

For AfDB

- Felix Oku, Senior Environmentalist: f.oku@afdb.org
- Alli Mukasa Senior Investment Officer: a.mukasa@afdb.org

Annex I: Site Location map of OPEA Project.

