Contents

13 Environment and Social Impact Assessment (ESIA)

A number of ecological, social and cultural issues associated with the proposed development have been identified by the Firm of Experts and specialists. The impacts identified in Section 13.1 cover all project phases, that is, construction, operations and decommissioning.

Each impact identified is evaluated using a risk ranking criteria before any mitigation measures and after applying appropriate mitigation measures. In instances where impacts were not considered significant by the specialists, an assessment table has not been included.

To facilitate cross referencing, impact identification numbers have been used in the environment impact assessment and the EMP.

13.1 List of potential impacts

- GS: Geology and soils
  - GS1: Extraction of natural resources for construction
  - GS2: Soil erosion
- SW: Surface water
  - SW1: Impact on water quality
- GW: Groundwater
  - GW1: Pollution of groundwater
- S: Soils
  - S1: Contamination of soils
- E: Ecology
  - E1: Impacts on terrestrial ecology
- AQ: Air quality
  - AQ1: Decreased air quality due to dust and VOC emissions
  - AQ2: Decreased air quality due to stack emissions
- W: Waste
  - W1: Pollution from waste generation
- N: Noise and vibration
  - N1: Noise during construction and commissioning
  - N2: Noise during operation
  - N3: Noise during decommissioning
- V: Visual Impacts
  - V1: Impacts on visual landscape

- M: Macroeconomic
  - M1: National economic development
  - M2: Stability of electric power supply
- SE: Socioeconomic
  - SE1: Compatibility with existing and proposed land uses
  - SE2: Increased crime
  - SE3: Creation of employment opportunities
  - SE4: Increased risk of communicable diseases
  - SE5: Social divisions over limited jobs
  - SE6: Accidents as a result of increased traffic
- T: Traffic
  - T1: Damage to roads and other infrastructure
  - T2: Increased traffic and road safety hazard
- HS: Health and safety
  - HS1: Occupational health and safety
- C: Cumulative impacts
  - C1: Economic development
  - C2: Transport

13.2 ESIA assessment methodology

The potential impacts associated with the proposed development have been assessed using the criteria given below.

Figure 13 1: Environmental Risk Assessment Criteria

Figure 13-1: Criteria for assessing significance of impacts

CONSEQUENCE

Magnitude of impact	Rating
Negligible	1
Minor	2
Marginal	3
Significant	4
Catastrophic	5

Geographic Extent of impact	Rating
Activity specific	1
Project specific	2
Local area	3
Regional	4
National	5

Impact duration	Rating
<1 month	1
1 - 12 months	2
13 - 36 months	3
37 - 72 months	4
>72 months	5

LIKELIHOOD

Frequency of activity	Rating
Annually or less	1
6 monthly/temporary	2
Monthly/infrequent	3
Weekly/life of the operation	4
Daily/permanent	5

Frequency of impact	Rating
Almost impossible	1
Highly unlikely	2
Unlikely	3
Possible	4
Definite	5

Definitions	
Activity:	Distinct process or task undertaken by an organization for which a responsibility can be assigned
Frequency of activity:	Refers to how often the proposed activity will take place
Frequency of impact:	Refers to the frequency with which a stressor (aspect) will impact on the receptor
Magnitude of impact:	Refers to the degree of change to the receptor status in terms of reversibility of the impact
Geographic extent of impact:	Refers to the geographical scale of the impact
Impact duration:	Refers to the length of time over which the stressor will cause a change in the resource or receptor

Figure 13-2: Significance ranking matrix

SIGNIFICANCE

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Magnitude+Geographic Extent+Duration of impact)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

POSITIVE/NEGATIVE MITIGATION RATINGS

Significance Rating	Value	Negative impact management recommendation	Positive impact management recommendation
Very High	126-150	Propose mitigation measures	Maintain current management
High	101-125	Propose mitigation measures	Maintain current management
Medium - High	76-100	Propose mitigation measures	Maintain current management
Low - Medium	51-75	Maintain current management	Propose mitigation measures
Low	26-50	Maintain current management	Propose mitigation measures
Very Low	1-25	Maintain current management	Propose mitigation measures

13.3 Subjectivity in assigning significance

Despite attempts at providing a completely objective and impartial assessment of the environmental implications of development activities, EIA processes can never escape the subjectivity inherent in attempting to define significance. The determination of the significance of an impact depends on both the context (spatial scale and temporal duration) and intensity of that impact. Since the rationalization of context and intensity will ultimately be prejudiced by the observer, there can be no wholly objective measure by which to judge the components of significance, let alone how they are integrated into a single comparable measure.

This notwithstanding, in order to facilitate informed decision-making, EIAs must endeavor to come to terms with the significance of the potential environmental impacts associated with particular development activities. Recognizing this, the Firm of Experts and specialists have attempted to address potential subjectivity in the current EIA process as follows:

- Being explicit about the difficulty of being completely objective in the determination of significance, as outlined above;
- Developing an explicit methodology for assigning significance to impacts and outlining this methodology in detail in this ESIA Study. Having an explicit methodology not only forces the assessor to come to terms with the various facets contributing towards the determination of significance, thereby avoiding arbitrary assignment, but also provides the reader of the ESIA with a clear summary of how the assessor derived the assigned significance;
- Wherever possible, differentiating between the likely significance of potential environmental impacts as experienced by the various affected parties; and
- Utilizing a team approach and internal review of the assessment to facilitate a more rigorous and defendable system.

Although these measures may not totally eliminate subjectivity, they provide an explicit context within which to review the assessment of impacts.

13.4 Assessment of impacts

The key impacts identified by the Firm of Experts are highlighted in this section, according to the relevant project phases. Design and planning issues have informed the mitigation measures which are presented for the construction, operations and decommissioning phases respectively.

In applying the impact assessment methodology the Firm of Experts used the precautionary principle to establish significance of impacts and their management and mitigation that is, where there is uncertainty or insufficient information, the Firm of Experts erred on the side of caution.

13.4.1 Geology and Soils (GS)

Extraction of natural resources for construction (GS1)

The power plant will require raw materials such as back fill (murram and hard-core), sand and aggregate for construction purposes. Such raw materials will be sourced from local quarries and river beds where they are found. Natural resource depletion may occur if not rationally done through activities such as burrowing and quarrying for construction materials.

Materials sites (quarry and burrow areas) if not reinstated and rehabilitated after natural resource extraction may cause landscape scarring, dangers of overhanging cliffs and falling rocks which creates environmental, health and safety hazards, stagnant water which small children could utilize for swimming purposes.

During the construction phase there is a potential for siltation of the Stony Athi River especially if the site is excavated during the rainy season and proper drainage mechanisms are not implemented.

Construction phase

Unmitigated Impact: Extraction of natural resources for construction	
Magnitude of impact	3
Geographic extent	4
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low-medium (-63)***
Comment/mitigation	
All burrow pit sites shall be clearly indicated on a plan and approved by the local authority; appropriate authorization to use the proposed burrows pits and quarries will be obtained before commencing activities; Burrow 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; Burrow rehabilitation plans, will be prepared prior to use and approved by the local authorities; Storm-water and groundwater controls shall be implemented to prevent runoff entering streams and the slumping of soil from hillside above; The use of burrow 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 and covered with topsoil.	
Mitigated Impact: Extraction of natural resources for construction	
Magnitude of impact	2
Geographic extent	4
Duration of impact	2
Frequency of activity	2
Frequency of impact	2
Result	***Low (-32)***

Soil erosion due to excavation (GS2)

The top soils at the proposed power plant are generally loose clays and held by the natural vegetation. During excavation, top soils will be removed and carted away to approved local authority dump sites.

The excavations and earthworks will lead to the removal of top soil which could end up weakening the soil profile and therefore leading to the soil erosion during construction phase.

Construction phase

Unmitigated Impact: Soil erosion due to excavation	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (-30)***
Comment/mitigation	
During construction, earthworks should be controlled so that land which is not required for construction is not disturbed. Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain. Excavated materials and excess earth will be kept at appropriate sites approved by the supervising engineer. Wherever possible, the earth dumping sites will be designed in such a manner as to facilitate natural water discharge. Drainage structures should be properly installed.	
Mitigated Impact: Soil erosion due to excavation	
Magnitude of impact	2
Geographic extent	1
Duration of impact	1
Frequency of activity	2
Frequency of impact	2
Result	***Very-low (-16)***

13.4.2 Surface Water (SW)

Impact on water quality (SW1)

The proposed site which covers an area of approximately four hectares lies within the upper Athi catchment. The closest river to the site is the Stony Athi River which is about 700m towards the east and south-east of the project location. The Stony Athi River which can become ephemeral during extended drought periods flows northwards into the main Athi River.

It is expected that the entire 4 hectares of land will be developed by the Proponent. The slope of the site is towards the south-east draining into the Stony Athi River and consequently with the completed footprint could potentially exacerbate the run-off response times, erodability and pollutant transport from the site.

During the construction phase, there could be impacts on water quality due to increased erosion, sediment load and sedimentation as a result of a storm event which enters the Stony Athi River. Additionally the use of construction equipment (excavators, trucks, etc.) poses a risk for leaks of oils and lubricants which could potentially contaminate surface water.

Hydrostatic testing of the heavy fuel oil (HFO) storage tanks and pipelines will be undertaken prior to commissioning the power plant. Depending on the quality of water released by hydrostatic testing, this used water could potentially result in contamination of the Stony Athi River.

During the operational phase, tank trucks loaded with heavy fuel oil (HFO) will be off-loaded into the two large HFO bulk storage tanks. Due to the connection and disconnection operations of the truck hoses it is possible that spillages will occur around the off-loading areas. The spillages will be washed down with water and directed to a primary water treatment system known as an oil water separator (OWS) which will be designed in accordance with international standards. As a minimum, the treated water should meet the discharge standards stipulated in Legal Notice (L.N.) 120: Environment Management and Coordination (Water Quality) Regulations, 2006.

During the construction phase the EPC contractor and their nominated sub-contractors will develop, rollout and implement wastewater management and control procedures for normal, abnormal and emergency situations. During the operational phase, the Proponent will develop their wastewater management and control procedures for normal, abnormal and emergency situations.

Construction phase

Unmitigated Impact: Impact on water quality	
Magnitude of impact	3
Geographic extent	4
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low-medium (-63)***
Comment/mitigation	
During construction, potentially contaminated run-off should be treated prior to discharging it into the environment. The EPC contractor and their nominated sub-contractors must adhere to the discharge limits stipulated in L.N. 120: Environment Management and Coordination (Water Quality) Regulations 2006.	
Mitigated Impact: Impact on water quality	

Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	2
Frequency of impact	2
Result	***Very-low (-20)***

Operational and decommissioning phase

Unmitigated Impact: Impact on water quality	
Magnitude of impact	4
Geographic extent	3
Duration of impact	2
Frequency of activity	2
Frequency of impact	2
Result	***Low (-36)***
Comment/mitigation	
The likelihood of leaks and spills during operation can be reduced by the construction of bunded areas around potential operational spill areas. Such areas include the tank farm, truck off-loading bays, pump stations, etc. Consistent monitoring and maintenance of pipes, pump stations and valves during operation will reduce the likelihood of spills.	
Mitigated Impact: Impact on water quality	
Magnitude of impact	3
Geographic extent	2
Duration of impact	1
Frequency of activity	1
Frequency of impact	2
Result	***Very-low (-18)***

13.4.3 Groundwater (GW)

Pollution of groundwater (GW1)

The project area is mainly composed of unconsolidated black cotton soil termed as vertisols, which varies in thickness from 0.5m to 3m. They are poorly drained, have low infiltration rate and low permeability and are capable of significantly upholding any released contaminants to the groundwater.

Immediately below the vertisols, weathered phonolitic brownish deposits with rounded grains are found. A gradual transition from the weathered upper layer of the phonolite formation to a less weathered one occurs.

It is noted that a shallow perched aquifer occurs between 0.5 and 1.5m below ground surface. This basically occurs as the interphase between the clay layer and the phonolitic rock. The other main aquifers are deep and occur from a depth of about 50m onwards. The main aquifer in the area is mostly formed within the old land surfaces and weathered portions between the different volcanic flows; however above it are fresh compact Phonolites highly impermeable that do not allow infiltration of the subsurface contaminants to reach the deeper aquifer.

During the construction phase, fugitive spills from construction plant and equipment related operations could potentially enter the sub-surface through interstitial spaces and or weathered zones within a rock. These types of spills could potentially impact the perched aquifer.

During the operational phase, groundwater contamination is unlikely to occur as most areas of the power plant will be paved with an impermeable surface.

Construction phase

Unmitigated Impact: Contamination of groundwater	
Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	4
Frequency of impact	4
Result	***Low (-40)***
Comment/mitigation	
The EPC contractor and their nominated sub-contractors will ensure that construction plant and equipment is in a good state of repair always and parked/ situated in approved locations on site. If any hydrocarbons are stored on-site (drums, tanks, etc.), they will be kept in impermeable bunded areas (drip trays) and always under a canopy cover. Safety and health induction training will be provided to the workers on procedures to be followed in the event of a spillage of hydrocarbon products at the construction site that could adversely impact sub-surface soil and/or groundwater quality.	
Mitigated Impact: Contamination of groundwater	
Magnitude of impact	1
Geographic extent	1
Duration of impact	1
Frequency of activity	4
Frequency of impact	2

Result	***Very-low (-18)***

13.4.4 Soils (S)

Contamination of soils (S1)

The project area is mainly composed of unconsolidated black cotton soil termed as vertisols, which varies in thickness from 0.5m to 3m. Immediately below the soils, weathered phonolitic brownish deposits with rounded grains are found. A gradual transition from the weathered upper layer of the phonolite formation to a less weathered one occurs.

The proposed power plant is to be constructed on a Greenfield site which has had no prior known activity on it. Soil tests were carried out on samples of soil collected from various parts of the site and indicated non-detectable levels of TPH and BTEX. The construction of the power plant will require use of heavy mechanically driven equipment which uses hydrocarbons as a source of energy.

During the construction phase fugitive spills of hydrocarbons can potentially occur resulting from poorly maintained construction plant and equipment, and improper storage, handling, use and disposal of fuels and lubricants.

Most of the areas where fugitive spills can potentially occur during the operational phase will be paved with an impervious material such as reinforced concrete. Fugitive spills which will be washed down by water will be directed to the primary surface water treatment system known as an oil water separator (OWS).

Construction phase

Unmitigated Impact: Contamination of soils	
Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	3
Frequency of impact	3
Result	***Low (-30)***
Comment/mitigation	
The EPC contractor and their nominated sub-contractors will ensure that construction plant and equipment is in a good state of repair always and parked/ situated in approved locations on site. If any hydrocarbons are stored on-site (drums, tanks, etc.), they will be kept in impermeable bunded areas (drip trays) and always under a canopy cover. Safety and health induction training will be provided to the workers on procedures to be followed in the event of a spillage of hydrocarbon products at the construction site that could adversely impact soil quality.	
Mitigated Impact: Contamination of soils	

Magnitude of impact	1
Geographic extent	1
Duration of impact	1
Frequency of activity	2
Frequency of impact	2
Result	***Very-low (-12)***

13.4.5 Ecology (E)

Impacts on the biological environment (E1)

The proposed power plant site is located within the upper Athi River catchment area; it is dry but adjacent to the seasonal Stony Athi River towards the east and south-east. The proposed project falls within the agro-climatic zone V-4 which is characterized as semi-arid with average rainfall amounting to 450mm – 900mm annually. The vegetation cover is described as bushland with potential plant growth being medium to low.

The main habitats within the Athi-Kapiti ecosystem are the Grass plain dominated by *Cynodon, Themeda, Cypress,* and *Digitaria* species; Dry forest, *Olea africana, Croton dichogamus, Brachylaena hutchinsii*, and *Calodendrum*; Riverine forest/valley forest, *Acacia xanthophloea*, *Euphorbia candelabrum*, *Apodytes dimidiata, Canthium schimperiana, Elaeodendron buchananii, Ficus eriocarpa, Aspilia mossambicensis, Rhus natalensis,* and *Newtonia* species.

The proposed project site is open with short grasses existing with very few trees dispersed at the lower edge of the site. The area is already degraded and there is no sensitive habitat.

The proposed project site is situated in the Athi-Kapiti plain ecosystem and lies about 8.5km to the south-east of the Nairobi National Park. The herbivores (wildebeest and zebra) use Kitengela Conservation Area and migratory corridor to the south of the Park to reach the Athi-Kapiti Plains. The migratory routes for the animals lie in the south of the proposed site.

The main flyways and stop-overs for the migratory birds (Palearctic birds) are within the Rift Valley (Ollorgessailie, Kariandusi, L. Turkana) and Lake Victoria. The proposed project site does not lie close to the bird migratory routes and therefore is not expected to have significant impacts.

Construction and operational phases

Unmitigated Impact: Impact on flora and fauna	
Magnitude of impact	3
Geographic extent	2
Duration of impact	2
Frequency of activity	2

Frequency of impact	2
Result	***Low (-28)***
Comment/mitigation	
Construction of the power plant should avoid any natural vegetation if possible. Management and mitigation measures of the ecological environment will be included in the EMP.	
Mitigated Impact: Impact on flora and fauna	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	1
Result	***Very-low (-18)***

13.4.6 Air quality (AQ)

Decreased air quality due to dust and VOC emissions (AQ1)

Air quality has been identified as an issue that impacts environmental and health concerns in an area. Currently Kenya is in the process of gazetting new air quality regulations which will be used to manage air pollution from point and mobile sources.

During the construction phase, there are potential air quality impacts resulting from generation of dust and volatile organic compounds (VOCs). These will potentially occur during site clearing activities as construction vehicles move in and out of the site. During the operational phase, there will be minimal dust generation as most areas where vehicles will move will be paved.

The proposed project is a thermal power plant which will use heavy fuel oil (HFO) as the primary energy source to drive the generators. The HFO will be trucked daily from Mombasa to the power plant; it is expected that there may be 10 – 15 tank truck deliveries a day during the operational phase. During this phase, the exhaust emissions from the trucks will potentially have a slight cumulative adverse impact of dust and VOCs into the environment.

Construction and decommissioning phase

Unmitigated Impact: Decreased air quality due to dust and VOC emissions	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	3

Frequency of impact	3
Result	***Low (-48)***
Comment/mitigation	
Management and mitigation of construction and decommissioning phase impacts will be included in the EMP.	
Mitigated Impact: Decreased air quality due to dust and VOC emissions	
Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	2
Frequency of impact	2
Result	***Very-low (-20)***

Operational phase

Unmitigated Impact: Decreased air quality due to dust and VOC emissions	
Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	4
Frequency of impact	2
Result	***Low (-30)***
Comment/mitigation	
Tank trucks should be in a good state of repair at all times. Use of low sulfur and/or ultra-low sulfur diesel in tank trucks is recommended.	
Mitigated Impact: Decreased air quality due to dust and VOC emissions	
Magnitude of impact	1
Geographic extent	2
Duration of impact	1
Frequency of activity	4
Frequency of impact	2
Result	***Very-low (-24)***

Decreased air quality due to stack emissions (AQ2)

The power plant is a medium speed diesel type having ten Wärtsilä model 20V32 type engines-generator sets. The engines are designed to run on heavy fuel oil (HFO) having a viscosity between 180cst and 380cst. The HFO consumption of the power plant will be approximately 406MT/day. Air dispersion modeling was undertaken using the US EPA AERMOD and European ADMS4 techniques. The air dispersion model evaluated the predicted ground level concentrations of sulfur dioxide, oxides of nitrogen and particulate matter for HFO containing a sulfur content of 2.0%.

The results of the air dispersion modeling were compared to the EC Directive 2008/50/EC air quality guidelines (AQG). The modeling of the power plant running at full capacity indicates that the power plant will not exceed the particulate matter emissions (PM_{10} and $PM_{2.5}$) AQG.

At the nearest sensitive receptor of Athi River town and the housing estate just past the Stony Athi River, none of the EC limit values are predicted to be exceeded. AERMOD predicts exceedences of SO_2 and NO_2 hourly limits at Lukenya hills with the frequency of exceedence being equal to the limit for SO_2 and slightly over the limit for NO_2. It must be pointed out that AERMOD has a range of uncertainty which ranges between -50% and 200%. Subsequently the highest hourly levels of SO_2 and NO_2 predicted by AERMOD would lie in the above uncertainty range. ADMS4 is slightly more conservative than AERMOD in the vicinity of the power plant with AERMOD being more conservative further away at the elevated areas such as Lukenya Hills.

The impacts of stack emissions will occur during the operational phase of the project.

Operational phase

Unmitigated Impact: Decreased air quality due to stack emissions	
Magnitude of impact	4
Geographic extent	3
Duration of impact	2
Frequency of activity	5
Frequency of impact	4
Result	***Medium- high (-81)***
Comment/mitigation	
Due to the difference in predicted concentrations from the two dispersion models, with the one being more conservative near-field and the other further afield, the Proponent should conduct bi-annual passive air sampling and analysis of ground level concentrations of SO_2 and NO_2 in the fallout areas on Lukenya Hills to determine actual concentrations of these pollutants. Secondly the engines should be "emission rated" to ensure that they comply with the latest IFC Guidelines with respect to NO_2 emissions (710ppm)	

Mitigated Impact: Decreased air quality due to stack emissions	
Magnitude of impact	3
Geographic extent	3
Duration of impact	1
Frequency of activity	3
Frequency of impact	3
Result	***Low (-42)***

13.4.7 Waste management (W)

Pollution from waste management (W1)

Several categories of waste will be generated during the construction and operational phases of the proposed power plant. During construction, waste will be generated from construction activities, domestic waste produced by construction teams, sewage, used oil and lubricants, and wastewater from hydrostatic testing.

A range of wastes will be generated during the operational phase of the project including domestic waste generated by operational and security personnel, used oil, tank sludge and replacement of components of the power plant infrastructure. Hazardous wastes such as contaminated water and soil and redundant electronic equipment and computers, pose significant pollution and health risks.

During decommissioning, waste will be mainly as a result of the dismantling of the depot infrastructure.

Construction and decommissioning phases

Unmitigated Impact: Pollution from waste management	
Magnitude of impact	3
Geographic extent	2
Duration of impact	2
Frequency of activity	3
Frequency of impact	5
Result	***Low-medium (-56)***
Comment/mitigation	
A waste management plan will be developed and implemented in accordance with L.N. 121: Environment Management and Coordination (Waste Management) Regulations 2006 to cover hazardous and non-hazardous waste. Mitigation and management of waste generation and disposal will be covered in the EMP. The EPC contractor and their nominated sub-contractors will ensure that all waste leaving the site does so in appropriate receptacles and that the waste is disposed off in accordance with the requirements in L.N. 121 and Mavoko Municipal Council	

by-laws on waste management. All waste must be managed according to recognized procedures and no waste disposal facilities are to be managed onsite. All waste should be disposed of in leak-proof containers such that it does not come into contact with and potentially pollute soils, surface water and groundwater.	
Mitigated Impact: Pollution from waste management	
Magnitude of impact	2
Geographic extent	1
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Very-low (-25)***

Operational phase

Unmitigated Impact: Pollution from waste management	
Magnitude of impact	3
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	5
Result	***Low (-49)***
Comment/mitigation	
A waste management plan will be developed and implemented in accordance with L.N. 121: Environment Management and Coordination (Waste Management) Regulations 2006 to cover hazardous and non-hazardous waste. Mitigation and management of waste generation and disposal will be covered in the EMP. The Proponent will ensure that all waste leaving the site does so in appropriate receptacles and that the waste is disposed off in accordance with the requirements in L.N. 121 and Mavoko Municipal Council by-laws on waste management. All waste must be managed according to recognized procedures and no waste disposal facilities are to be managed onsite. All waste should be disposed of in leak-proof containers such that it does not come into contact with and potentially pollute soils, surface water and groundwater.	
Mitigated Impact: Pollution from waste management	
Magnitude of impact	2
Geographic extent	1
Duration of impact	1
Frequency of activity	1
Frequency of impact	3

Result	***Very-low (-16)***

13.4.8 Noise and vibration (N)

Noise during construction and commissioning (N1)

The proposed power plant site is located along the main Mombasa – Nairobi highway. The daily traffic (a large proportion of which is trucks) noise from this highway contributes highly to the ambient noise levels. There is a residential estate currently under construction about 700m due-east of the proposed project site. The highway traffic noise cannot be heard when one is in the show-house of this residential development which is situated about 150m off the main highway.

During the construction phase, noise is expected to be generated from construction workers, large scale equipment and vehicles used for clearing and excavating, laying of foundations, installation of storage tanks, powerhouse engines and associated infrastructure.

Construction phase

Unmitigated Impact: Noise pollution during construction	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	5
Result	***Low (-42)***
Comment/mitigation	
As a minimum, the EPC contractor and their nominated sub-contractors will ensure that the equipment used for the construction phase complies with the requirements of L.N. 25: Factories and Other Places of Work (Noise Prevention and Control) Regulations, 2005 and L.N. 61: Environment Management and Coordination (Noise and Excessive Vibration Prevention) Regulations 2009.	
Mitigated Impact: Noise pollution during construction	
Magnitude of impact	2
Geographic extent	1
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Very-low (-25)***

Noise during operation (N2)

The proposed power plant is expected to be operational twenty-four hours a day, seven days a week. During operations the principle sources of noise pollution are expected to be generated from the generator sets and trucks entering and leaving the power plant. The proposed power plant is designed to attenuate noise level to 70dB(A) at the fence line. The power plant is expected to comply with the requirements of L.N. 61: Environment Management and Coordination (Noise and Excessive Vibration Control) Regulations, 2009 and L.N. 25: Factories and Other Places of Work (Noise Prevention and Control) Regulations 2005.

Operational phase

Unmitigated Impact: Noise during operation	
Magnitude of impact	3
Geographic extent	3
Duration of impact	5
Frequency of activity	4
Frequency of impact	3
Result	***Medium-high (-77)***
Comment/mitigation	
A hearing conservation program will be developed, rolled out and implemented within the power plant in accordance with L.N. 25. Maintenance and service schedules for the equipment should be coordinated to reduce generation of excessive noise and vibration from the power plant. Ambient noise level surveys will be undertaken periodically (annually) to ensure compliance with community noise levels stipulated under Kenyan legislation and shared with the community for educational purposes.	
Mitigated Impact: Noise during operation	
Magnitude of impact	2
Geographic extent	3
Duration of impact	2
Frequency of activity	4
Frequency of impact	2
Result	***Low (-42)***

Noise generated during decommissioning of the power plant (N3)

During closure, likely sources of noise pollution will be heavy machinery and equipment for the removal of the generator sets, power house building, heavy fuel oil storage tanks and other associated infrastructure. Abnormal load trucks will need to be utilized for transportation of infrastructure components to an appointed facility where they will be broken down or recycled. During this process, noise

will be generated from the contractors and workers assigned to rehabilitate the land and the equipment used to assist with this activity(ies). Together with these activities, noise will be generated by the rehabilitation team and is more likely to be noticeable at night from the camp due to reduced ambient noise levels.

Decommissioning phase

Unmitigated Impact: Noise from decommissioning of the power plant	
Magnitude of impact	3
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	4
Result	***Low (-42)***
Comment/mitigation	
Prior to decommissioning, the EPC contractor will undertake a noise level survey to establish the ambient noise levels. During decommissioning the EPC contractor will coordinate activities that produce the most noise levels to take place when the surrounding noise levels are at their peak. The EPC contractor will further improve on the existing management of noise generation from equipment and staff to ensure that they comply with Kenyan legislation at the time of decommissioning.	
Mitigated Impact: Noise from decommissioning of the power plant	
Magnitude of impact	2
Geographic extent	1
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Very-low (-25)***

13.4.9 Visual Impacts (V)

Impacts on the visual landscape (V1)

The study area is dominated by a range of vistas and environments primarily dominated by industrial activities. The project site is fronted by the main Mombasa – Nairobi highway to the north, a disused quarry to the south, a steel manufacturing plant to the north-west and a greenfield site to the east. Dirt roads traverse the landscape which is semi-arid in nature. The study area is currently littered with excavated soils from the excavation of the new Mombasa – Nairobi dual carriageway which is under construction. There are minimal agricultural activities in the study area. The vicinity of the study area is characterized by some limestone quarrying activities as evidenced by open cast limestone mines, stockpiles and limited scaring of the landscape. Due to the largely undeveloped

semi-arid nature of the landscape, the Athi River Steel Plant and the proposed Tile & Carpet Centre projects are clearly visible. The Greenpark residential estate which is located about 700m towards the north-east of the study site is also visible.

Visual impacts are likely to be most severe during the construction phase when the power plant is being constructed. It is not anticipated that there will be severe visual impacts from the power plant during the operational phase as the area is earmarked for industrial purposes by the Mavoko Municipal Council.

The power plant will consist mainly of prominent above ground structures most notably the powerhouse building, stacks and two heavy fuel oil storage tanks. These structures will be visually prominent to passers-by.

Construction and operational phases

Unmitigated Impact: Impacts on visual landscape	
Magnitude of impact	3
Geographic extent	3
Duration of impact	3
Frequency of activity	4
Frequency of impact	5
Result	***Medium-high (-81)***
Comment/mitigation	
Trees can be planted along the frontage of the plot to screen the development. The infrastructure should be painted in colors that blend with the local environment. Waste management measures should be in place at all times and the entire site especially the fuel offloading areas must be kept clean.	
Mitigated Impact: Impacts on visual landscape	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	4
Frequency of impact	3
Result	***Low (-42)***

13.4.10 Macroeconomic (M)

National economic development

Over recent years, Kenya has experienced significant economic development. The proposed project is part of three new power plants that the KP&LC is financing in order to meet the growing demand for electric power. The proposed power plant will bring significant foreign direct investment into the country thereby boosting the national economy.

The fact that there will be an improved supply of electric power into the national grid implies a number of spin-offs for the country including more available electric power supply for consumers and less black-outs. The industrial and manufacturing sector in Kenya is particularly important since it employs close to 25% of the working population and is a major source of employment opportunities. The electricity generated from the power plant will be evacuated to a proposed industrial concern in Athi River and the KP&LC's Embakasi substation.

During the operational phase, several positive economic spin-offs are envisaged as well as the creation of a limited number of permanent generally high skilled jobs.

Operational phase

Benefits without construction of power plant: National economic benefits	
Magnitude of impact	2
Geographic extent	5
Duration of impact	3
Frequency of activity	2
Frequency of impact	4
Result	***Low-medium (+60)***
Comment/mitigation	
Management of enhancement measures for generation of economic benefits in the Athi River area will be included in a number of programs and plans including a communication and information program, labor and human resources plan and a community liaison development plan.	
Benefits with construction of power plant: National economic benefits	
Magnitude of impact	3
Geographic extent	4
Duration of impact	4
Frequency of activity	4
Frequency of impact	5
Result	***Medium-high (+99)***

Stability of electric power supply

The above mentioned economic growth in Kenya has resulted in increased demand for electric power supply. Electric power generation currently relies heavily on hydropower and due to unpredictable climatic conditions has had adverse impacts on the economy. The Government has had to contract emergency power generation through Aggreko of the U.K. to supplement hydropower, geothermal and thermal power respectively. The Government through the Ministry of Energy, power generation and transmission companies and key energy lead agencies has developed a least cost power development plan (LCPDP) which is the country's electric power generation and transmission blueprint. The LCPDP is revised annually on the basis of the demand forecast for electricity and in the current revision of 2009, identified the construction of three 80MW medium speed diesel (MSD) engine power plants. The KP&LC was given the go-ahead to purchase electric power through independent power producers (IPPs).

The construction of the proposed power plant could thus provide additional capacity to feed into the national grid in the short to medium term with benefits of improved availability of electricity to consumers extending for the lifetime of the project envisaged to be twenty years.

Operational phase

Benefits without construction of power plant: Stability of electricity supply	
Magnitude of impact	3
Geographic extent	4
Duration of impact	3
Frequency of activity	3
Frequency of impact	4
Result	***Low-medium (+70)***
Comment/mitigation	
It is prudent to expedite construction of the power plant in twelve months to increase the supply of electricity in order to meet the growing demand.	
Benefits with construction of power plant: Stability of electricity supply	
Magnitude of impact	4
Geographic extent	5
Duration of impact	4
Frequency of activity	4
Frequency of impact	5
Result	***High (+117)***

13.4.11 Socio-economic (SE)

Compatibility with existing and proposed land use (SE1)

The proposed site is currently zoned for "light inoffensive industrial" use. The Mavoko Municipal Council currently does not have a formal master plan of existing and proposed land uses within the local authority's jurisdiction which begins at the Kapa Oil Refineries along the main Nairobi – Mombasa highway and extends beyond the proposed project site. The Mavoko Municipal Council approves development planning permission for industrial projects fronting the Nairobi – Mombasa highway such as the proposed power plant as long as the project is not out of character with its surroundings. There are already a number of heavy industrial businesses in the vicinity of the power plant such as the Athi River Steel Plant, East African Portland Cement quarry, Tile & Carpet Centre, Devki Steel Mills, etc. There is also a residential estate currently under construction about 700m due north-east of the project site.

During the operational phase, residential development near the power plant should be restricted by the need to comply with noise attenuation levels produced by the power plant at the fence line.

Following decommissioning and closure, the power plant site can be made available for commercial/industrial purposes after appropriate rehabilitation measures are implemented.

Operational phase

Unmitigated Impact: Compatibility with existing and proposed land use	
Magnitude of impact	3
Geographic extent	3
Duration of impact	3
Frequency of activity	4
Frequency of impact	4
Result	***Low-medium (-72)***
Comment/mitigation	
Public awareness should be created about safe land uses in the vicinity of the power plant.	
Mitigated Impact: Compatibility with existing and proposed land use	
Magnitude of impact	2
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	3
Result	***Low (-42)***

Decommissioning phase

Unmitigated Impact: Compatibility with existing and proposed land use	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	2
Frequency of impact	4
Result	***Low (-48)***
Comment/mitigation	
Rehabilitation of the project site will make it more appealing for commercial/ industrial activities to recommence.	
Mitigated Impact: Compatibility with existing and proposed land use	
Magnitude of impact	2
Geographic extent	3
Duration of impact	5
Frequency of activity	1
Frequency of impact	2
Result	***Very low (-30)***

Increased crime (SE2)

The construction and operation of the power plant could potentially contribute to increased crime levels and in-migration in the study area. Nairobi and by extension Mavoko Municipality in general displays high levels of crime, especially in urban areas. Crime levels are often associated with problems of overcrowding, poor infrastructure, community dislocation, poverty and organized syndicates. Crime is a potential impact during the construction and operational phases as there will be large numbers of contracted workers and service providers. This could give would-be criminals opportunity to commit crime. Attempted theft of electric cables and associated equipment either by individuals or syndicates could be a particular problem, resulting in increased risk to landowners and property.

Construction phase

Unmitigated Impact: Increased crime	
Magnitude of impact	4
Geographic extent	2
Duration of impact	2
Frequency of activity	3

Frequency of impact	4
Result	***Low-medium (-56)***
Comment/mitigation	
The communication and information program must include a strategy to inform communities about job opportunities in order to manage expectations. Construction will generally take place during the day and no workers should be allowed to stay overnight at the site. Security measures need to be put in place during the construction phase to limit theft and malicious damage to the property on the depot. The property should be fenced off and strict security access must be implemented to distinguish between workers and non-workers.	
Mitigated Impact: Increased crime	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (-30)***

Operational phase

Unmitigated Impact: Increased crime	
Magnitude of impact	3
Geographic extent	2
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low (-49)***
Comment/mitigation	
Management and mitigation measures for crime prevention will be included in the EMP. High-tech security systems will be fully functional during the operational phase and fewer workers will be present on site. Perimeter security lighting will provide luminance which should improve security especially at night.	
Mitigated Impact: Increased crime	
Magnitude of impact	2
Geographic extent	2
Duration of impact	1
Frequency of activity	2
Frequency of impact	3

Result	***Very-low (-25)***

Creation of employment opportunities (SE3)

Job opportunities will be generated during the construction and operational phase of the power plant. The unemployment rate in Mavoko is generally high and the local communities have expressed their willingness to provide labor and manpower services for the project. The power plant is expected to generate about 100 jobs during the construction phase of the project while another 28 jobs will be created during the operational phase. The construction phase is expected to represent opportunities for local employment and service provision such as the use of local transport, provision of social amenities and sourcing of construction materials locally. There are likely to be spin-offs provided by training of people employed or contracted locally.

Indirect employment opportunities may arise in the operational phase resulting from provision of social services near the power plant site such as kiosks, bars, lodgings, etc. for the tank-truck drivers.

During the operational phase, the increased stability of electric power supply to the grid is likely to enhance the national economy which is likely to result in increased employment opportunities.

Construction phase

Benefits without the power plant: Creation of employment opportunities	
Magnitude of impact	2
Geographic extent	3
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (+35)***
Comment/mitigation	
The EPC contractor and their nominated sub-contractors should manage labor expectations by providing first preferences for employment to the local communities. The district administration should be consulted when recruiting local workers and service providers.	
Benefits without the power plant: Creation of employment opportunities	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	5
Result	***Low-medium (+64)***

Operational phase

Benefits without the power plant: Creation of employment opportunities	
Magnitude of impact	2
Geographic extent	3
Duration of impact	4
Frequency of activity	4
Frequency of impact	2
Result	***Low (+54)***
Comment/mitigation	
The Proponent should as far as possible endeavor to provide preference for employment to skilled workers from the local communities.	
Benefits without the power plant: Creation of employment opportunities	
Magnitude of impact	2
Geographic extent	3
Duration of impact	5
Frequency of activity	4
Frequency of impact	4
Result	***Medium-high (+80)***

Increased risk of disease with influx of workers (SE4)

Kenya experiences a high prevalence rate of HIV/AIDS and other communicable diseases. These types of diseases are exacerbated by the poverty and movement of workers. The high unemployment rate further provides a temptation for people to be drawn into commercial sex.

The construction of the proposed power plant could exacerbate the risk of spread of disease if adequate measures are not taken. Local communities can be exposed to increased risk of communicable diseases such as HIV/AIDS through risky behaviors involving job seekers and people employed on the project. it is anticipated that the risk of communicable diseases will be high during the construction phase as this will be the period when the highest number of people with disposable income will be present. These behaviors could potentially continue during the operation phase albeit at a minimal prevalence rate and are subsequently not assessed.

During the operational phase, the prevalence of HIV/AIDS and other communicable diseases may increase resulting from heavy fuel oil (HFO) tank truck deliveries to the power plant. Tank-truck drivers who are unable to return to Mombasa on the same day of product offloading, may park near the power plant. This behavior will give rise to the mushrooming of commercial sex activities which has been experienced in other parts of Kenya where similar types of petroleum tank-truck activities occur.

Construction phase

Unmitigated Impact: Increased risk of communicable diseases	
Magnitude of impact	2
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low (-49)***
Comment/mitigation	
Management and mitigation measures for minimizing HIV/AIDS and other communicable diseases will be included in the communication and information program.	
Mitigated Impact: Increased risk of communicable diseases	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (-30)***

Social divisions over limited jobs (SE5)

There is a high unemployment rate throughout the study area; this was evidenced during the public/stakeholder meetings in which the local community was vocal about job creation for their siblings during the construction and operational phases of the project respectively. Subsequently the proposed power plant has already contributed to high expectations of employment creation. Given the high skills generally required for construction and operation of thermal power plants, the number of jobs created at the local community level may be limited. This is likely to lead to discontent in communities if it is perceived that preferential treatment is given to "outsiders" both in terms of procurement and jobs. Corruption and nepotism could exacerbate this impact. This impact is likely to be most significant during the construction phase.

Construction phase

Unmitigated Impact: Social divisions over limited jobs	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2

Frequency of activity	2
Frequency of impact	4
Result	***Low (-48)***
Comment/mitigation	
The communication and information program should be used to maximize procurement of jobs from the local community as a preference. Employment should be provided to all workers on the basis of merit and experience needed.	
Mitigated Impact: Social divisions over limited jobs	
Magnitude of impact	2
Geographic extent	2
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (-30)***

Accidents as a result of increased traffic (SE6)

The influx of construction workers will also entail an increase in traffic on the Nairobi – Mombasa highway. This will be due to an increase in construction vehicles which will be delivering construction material and transporting construction rubble.

During operation there will be a number of fully laden tank-trucks delivering heavy fuel oil (HFO) to the power plant. While the number of tank-trucks that will be used to transport HFO will be determined by the demand for electricity, it is expected that there will be about 10 – 15 HFO tank truck deliveries being done a day. Due to the longer travel distances from Mombasa to Nairobi and given the non-defensive behaviors of some vehicle drivers and pedestrians in the area, there is a potential for increased traffic related accidents in the study area.

Construction phase

Unmitigated Impact: Accidents as a result of traffic	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low-medium (-56)***
Comment/mitigation	
Management and mitigation measures for minimizing damage to transport infrastructure will be included in the EMP. Safety plans for pedestrians and	

individuals in road traffic will be included in the EMP.	
Mitigated Impact: Accidents as a result of traffic	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	2
Frequency of impact	3
Result	***Low (-40)***

Operational phase

Unmitigated Impact: Accidents as a result of traffic	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	5
Frequency of impact	4
Result	***Medium-high (-72)***
Comment/mitigation	
All road users that are directly involved with the power plant operations will strictly adhere to defensive driving skills. All vehicles entering or leaving the power plant will be maintained in an excellent state of repair.	
Mitigated Impact: Accidents as a result of traffic	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	4
Frequency of impact	3
Result	***Low-medium (-56)***

13.4.12 Traffic (T)

Damage to roads and other transport infrastructure (T1)

Currently the Athi River – Machakos turn-off section of the Nairobi – Mombasa highway is undergoing construction. The proposed project site has a frontage to this highway and will be used for accessing the project site. Damage to the highway will predominantly occur during the construction phase resulting from

transportation of heavy machinery, equipment and components and construction materials.

Construction phase

Unmitigated Impact: Damage to roads and other transport infrastructure	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	3
Result	***Low (-48)***
Comment/mitigation	
Management and mitigation measures for minimizing damage to transport infrastructure will be included in the EMP.	
Mitigated Impact: Damage to roads and other transport infrastructure	
Magnitude of impact	2
Geographic extent	3
Duration of impact	2
Frequency of activity	2
Frequency of impact	2
Result	***Low (-28)***

Increased traffic and road safety hazard (T2)

Kenya generally experiences a high traffic accident rate resulting from poor compliance with road safety rules and un-roadworthy vehicles.

During the construction phase, the proposed project will potentially contribute to increased traffic and safety hazards resulting from transportation of construction equipment, building materials and construction vehicles in the study area. Additionally there will be a requirement for compliance with abnormal load transportation requirements of the generator sets from Mombasa to the project site; this will potentially cause traffic congestion along the busy Mombasa – Nairobi highway and possibly accidents.

During the operational phase, the risks may reduce resulting from an absence of construction related vehicles in the study area. However there will be about 10 – 15 fully laden tank-trucks delivering heavy fuel oil a day to the power plant which can potentially lead to increased traffic and road safety hazards.

Construction phase

Unmitigated Impact: Increased traffic and road safety hazard	
Magnitude of impact	4
Geographic extent	4
Duration of impact	2
Frequency of activity	3
Frequency of impact	4
Result	***Low-medium (-70)***
Comment/mitigation	
Minimize the number of construction vehicles on the road in the peak hours. Implement a motor vehicle safety program to ensure that drivers are not fatigued, are "fit-for-duty", possess the correct type of driving license, have undergone defensive driving training, etc.	
Mitigated Impact: Increased traffic and road safety hazard	
Magnitude of impact	3
Geographic extent	3
Duration of impact	2
Frequency of activity	3
Frequency of impact	3
Result	***Low (-48)***

Operational phase

Unmitigated Impact: Increased traffic and road safety hazard	
Magnitude of impact	4
Geographic extent	3
Duration of impact	2
Frequency of activity	4
Frequency of impact	4
Result	***Low-medium (-72)***
Comment/mitigation	
A motor vehicle safety program will be implemented within the company for in-house and contracted transport truck fleet operators. A road transport supplier risk assessment will be undertaken for the successful heavy fuel oil contractor to ensure that they have a safety and health management system implemented.	
Mitigated Impact: Increased traffic and road safety hazard	
Magnitude of impact	3

Geographic extent	3
Duration of impact	1
Frequency of activity	4
Frequency of impact	2
Result	***Low (-42)***

13.4.13 Health and Safety (HS)

Occupational health and safety (HS1)

The development of the proposed power plant will involve a range of activities that are potentially unsafe to workers. Examples of such activities include excavation, use of pneumatic drills for cutting through hard rock, working at heights, welding, etc. Such activities require the use and operation of heavy duty equipment, machinery and vehicles.

During the construction phase, the potential occupational safety and health risks could emanate from:

- Injury to workers from the operation of machinery, equipment and construction vehicles;
- Injuries while working at heights;
- Road accidents; and
- Exposures to diseases including malaria, HIV/AIDS and TB.

During the operational phase the potential occupational safety and health risks include: Injuries to workers from routine monitoring and maintenance activities (vehicle accidents, replacement of components/parts, etc.) and emergencies such as equipment malfunction, explosions, fires, etc.

Construction phase

Unmitigated Impact: Risks to occupational health and safety of workers	
Magnitude of impact	4
Geographic extent	1
Duration of impact	2
Frequency of activity	4
Frequency of impact	4
Result	***Low-medium (-56)***
Comment/mitigation	
The EPC Contractor and their nominated sub-contractors will ensure that they continuously undertake safety and health risk assessments of various potentially harmful activities. Safety and health induction training will be provided to all contractor employees including regular tool-box talks. The EPC contractor will	

comply with the Occupational Safety and Health Act, 2007 including all relevant subsidiary legislation under the Act.	
Mitigated Impact: Risks to occupational health and safety of workers	
Magnitude of impact	2
Geographic extent	1
Duration of impact	2
Frequency of activity	3
Frequency of impact	3
Result	***Low (-30)***

Operational phase

Unmitigated Impact: Risks to occupational health and safety of workers	
Magnitude of impact	4
Geographic extent	2
Duration of impact	2
Frequency of activity	4
Frequency of impact	4
Result	***Low-medium (-64)***
Comment/mitigation	
A health, safety and environment (HSE) management system will be developed, rolled out and implemented. This system which will be based on the TQM cycle will be reviewed annually or after a major accident or incident. Periodic H&S inspections and annual statutory audits will be undertaken to verify and validate the competency of the HSE management system with changes being made as necessary.	
Mitigated Impact: Risks to occupational health and safety of workers	
Magnitude of impact	2
Geographic extent	1
Duration of impact	2
Frequency of activity	4
Frequency of impact	2
Result	***Low (-30)***

13.4.14 Cumulative impacts (C)

A cumulative impact in relation to an activity may be defined as the impact of an activity that in itself may not be significant but may become significant when added to existing and potential impacts emanating from similar or diverse activities or undertakings in the area. This section describes the following cumulative impacts:

Economic development (C1)

Currently the demand for electric power in Kenya is greater than what the KP&LC can supply its customers. KP&LC has an ambitious plan of connecting 200,000 new customers annually to the national grid which implies that there will be a greater demand for electricity in the coming years. The construction of the proposed power plant will result in an increased and consistent electric power supply in Nairobi and its environs. This is likely to have positive spin-off effects for economic development in these areas. Subsequently electric power supply will not become a limitation for the national economy. For the study area, consistent supply of electric power is essential for sustaining manufacturing and commercial activities thus contributing to maintaining and increasing employment.

Transport (C2)

The development of the proposed power plant during the construction phase of the project is likely to place increasing pressure on the dual carriage way under construction in the study area. This will be alleviated during the operational phase when the volumes of traffic will be reduced due to the absence of construction vehicles and equipment. During the operational phase there will be a minor adverse cumulative impact on the dual carriage way arising from the delivery of heavy fuel oil via tank-trucks to the power plant.

Visual impacts (C3)

The construction and operational phases of the power plant are likely to result in slight visual impacts within the local area. The area is zoned for industrial use and is beginning to mushroom with developments such as a ceramic tile and hardware center and two existing steel manufacturing plants. Due to the size of the emission stacks, power house and heavy fuel oil storage tanks, commuters on the Nairobi – Mombasa highway will notice the addition of the power plant to the disturbed landscape. This may have a slight negative impact.

13.5 Summary of impacts

Table 2 summarizes the significance of each identified impact as calculated in Section 13.3.

Table 1: Summary of significance of each identified impact

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Geology and Soils (GS)							
Extraction of natural resources for construction		Low-medium (-)	Low (-)				
Soil erosion		Low (-)	Very-low (-)				
Surface water (SW)							
Impact on water quality		Low-medium (-)	Very-low (-)	Low (-)	Very-low (-)		
Groundwater (GW)							
Pollution of groundwater		Low (-)	Very-low (-)				
Soils (S)							
Contamination of soils		Low (-)	Very-low (-)				
Ecology (E)							
Impacts on terrestrial ecology		Low (-)	Very-low (-)	Low (-)	Very-low (-)		
Air quality (AQ)							
Decreased air quality due to dust and VOCs		Low (-)	Very-low (-)	Low (-)	Very-low (-)		

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Decreased air quality due to stack emissions				Medium-high (-)	Low (-)		
Waste (W)							
Pollution from waste generation		Low-medium (-)	Very-low (-)	Low (-)	Very-low (-)		
Noise and vibration (N)							
Noise during construction		Low (-)	Very-low (-)				
Noise during operation				Medium-high (-)	Low (-)		
Noise during decommissioning						Low (-)	Very-low (-)
Visual impacts (V)							
Impacts on visual landscape		Medium-high (-)	Low (-)	Medium-high (-)	Low (-)		
Macroeconomic (M)							
National economic development				Low-medium (+)	Medium-high (+)		
Stability of electric power supply				Low-medium (+)	High (+)		
Socio-economic (S)							

Impact	Code	Significance rating					
		Construction		Operation		Decommissioning	
		Without mitigation	With mitigation	Without mitigation	With mitigation	Without mitigation	With mitigation
Compatibility with existing and proposed land use				Low-medium (-)	Low (-)	Low (-)	Very low (-)
Increased crime		Low-medium (-)	Low (-)	Low (-)	Very low (-)		
Creation of employment opportunities		Low (+)	Low-medium (+)	Low (+)	Medium-high (+)		
Increased risk of communicable diseases		Low (-)	Low (-)				
Social divisions over limited jobs		Low (-)	Low (-)				
Accidents as a result of increased traffic		Low-medium (-)	Low (-)	Medium-high (-)	Low-medium (-)		
Traffic (T)							
Damage to roads and other infrastructure		Low (-)	Low (-)				
Increased traffic and road safety hazards		Low-medium (-)	Low (-)	Low-medium (-)	Low (-)		
Health and safety (HS)							
Occupational health and safety		Low-medium (-)	Low (-)	Low-medium (-)	Low (-)		